WASHINGTON
UNION STATION
STATION EXPANSION

Draft Environmental Impact Statement for Washington Union Station Expansion Project

Appendix C3 - Environmental Consequences Technical Report

U.S. Department of Transportation
Federal Railroad Administration

June 2020

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STATION EXPANSION

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Acronyms and Abbreviations

ACM	Asbestos-Containing Material
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
AERMOD	Atmospheric Dispersion Modeling System
AHSRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AM	Morning
Amtrak	National Railroad Passenger Corporation
ANSI	American National Standards Institute
AOC	Architect of the Capitol
AOE	Assessment of Effects
APE	Area of Potential Effects
asl	Above Sea Level
BMP	Best Management Practice
BTU	British Thermal Unit
CAA	Clean Air Act
CCC	Community Communications Committee
CFA	Commission of Fine Arts
CFR	Code of Federal Regulations
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNN	Cable News Network
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CSO	Combined Sewer Overflow
CT	Census Tract

CWA	Clean Water Act
cy	Cubic Yards
dBA	A-weighted Decibel
DC	District of Columbia
DCMR	District of Columbia Municipal Regulations
DCOP	District of Columbia Office of Planning
DDOT	District Department of Transportation
DDFHV	District Department of For-hire Vehicles
DEIS	Draft Environmental Impact Statement
DOEE	Department of Energy and Environment
ECC	Energy Conservation Code
EEOC	Equal Employment Opportunity Commission
EIS	Environmental Impact Statement
EIA	United States Energy Information Administration
EISA	Energy Independence and Security Act
EJ	Environmental Justice
EMS	Emergency Medical Services
EO	Executive Order
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EUI	Energy Use Intensity
FAR	Floor-Area Ratio
FEIS	Final Environmental Impact Statement
FEMP	Federal Energy Management Program
FHWA	Federal Highway Administration
FPS	Federal Protective Services
FR	Federal Register
FRA	Federal Railroad Administration
FTA	Federal Transit Administration

GAR	Green Area Ratio
GCC	District of Columbia Green Construction Code
GHG	Greenhouse Gas
gpd	Gallons per Day
gpm	Gallons per Minute
GPO	Government Printing Office
GSF	Gross Square Foot (Feet)
HVAC	Heating, Ventilation, and Air Conditioning
In/s	Inches per Second
ITE	Institute of Transportation Engineers
I/M	Inspection and Maintenance
kBTU	Kilo British Thermal Unit
lbs	Pounds
Ldn	Day-night Average Sound Level
Leq	Equivalent Sound Level
Lmax	Maximum A-weighted Level
LOD	Limit of Disturbance
LOS	Level of Service
MARC	Maryland Area Regional Commuter
MMBTU	Million British Thermal Unit
MOA	Memorandum of Agreement
MOE	Measure of Effectiveness
MOVES2014	2014 Motor Vehicles Emission Simulator
MPD	Metropolitan Police Department
MPO	Metropolitan Planning Organization
MS4	Municipal Separate Storm Sewer System
MSAT	Mobil Source Air Toxics
MSRF	Midday Storage Replacement Facility
MTA	Maryland Transit Administration

MWCOG	Metropolitan Washington Council of Governments
MWh	Megawatts Hours
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NB	Northbound
NBC	National Broadcasting Company
NCHRP	National Cooperative Highway Research Program
NCPC	National Capital Planning Commission
NE	Northeast
NEC	Northeast Corridor
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIHL	Noise-Induced Hearing Loss
NRHP	National Register of Historic Places
NoMA	North of Massachusetts Avenue
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPR	National Public Radio
NPS	National Park Service
NW	Northwest
O_3	Ozone
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
Pb	Lead
PCB	Polychlorinated Biphenyl
PDR	Production, Distribution, Repair
PM	Afternoon / Evening
$PM_{2.5}$	Particulate Matter Sized 2.5 Micrometers or Less

PM_{10}	Particulate Matter Sized 10 Micrometers or Less
ppb	Parts per Billion
ppm	Parts per Million
PPV	Peak-Particle Velocity
RCRA	Resource Conservation and Recovery Act
REA	Railway Express Agency
ROD	Record of Decision
SB	Southbound
SE	Southeast
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOE	Support of Excavation
SPCC	Spill Prevention, Control, and Countermeasure
SWPPP	Stormwater Pollution Prevention Plan
SW	Southwest
SWRv	Stormwater Retention Volume
TIAA	Teachers Insurance and Annuity Association
The District	Washington, DC
The Project	Washington Union Station Expansion Project
TNC	Transportation Networking Companies
TNM	Traffic Noise Model
TPH-DRO	Total Petroleum Hydrocarbons, Diesel Range Organics
tpy	Tons per Year
TSA	Transportation Security Administration
TSCA	Toxic Substances Control Act
TVRA	Threat, Vulnerability, and Risk Assessment
TWA	Time-Weighted Average
UDC	University of the District of Columbia

U.S.	United States
USC	United States Code
U.S.DOT	United States Department of Transportation
USN	Union Station North Zoning District
USRA	Union Station Redevelopment Act of 1981
USRC	Union Station Redevelopment Corporation
UST	Underground Storage Tank
VBIED	Vehicle-Borne Improvised Explosive Device
V/C	Volume to Capacity
VdB	Vibration Level
VMT	Vehicle-Miles Traveled
VOC	Volatile Organic Compound
VOR	Vehicle Occupancy Ratio
VRE	Virginia Railway Express
WMATA	Washington Metropolitan Area Transit Authority
WUS	Washington Union Station
$\mu g/m^3$	Micrograms per Cubic Meter

1 Analysis Framework

1.1 Introduction

Prior to issuing permits or approvals for a project, Federal agencies must consider the environmental effects of their proposed actions in accordance with the National Environmental Policy Act (NEPA). To comply with NEPA and the Council on Environmental Quality (CEQ) *Implementing Regulations for NEPA*, the Federal Railroad Administration (FRA) is preparing a Draft Environmental Impact Statement (DEIS) to identify impacts of the Washington Union Station (WUS) Expansion Project (Project) on the on the human and natural environment.[1]

This *Draft Environmental Consequences Technical Report* describes and characterizes potential direct, indirect, and cumulative impacts of the Project on the environment described in the *Washington Union Station Expansion Project, Affected Environment Report* (**Appendix C2**). Refer to the *Affected Environment Report* for a detailed description of the various aspects of the environment the Project could affect. The *Draft Environmental Consequences Technical Report* also identifies measures to avoid, minimize, or mitigate potential adverse impacts. The analyses presented in this report will be summarized in the DEIS.

Chapter 1 defines the impact analysis framework used to adhere to FRA's *Procedures for Considering Environmental Impacts*.[2] Whenever applicable and practicable, FRA conducted the analyses in accordance with the environmental review policies and guidance of relevant Federal agencies as well as state and local jurisdictions. In this way, the DEIS will support the review of the document by Federal, state, and local agencies from which permits or approvals are required for the Project.

1.2 Project Overview

Union Station Redevelopment Corporation (USRC) and the National Railroad Passenger Corporation (Amtrak) (collectively, the Proponents) are jointly proposing the Project. Under a long-term lease with FRA, USRC is responsible for the rehabilitation, redevelopment, and ongoing management and operations of WUS. Amtrak owns the tracks and platforms at WUS. The Project includes expanding

[1] 40 CFR 1500-1508

[2] 64 FR 28545

and modernizing the multimodal transportation facilities at WUS to meet current and future needs, while preserving the historic station building.

1.2.1 Purpose and Need

The purpose of the Project is to support current and future long-term growth in rail service and operational needs; achieve compliance with the Americans with Disabilities Act of 1990 (ADA) and emergency egress requirements; facilitate intermodal travel; provide a positive customer experience; enhance integration with the adjacent neighborhoods, businesses, and planned land uses; sustain WUS's economic viability; and support continued preservation and use of the historic station building.

The Project is needed to improve rail capacity, reliability, safety, efficiency, accessibility, and security, for both current and future long-term railroad operations at this historic station.

1.2.2 Project Elements

The Project includes the following program elements:

- Historic Station – The historic station building is listed in the National Register of Historic Places and is an important part of the urban fabric of Washington, DC (the District). The Project would preserve the historic station and sensitively integrate it with the other elements. The historic station building would continue to be the primary entrance to WUS and a grand welcoming space worthy of the nation's capital.
- Tracks and Platforms – The tracks and platforms provide space for trains and their passengers and serve a core function of WUS. The Project would implement a new track and platform plan providing 19 revenue tracks and 30-foot wide platforms.
- Bus Facility – Intercity, transit, and charter buses are parts of the WUS programming identified in the Union Station Redevelopment Act of 1981 (USRA) and long-established transportation modes at WUS. The Project includes a bus facility with new parking/loading bays and platforms for intercity, transit, and charter bus services.
- Train Hall – A monumental train hall is an architectural feature that adds air and light to the main train concourse and train platforms. It enhances passengers experience and is a common feature at large train stations across the world.
- Parking – Parking has been a component of WUS since USRA. Parking at WUS serves Amtrak and WUS users as well as rental car companies. The Project includes new parking facilities.
- Concourses and Retail – Concourses provide circulation space for passengers and retail that contributes revenue for WUS maintenance and operations. Circulation space and retail opportunities in concourses enhance passenger experience. The Project includes the construction of four new concourses.

- For-Hire Vehicles[3] – For-hire vehicle facilities provide WUS users and visitors with a range of transportation options. The Project provides enhanced for-hire vehicle facilities, including pick-up and drop-off areas at the front of the historic station building; in an underground facility; on the same level as H Street NE; and on First and 2nd Street NE.
- Bicycle and Pedestrian Access – Quality bicycle and pedestrian access is essential for a multimodal facility in an urban environment. The Project enhances pedestrian and bicycle facilities at WUS.

1.2.3 Timeframe

The planning horizon year for the Project is 2040. This is the year when the Project would likely be complete and operational. Depending on the Action Alternative, construction would take from approximately 11 years and 5 months to approximately 14 years and 4 months.

1.3 Definitions

The CEQ Implementing Regulations and *Forty Most Asked Questions*[4] concerning CEQ's NEPA Regulations provide the following key definitions:

- **Major Actions** include actions with effects that may be major and which are potentially subject to Federal control and responsibility. Actions include new and continuing activities including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by Federal agencies. Actions also include new or revised agency rules, regulations, plans, policies, procedures, and legislative proposals.
- **No-Action Alternative** is the state in which the proposed activity or action would not take place.
- **Action Alternatives**, or range of alternatives, include all reasonable alternatives that must be rigorously explored and objectively evaluated in an EIS. The range of alternatives can also include other alternatives eliminated from detailed study with a brief discussion of the reasons for eliminating them.
- **Direct impacts** result from the action and occur at the same time and place.[5]
- **Indirect impacts** result from the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density,

[3] "For-hire vehicle" refers to taxis and transportation networking companies like Uber and Lyft.

[4] Council on Environmental Quality. 1981. *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*. Accessed from https://www.energy.gov/nepa/downloads/forty-most-asked-questions-concerning-ceqs-national-environmental-policy-act. Accessed on April 3, 2020.

[5] Effects and impacts, as used in the CEQ Implementing Regulations and this report, are synonymous.

or growth rate, and related effects on air and water and other natural systems, including ecosystems.

- **Cumulative impacts** are the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

Impacts may vary with regard to their duration, significance, and outcome:

- **Duration:** The duration of an impact is the amount of time the impact is expected to last. Long-term, permanent, or operational impacts are those that would occur over the lifetime of a project. Short-term or temporary impacts are those that would occur during a specific phase of the project, such as construction.
- **Context and Intensity:** As defined in the CEQ's *Implementing Regulations*, significance requires consideration of both context and intensity. Depending on the nature of the topic, relevant contexts include society as a whole (human, national), the affected region, the affected interests, or the locality. Intensity refers to the severity of impact and includes consideration of beneficial and adverse impacts. Intensity can be assessed using a wide range of criteria. Among these criteria are public health and safety, unique characteristics of the geographic locale, the level of public controversy, whether the action would fail to comply with applicable laws and regulations, and other considerations. In this report, impacts are assessed using the following scale[6]:
  - **Negligible impacts** may be adverse or beneficial but would occur at the lowest level of detection.
  - **Minor impacts** would be noticeable but would not affect the function or integrity of the resource.
  - **Moderate impacts** would be readily apparent and would influence the function or integrity of the resource.
  - **Major impacts** would be substantial and would result in severely adverse or exceptionally beneficial changes to the resource.
- **Outcome:** Impacts may be beneficial or adverse:
  - **Beneficial impacts** would result in positive outcomes to the natural or human environment.
  - **Adverse impacts** would result in unfavorable or undesirable outcomes to the natural or human environment.

[6] For some of the resources considered in this report, resource-specific definitions that build on and refine these general definitions are provided in the *Methodology* section.

1.4 Framework for Evaluating Impacts

Impacts analysis is the scientific and analytic basis for comparing the Project's Action Alternatives. This report provides the full results of the technical impacts analyses FRA conducted for the Project, which will be condensed in the *Environmental Consequences* chapter of the DEIS.

The report considers impacts on the following resource categories:

- Natural Ecological Systems
- Water Resources and Water Quality
- Solid Waste Disposal and Hazardous Materials
- Transportation
- Air Quality
- Greenhouse Gas Emissions and Resilience
- Energy Resources
- Land Use, Land Planning, and Property
- Noise and Vibration
- Aesthetics and Visual Quality
- Cultural Resources
- Parks and Recreation Areas
- Social and Economic Conditions
- Public Safety and Security
- Public Health, Elderly, and Persons with Disabilities
- Environmental Justice

FRA analyzed and assessed the potential environmental impacts of the No-Action Alternative and six Action Alternatives on these resources (see **Section 1.7**, *Alternatives* for a summary description of the alternatives). The assessment was conducted relative to two baselines (see **Table 1-1**):

- The operational impacts of the No-Action Alternative in the 2040 planning horizon year were assessed relative to existing conditions as of 2017.[7]
- The operational impacts of the Action Alternatives in the 2040 planning horizon year were assessed relative to No-Action Alternative conditions in 2040 and relative to existing conditions as of 2017. The two-baseline approach was adopted because the No-Action

[7] Existing conditions of the affected environment for each resource are described in a separate *Affected Environment Technical Report* (**Appendix C2**).

Alternative includes the development of the privately owned air rights above the WUS rail terminal, a separate, large scale project that would substantially change conditions in the Project Area. Assessment against both No-Action Alternative and existing conditions is intended to provide a more complete understanding of the impacts of the Project.

- The construction impacts of all alternatives were assessed relative to existing conditions.

Table 1-1. Framework for Evaluating Impacts

Alternative	Impacts	No-Action Alternative Baseline (2040)	Existing Conditions Baseline (2017)
No-Action Alternative	Operation (2040)	N/A	●
	Construction	N/A	●
Action Alternatives	Operation (2040)	●	●
	Construction	N/A	●

N/A = Not applicable

1.5 Analysis Methodology

FRA conducted the impact analyses presented in this report in accordance with FRA's *Procedures for Considering Environmental Impacts*[8] along with other applicable guidance and regulations. Each section of the report lists the laws and regulations that apply to the resource under consideration and describes the methodologies used for the impact assessment. Whenever applicable and practicable, the analyses have been conducted in accordance with local environmental review policies and guidance.

For each resource category, the following information is provided:

- **Regulatory Context**: List of relevant Federal and local laws and regulations.
- **Study Area**: Definition of the area or areas within which the Project may have impacts.
- **Methodology**: Summary description of the approach adopted to evaluate and assess the potential operational and construction impacts of the alternatives. The methodology section summarizes or completements the information presented in the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**).
- **Impact Analysis**: Description and assessment of the operational (long-term or permanent) and construction impacts of the No-Action Alternative and the six Action Alternatives. In

8 Federal Railroad Administration. 2012. *Procedures for Considering Environmental Impacts.* Accessed from https://www.fra.dot.gov/eLib/Details/L02710. Accessed on April 3, 2020.

accordance with CEQ's regulations for implementing NEPA, the DEIS assesses impacts based on context and intensity. The assessment uses the scale defined in **Section 1.3**, *Definitions* or, as applicable, the more resource-specific scales defined in the *Methodology* section for the affected resource.

For each resource, the direct and indirect operational impacts of the No-Action Alternative are assessed relative to existing conditions. The direct and indirect operational impacts of the Action Alternatives are assessed relative to the No-Action Alternative. This assessment is complemented by a briefer evaluation of the impacts relative to existing conditions. For the Action Alternatives, indirect impacts include the impacts of the potential development of the Federally owned air rights within the footprint of the existing parking garage that Project elements would not occupy.

- **Comparison of Alternatives**: Comparison of the impacts of each of the seven alternatives highlighting meaningful differences.
- **Avoidance, Minimization, and Mitigation:** If applicable, list of recommended measures the Project Proponents would implement to minimize, avoid, or mitigate the adverse impacts of the Action Alternatives wherever practicable. The measures listed in this section are under consideration.
- **Permits and Regulations**: If applicable, list of relevant permitting or regulatory requirements the Project Proponents would have to comply with.

1.6 Project Area and Study Area

Impact analysis for each resource section considered the Project Area (**Figure 1-1**) as well as a Local and, if applicable, a Regional Study Area representing the radius within which the alternatives have the potential to result in permanent or temporary impacts. Often, the Local Study Area, proximate to the Project Area, is the focus of direct impacts while indirect impacts may be felt farther away, in the Regional Study Area. The Study Areas differ by resource because the type and range of potential impacts vary. For example, the visual and aesthetic resources Study Area encompasses vistas from which the larger construction activities or permanent elements of the Action Alternatives may be visible while the traffic Study Area consists of streets and intersections where Project-related traffic could cause operational changes.

Figure 1-1. Project Area

1.7 Alternatives

Following concept screening, concept refinement, alternatives refinement, and construction analysis, FRA selected six Action Alternatives for analysis in the DEIS along with the No-Action Alternative. This section provides a summary description of the alternatives.

1.7.1 No-Action Alternative

In the No-Action Alternative, the Project would not take place. The No-Action Alternative reflects the state of the environment in the absence of the Project in the horizon year of 2040. Under the No-Action Alternative, many aspects of WUS would stay unchanged relative to existing conditions and would continue as at present, including:

- **Structures:** No major new infrastructure would be built. Routine maintenance and repairs would continue as at present.
- **Mix of Uses:** The current mix of uses at WUS would continue, including approximately 208,000 square feet of retail space, 120,000 square feet of office space, and 85,600 square feet of Amtrak support areas.
- **Parking:** Parking would remain southwest of H Street NE within the existing garage, capable of accommodating around 2,450 cars. Ingress into the garage would continue to be from H Street NE (west intersection) and Columbus Circle (east ramp). Egress would continue to be through H Street NE via the west intersection and through the ramp running parallel to First Street along the west side of the station (west ramp).
- **Buses:** There would continue to be 61 bus spaces in the existing facility southwest of H Street NE, below the parking garage. Buses would continue to enter the facility via the H Street west intersection and to exit through the bus-only exit ramp to H Street NE.
- **For-Hire Vehicles:** Taxis would continue to have approximately 24 spaces, distributed across the two northernmost lanes of Columbus Circle, for pick-up and drop-off. Non-taxi for-hire vehicles would continue to share with private vehicles the approximately 24 spaces available in the two southernmost traffic lanes of the circle.
- **Bicycles:** Bikeshare facilities would remain on the east side of WUS at F Street NE, with 54 bikeshare spaces. The bicycle station parking facility in the southwest would continue to offer around 100 bicycle parking spaces.
- **Pedestrians:** Pedestrians would continue to enter or exit WUS via the Washington Metropolitan Transit Authority (WMATA) Metrorail First and G Street entrances, the southwest portico and front of the historic station building, and the H Street bus facility.
- **Intercity and Commuter Operations and Ridership:** Operations by Amtrak, Virginia Railways Express (VRE), and Maryland Area Regional Commuter (MARC) trains and intercity bus companies would continue but with increased passenger volumes and levels of service as shown in **Table 1-2**.

Table 1-2. Passenger Volumes[1] by Service, No-Action Alternative

Service	Existing Volumes	No-Action Alternative Volumes (2040)	Train or Bus Service Change over Existing Conditions
Amtrak[2]	16,400 daily 5.033 million annually	21,800 daily (+33%) 6.694 million annually	+24%
MARC[2]	28,100 daily 7.683 million annually	37,900 daily (+35%) 9.483 million annually	+11%
VRE[2]	3,900 daily 1.06 million annually	4,900 daily (+29%) 1.378 million annually	+6%
WMATA[3]	29,000 daily boardings 7.25 million annual boardings	43,800 daily boardings (+51%) 10.95 million annual boardings	+0%[5]
Intercity Bus[4]	10,000 daily 2.5 million annually	12,700 daily (+27%) 3.175 million annually	+27%

1. Passenger volume measures the number of passengers that are boarding and alighting at WUS.
2. FRA. 2016. NEC Future, Tier 1 Final EIS. Accessed from https://www.fra.dot.gov/necfuture/. Accessed on June 6, 2018; FRA. 2016. WUS Operating Plan.
3. WMATA, 2016. WMATA reports ridership based on boardings not total ridership (boardings and alightings). Other figures in this table represent total ridership.
4. Union Station Parking Garage. 2016. Daily Intercity Bus Ridership Data.
5. Based on information from WMATA, it is expected that trains would arrive every three minutes at the peak period. Fifty percent of the peak-hour cars on the Red Line would continue to be eight-car trains as at present.

The No-Action Alternative includes several projects with independent utility that would take place within the Project Area, with likely completion dates prior to 2040. These include several station and track improvement projects the Project Proponents identified. These projects are shown in **Table 1-3**.

Table 1-3. Station and Track Improvement Projects Included in the No-Action Alternative

Station and Track Improvements	Description	Design Completion	Construction Completion Year(s)
General Garage Restoration	Ongoing structural repairs and maintenance to the mezzanine rental car level and levels 1-4 of the incompatible parking garage.	Ongoing	Ongoing
West End Mezzanine Patio	Creation of a new eatery patio seating area at mezzanine level above the Le Pain Quotidien space.	Complete	Complete
Relocate Heating Ventilation and Air Conditioning (HVAC) Unit	Decommission units in the train concourse mechanical rooms and install new units on the roof of the Claytor Concourse.	Complete	2018
Rehabilitate Track 22	Rehabilitate engine storage track to provide revenue service and improve operational flexibility.	Complete	2022

Station and Track Improvements	Description	Design Completion	Construction Completion Year(s)
Original Concourse Ceiling Repair	Plaster repair to the original concourse ceiling damaged by the 2011 earthquake. Structurally reinforce the ceiling so it is seismically sound for the future.	Complete	Complete
Replace North Hangar Escalator	Replace six escalators connecting to the eastern run-through platforms.	Complete	2018
New Elevator, Tracks 27-28	Install new ADA-compliant elevator.	Complete	2019
Electrify Tracks 8-9	Electrify tracks to enhance operational flexibility.	Complete	2019
Amtrak Police Relocation	Relocate personnel to REA Building and construct new one-story patrol facility.	Ongoing	2022
Relocate Satellite Commissary	Replace refrigerated storage area from under H Street Bridge.	Ongoing	2022
K Tower Improvements	Implement new train dispatch software and relocate Amtrak operational personnel to the REA Building.	Complete	2020
Concourse Modernization Project	Fully renovate the Claytor Concourse and North Hangar. Expand passenger areas and add a new Club Acela lounge.	Ongoing	To be Determined (TBD)
Sub-basement Track-bed Replacement	Repair track bed support elements in the sub-basement.	2021	2025
Substation 25A Relocation	Relocate and replace substation; sectionalize overhead catenary to improve operational flexibility.	2021	TBD
Crew Base Renovation	Renovate and potentially expand the existing Transportation Building for operational functions.	2021	TBD
Retail Mezzanine Development	Reconfiguration of the Retail Concourse Mezzanine to create a more open layout and expose more historic fabric to the public than what currently exists.	TBD	TBD
Presidential Reception Room	Reconfiguration of the Presidential Reception Room's west wall to create a new entrance connection to the lobby area and East Hall. The new entrance would create a more direct connection to the lobby area and East Hall from the Presidential Reception Room.	TBD – DC SHPO approved	TBD

The No-Action Alternative also includes the following projects, which are all independent of the Project and have anticipated completion dates earlier than 2040:

- **VRE Midday Storage Replacement Facility Project:** The VRE Midday Storage Replacement Facility Project would replace the current storage space leased from Amtrak at the Ivy City Coach Yard in the District.

- **H Street Bridge Replacement:** The District Department of Transportation (DDOT) is planning to replace the H Street Bridge because the deck is reaching the end of its useful life.
- **DC Streetcar Extension:** The current DC Streetcar line, which runs from WUS to Benning Road NE and Oklahoma Avenue NE, is programmed for extension eastward and westward. As part of this expansion, the construction of a new streetcar stop and the realignment of tracks on the H Street Bridge to accommodate the western extension would take place within the Project Area.
- **WMATA Station Improvements:** WMATA would expand and relocate the First Street entrance to the North Mezzanine of the Union Station Metrorail Station. A new ramp would be outside of the station, above the First Street sidewalk. Moving the ramp outside would make room for additional fare gates and circulation space inside.
- **Private Air-rights Development:** This project would be a mixed-use development in the private air-rights above the WUS rail terminal. **Table 1-4** shows the development scenario assumed for the impact analysis. This level of development would be consistent with the Union Station North (USN) Zoning District applying to the area.

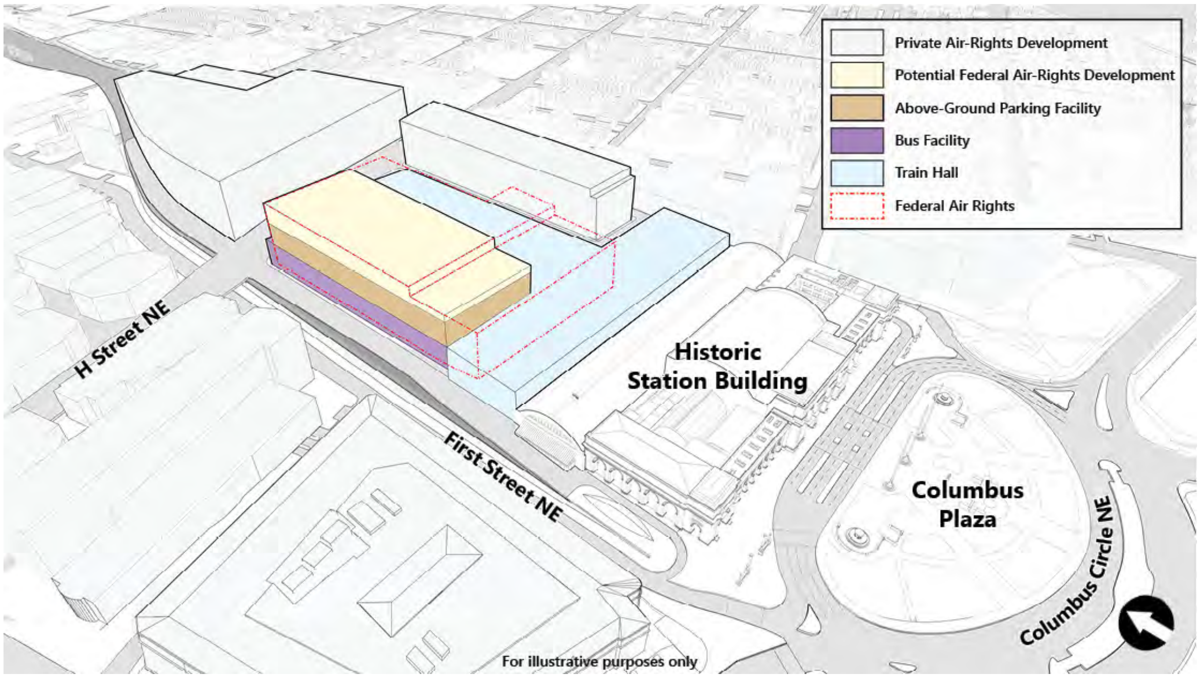
Table 1-4. Private Air-rights Development Scenario in the No-Action Alternative

Component	Size
Residential	1,050,000 square feet (sf)
Hotel	410,000 sf
Office	2,160,000 sf
Retail	120,000 sf
Total	3,740,000 sf
Parking	1,320 spaces

1.7.2 Alternative A

Alternative A features a north-south train hall between H Street NE and Concourse A. The bus facility and parking facility would be in a new, above-ground structure (multimodal surface transportation center) in the southwest corner of the Project Area, approximately where the existing parking garage now stands. The Federally owned air-rights space not used for the multimodal surface transportation center would be available for potential future development. **Figure 1-2** illustrates Alternative A. Summary descriptions of its key features are below.

Figure 1-2. Illustration of Alternative A



- **Structures:** The north-south train hall would be approximately 180,000 square feet in size and cover portions of three centrally located platforms between H Street NE and the south ends of the tracks. The bus and parking facilities would be approximately 105,400 square feet and 599,000 square feet, respectively.
- **Mix of Uses:** Retail space would be approximately 280,000 square feet and the Amtrak support area approximately 297,400 square feet.
- **Parking:** Parking would be southwest of H Street NE, above ground in the new multimodal surface transportation center. Access would be via H Street NE. There would be space for approximately 1,750 cars.
- **Buses:** A 26-slip facility would be located southwest of H Street, below the parking facility. Access would be from H Street NE.
- **For-Hire Vehicles/Pick-up and Drop-off:** For-hire and private vehicles would have around 40 spaces for pick-up and drop off. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, and at deck-level next to the train hall. The parking facility would have storage space for for-hire vehicles.
- **Bicycles:** Bikeshare and bicycle parking options would remain at First and 2nd Streets NE and would offer more Bikeshare bicycles (approximately 105). The capacity for bike storage would increase by approximately 200 spots.

- **Pedestrians:** Pedestrians would be able to access the station via the existing Metrorail station's First and G Street entrance, the southwest portico of the historic station, the front of the station, and from H Street NE. New entrances would be available under the H Street Bridge at First and 2nd Streets NE and at the train hall headhouse on the H Street Bridge.
- **Intercity and Commuter Operations and Ridership**: Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) **(Table 1-5)**.

Table 1-5. Passenger Volumes by Service, All Action Alternatives

Service	Existing Volumes	Action Alternatives Volumes (2040)	Train or Bus Service Change over Existing Conditions
Amtrak	16,400 daily 5.033 million annually	32,000 daily (+95%) 9.070 million annually	148%
MARC	28,100 daily 7.683 million annually	70,700 daily (+152%) 19.293 million annually	163%
VRE	3,900 daily 1.06 million annually	13,600 daily (+258%) 3.706 million annually	187%
WMATA	29,000 daily boardings 7.25 million annual boardings	43,800 daily boardings (+51%) 10.95 million annual boardings	0%
Intercity Bus	10,000 daily 2.5 million annually	11,900 daily (+19%) 2.975 million annually	19%

- **Property Acquisition:** Approximately 3.1 acres of private air rights would be acquired for the train hall, circulation roadways, and other Project elements.
- **Potential Development of Federal Air Rights:** The Federal air rights not needed for the new bus and parking facilities would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 323,720 gross square feet (GSF).[9]
- **Estimated Construction Cost:** Alternative A would cost approximately $6.1 billion to construct. [10]
- **Estimated Construction Duration:** Alternative A would take an estimated 11 years and 5 months to construct.

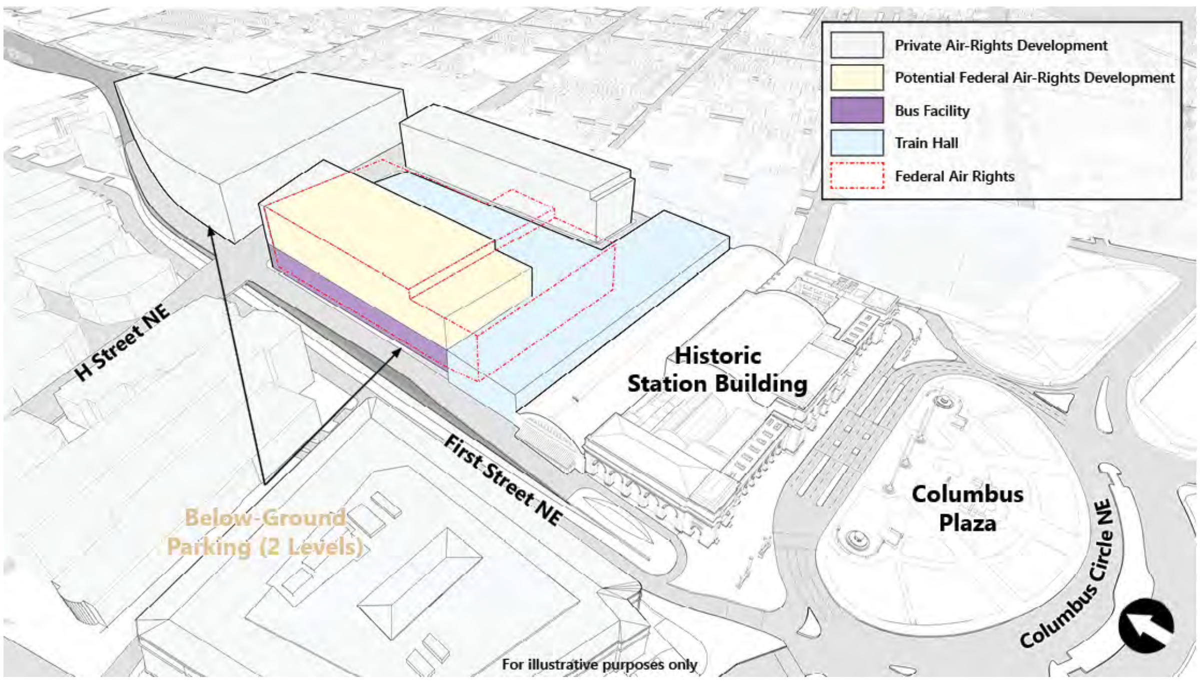
9 The nature of the potential future Federal air-rights development is undetermined. However, commercial development is likely. Given the Federal air rights' location above a multi-story bus and parking facility with no opportunity for direct access from the street level, the impact analysis assumes that in Alternative A, the development would consist of additional parking.

10 See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

1.7.3 Alternative B

Alternative B features a north-south train hall between H Street NE and east-west Concourse A. The bus facility would be in the southwest corner of the Project Area, approximately where the existing parking garage is located. All parking would be below ground. The portion of the Federally owned air rights not needed for the bus facility would be available for potential future development. **Figure 1-3** illustrates Alternative B. Summary descriptions of its key features are below.

Figure 1-3. Illustration of Alternative B



- **Structures:** The north-south train hall would be approximately 180,000 square feet in size and cover portions of three centrally located platforms between H Street NE and the ends of the tracks. The new bus facility would be approximately 105,400 square feet.
- **Mix of Uses:** Retail space would be approximately 280,000 square feet and the Amtrak support area approximately 297,400 square feet.
- **Parking:** Parking would be in two below-ground levels between K Street NE and Concourse A. Together, the two levels would accommodate approximately 2,000 cars. Access would be via K Street NE.
- **Buses:** A 26-slip facility would be southwest of H Street NE. Access would be via H Street.
- **For-Hire Vehicles/Pick-up and Drop-off:** For-hire and private vehicles would have around 50 spaces for pick-up and drop off. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, at deck-level next to the train hall, and in the below-ground parking facility.

- **Bicycles:** Bikeshare and bicycle parking options would remain at First and 2nd Streets NE and would offer more Bikeshare bicycles (approximately 105). The capacity for bike storage would increase to approximately 200 bicycles.
- **Pedestrians:** Pedestrians would be able to access the station via the Metrorail station's First and G Street entrance, the southwest portico of the historic station, the front of the station, and from H Street NE. New entrances would be located under the H Street Bridge. Entrances would also be available at the train hall headhouse on the H Street Bridge.
- **Intercity and Commuter Operations and Ridership:** Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) (see **Table 1-3** above).
- **Property Acquisition:** Approximately 2.8 acres of private air rights would be acquired for the train hall, circulation roadways, and other Project elements.
- **Potential Development of Federal Air Rights:** The Federal air rights not needed for the new bus facility would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 917,420 GSF.[11]
- **Estimated Construction Cost:** Alternative B would cost approximately $7.5 billion to construct.[12]
- **Estimated Construction Duration:** Alternative B would take an estimated 14 years and 4 months to construct.

1.7.4 Alternative C

Alternative C would provide an east-west train hall encompassing east-west Concourse A and a bus pick-up and drop-off area between the train hall and the historic station building. The bus facility would be north of H Street NE. Vehicular parking would be both above the bus facility and below ground. Alternative C has two options. The East Option (**Figure 1-4**) would place the bus facility and above-ground parking along the east side of the Project Site. The West Option (**Figure 1-5**) would place them along the west side of the Project Site. Summary descriptions of its key features are below.

[11] The nature of the potential future air-rights development is undetermined. However, commercial development is likely. The impact analysis assumes that in Alternative B, it would consist of office space. The same assumption holds for Alternatives C, D, and E.

[12] See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

Figure 1-4. Illustration of Alternative C, East Option

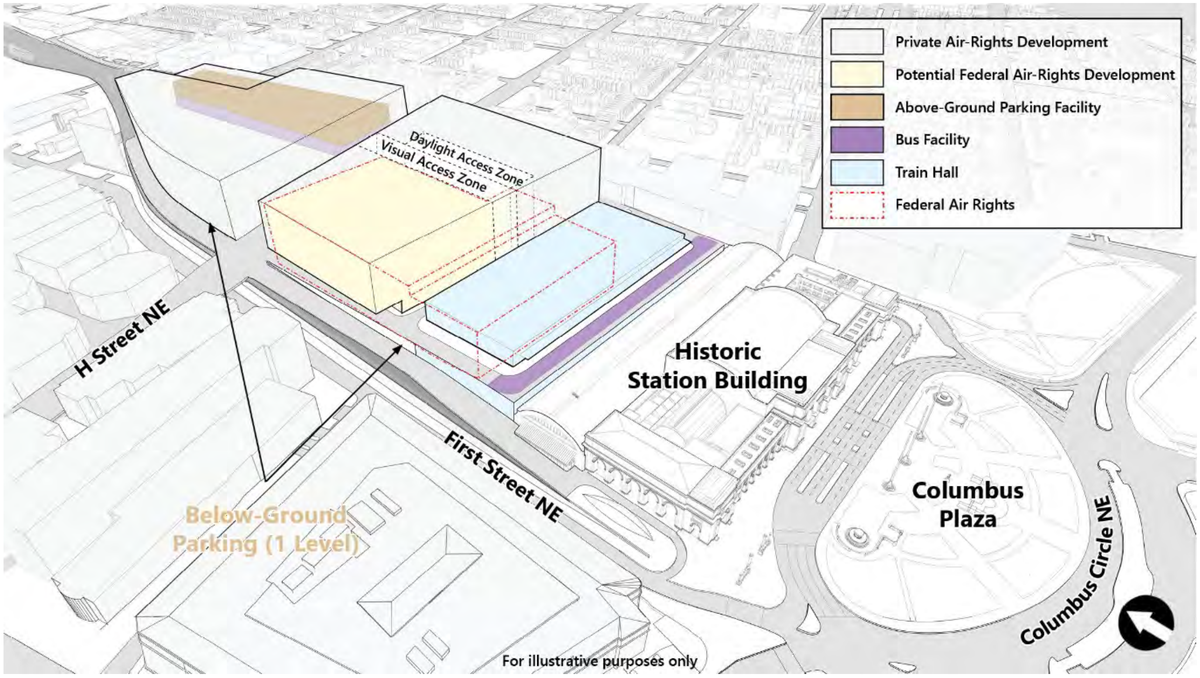
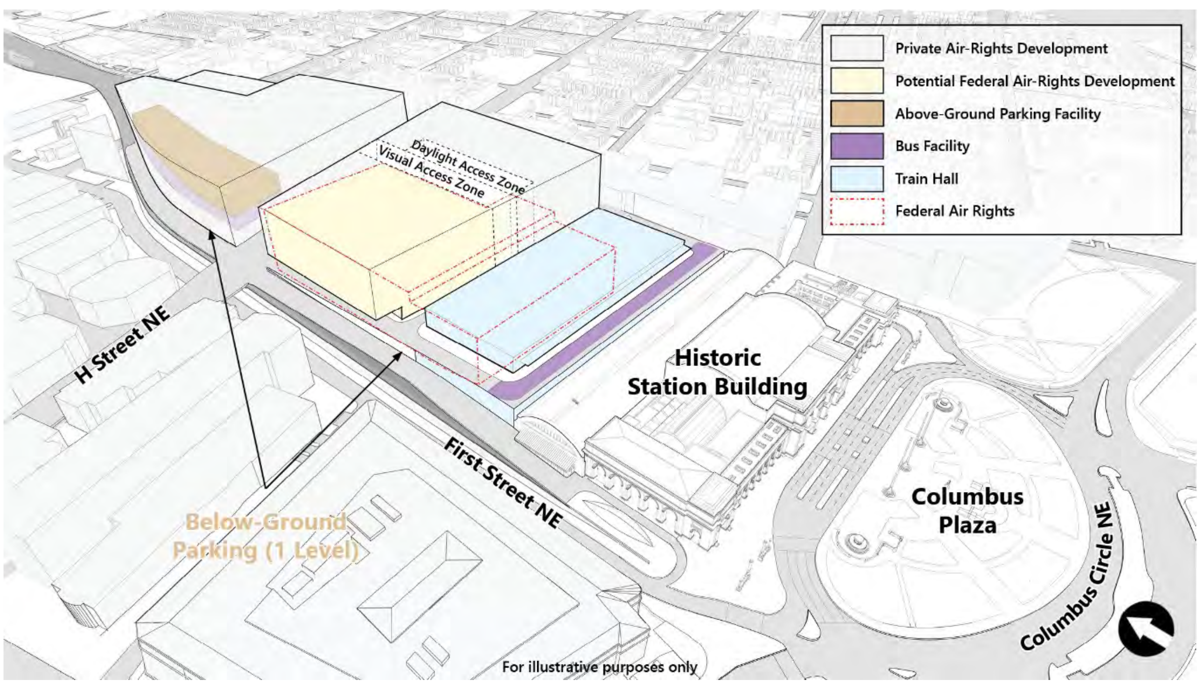


Figure 1-5. Illustration of Alternative C, West Option



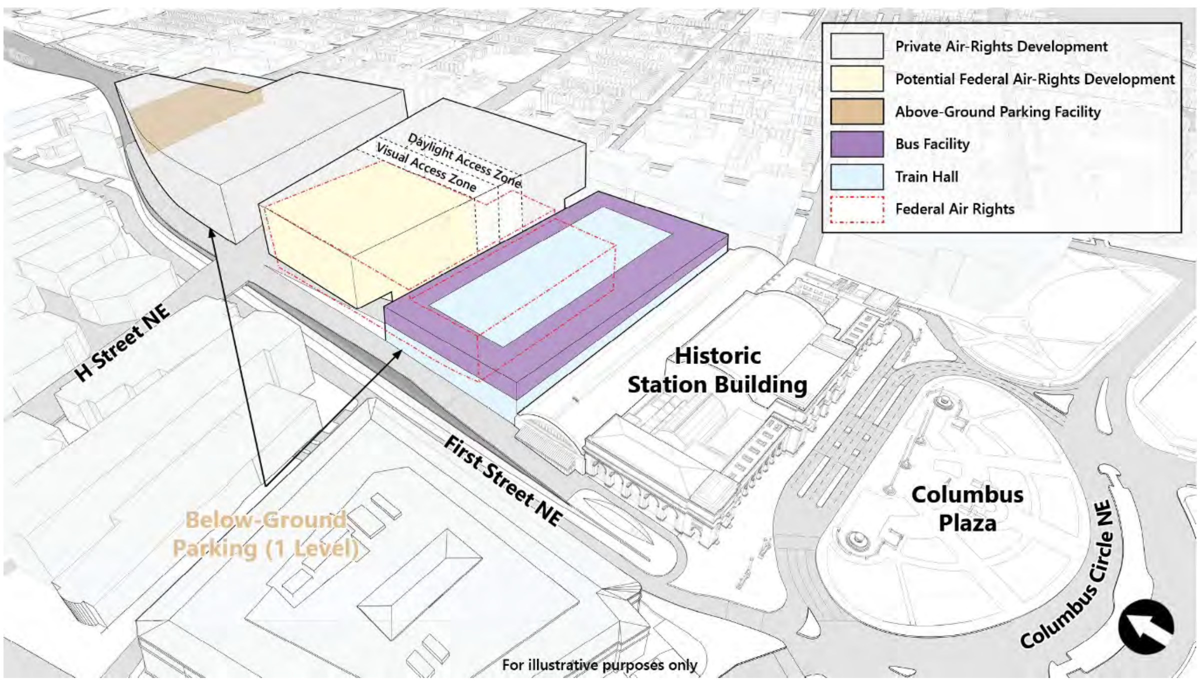
- **Structures:** The east-west train hall would be approximately 115,000 square feet. It would cover the train engines and part of the first car on all the tracks. The main bus facility would be approximately 122,250 square feet (East option) or 130,000 square feet (West Option). The pick-up and drop-off area would be approximately 37,600 square feet in both options. The above-ground parking facility would be approximately 387,000 square feet (East Option) or 360,000 square feet (West Option).
- **Mix of Uses:** Retail space would be approximately 280,000 square feet and the Amtrak support area approximately 297,400 square feet.
- **Parking:** Parking would be provided above the bus facility in the northeast (East Option, capacity of approximately 750 cars) or northwest (West Option, capacity of approximately 710 cars) part of the Project Area. Access would be via H Street NE. Both options would also have one level of below-ground parking (with space for approximately 900 cars), reached via K Street NE.
- **Buses:** The main bus facility would be built northeast of H Street NE and have 17 slips (East Option) or it would be built northwest of H Street NE and have 19 slips (West Option). The bus pick-up and drop-off area would accommodate nine buses. Both the main facility and the pick-up and drop-off area would be accessed via H Street NE.
- **For-Hire Vehicles/Pick-up and Drop-off:** For-hire and private vehicles would have around 50 spaces for pick-up and drop off. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, at deck-level next to the train hall, and in the below-ground parking facility.
- **Bicycles:** The existing Bikeshare and bicycle parking would stay at First and 2nd Street NE. Additional Bikeshare spots would be provided (approximately 104). The capacity for bicycle storage would be approximately 200 bicycles.
- **Pedestrians:** Pedestrians would access WUS via the existing Metrorail station's First and G Street entrance, the southwest portico of WUS, the front of the station, and from H Street NE. New entrances would be located under the H Street Bridge.
- **Intercity and Commuter Operations and Ridership:** Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) (see **Table 1-3** above).
- **Property Acquisition:** Approximately 4.6 acres (East Option) or 4.8 acres (West Option) of private air rights would be acquired to accommodate various elements of the Project.

- **Potential Development of Federal Air Rights:** [13] The Federal air rights not needed for the Project would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 952,600 GSF.
- **Estimated Construction Cost:** Alternative C (either option) would cost approximately $6.2 billion to construct. [14]
- **Estimated Construction Duration:** Alternative C (either option) would take an estimated 12 years and 3 months to construct.

1.7.5 Alternative D

Alternative D features an east-west train hall with integrated bus facility, above-ground parking just south of K Street NE, and below-ground parking. **Figure 1-6** illustrates Alternative D. Summary descriptions of its key features are below.

Figure 1-6. Illustration of Alternative D



- **Structures:** The east-west train hall would be approximately 100,000 square feet. It would cover the train engines and part of the first car on all the tracks. The approximately

13 Although development of the Federally owned air rights is not part of the Project, the development of those rights may result from the Project.

14 See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

108,000-square-foot bus facility would be integrated with the train hall. The above-ground parking facility would be approximately 288,000 square feet.

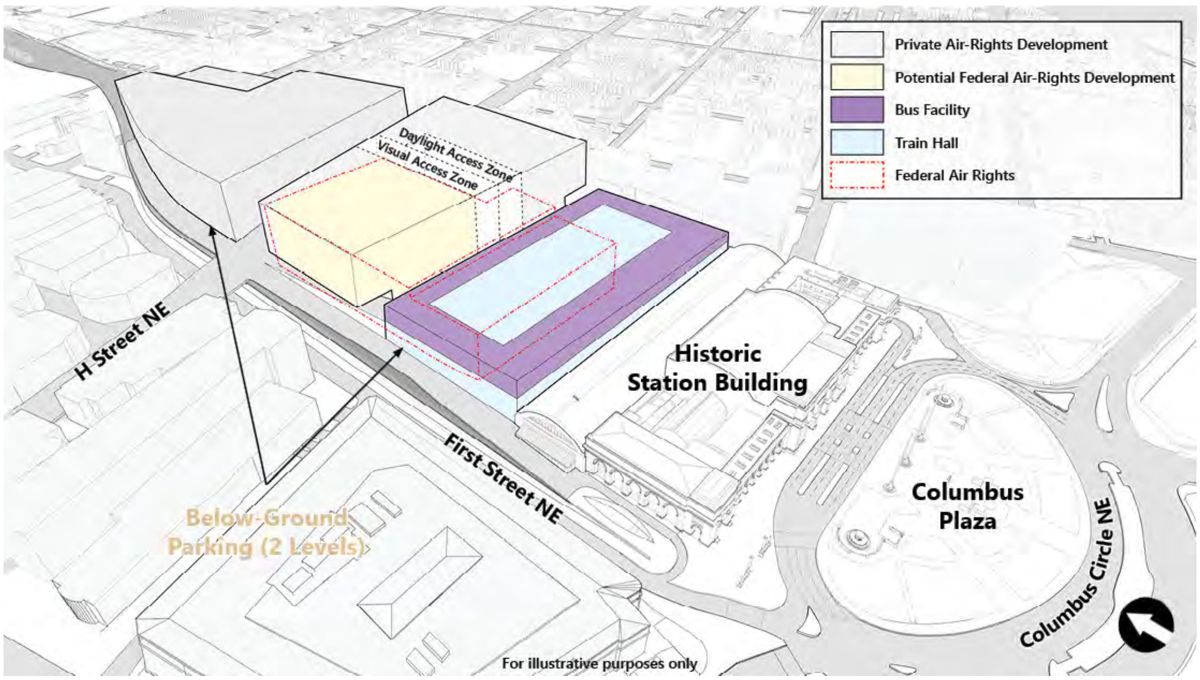
- **Mix of Uses:** Retail space would be approximately 308,000 square feet and the Amtrak support area approximately 297,400 square feet.
- **Parking:** An above-ground parking facility (capacity for approximately 750 cars) would be built in the far north part of the Project Area, just south of K Street NE. One level of below-ground parking would also be provided, with space for approximately 900 cars. Entry to and exit from the above-ground parking facility would be via H Street. The below-ground facility would be accessed via K Street NE.
- **Buses:** The integrated bus facility would have 27 spaces distributed on either side of the train hall. Access would be via H Street NE.
- **For-Hire Vehicles/Pick-up and Drop-off:** For-hire and private vehicles would have approximately 50 spaces for pick-up and drop-off. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, at deck-level next to the train hall, and in the below-ground parking facility.
- **Bicycles:** The existing Bikeshare and bicycle parking options would remain at First and 2nd Street NE. Additional Bikeshare bicycles would be provided (approximately 104). The capacity for bicycle storage would be approximately 200 bicycles.
- **Pedestrians:** Pedestrians would access WUS via the existing Metrorail station's First and G Street entrance, the southwest portico of WUS, the front of the Station, and from H Street NE. There would be new entrances under the H Street Bridge.
- **Intercity and Commuter Operations and Ridership:** Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) (see **Table 1-3** above).
- **Property Acquisition:** Approximately 4.8 acres of private air rights would be acquired to accommodate various elements of the Project.
- **Potential Development of Federal Air Rights:** The Federal air rights not needed for the Project would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 688,050 GSF.
- **Estimated Construction Cost:** Alternative D would cost approximately $6.2 billion to construct. [15]
- **Estimated Construction Duration:** Alternative D would take an estimated 12 years and 3 months to construct.

[15] See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

1.7.6 Alternative E

Alternative E features an east-west train hall with integrated bus facility and only below-ground parking (**Figure 1-7**). Summary descriptions of its key features are below.

Figure 1-7. Illustration of Alternative E



- **Structures:** The east-west train hall would be approximately 100,000 square feet in area. The train hall would cover the train engines and part of the first car on all the tracks. The bus facility (integrated with the train hall) would be approximately 108,000 square feet in size.
- **Mix of Uses:** Retail space would be approximately 308,000 square feet and the Amtrak support area approximately 297,400 square feet.
- **Parking:** Parking would be in two below-ground levels, with space for approximately 2,000 cars. Access would be via K Street NE.
- **Buses:** The integrated bus facility would have 27 spaces distributed on either side of the train hall. Access would be via H Street NE.
- **For-Hire Vehicles/Pick-up and Drop-off:** For-hire and private vehicles would have 50 spaces for pick-up and drop-off. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, at deck-level next to the train hall, and in the below-ground parking facility.

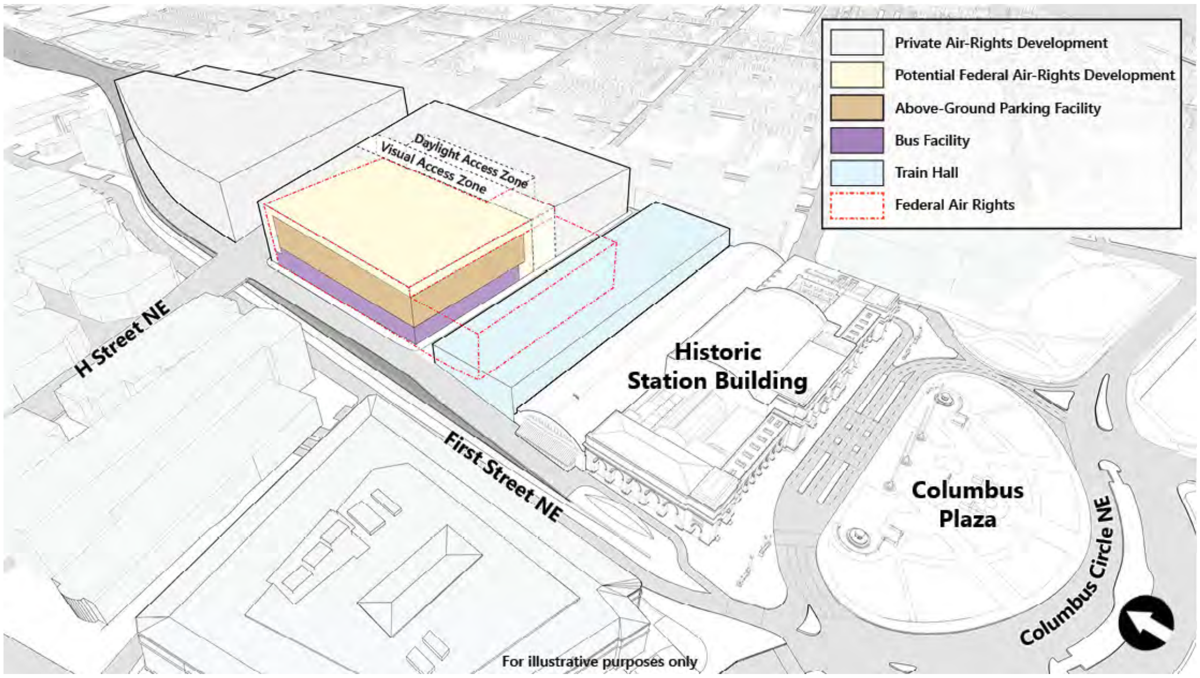
- **Bicycles:** The existing Bikeshare and bicycle parking options would remain at First and 2nd Streets NE. Additional Bikeshare bicycles would be provided (approximately 104). The capacity for bicycle storage would be approximately 200 bicycles.
- **Pedestrians:** Pedestrians would access WUS via the existing Metrorail station's First and G Street entrance, the southwest portico of WUS, the front of the Station, and from H Street NE. New entrances would be located under the H Street Bridge.
- **Intercity and Commuter Operations and Ridership:** Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) (see **Table 1-3** above).
- **Property Acquisition:** Approximately 1.9 acres of private air rights would be acquired to accommodate various elements of the Project.
- **Potential Development of Federal Air-Rights:** The Federal air rights not needed for the Project would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 688,050 GSF.
- **Estimated Construction Cost:** Alternative E would cost approximately $6.9 billion to construct.[16]
- **Estimated Construction Duration:** Alternative E would take an estimated 14 years and 4 months to construct.

1.7.7 Alternative A-C (Preferred Alternative)

Alternative A-C features an east-west train hall encompassing Concourse A. The bus facility and parking facility would be in a new, above-ground structure (multimodal surface transportation center) located in the southwest corner of the Project Area, approximately where the existing parking garage now stands. The portion of the Federally-owned air rights not used for the multimodal surface transportation center would be available for potential future development. **Figure 1-8** illustrates Alternative A-C. Summary descriptions of its key features are below.

[16] See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

Figure 1-8. Illustration of Alternative A-C



Structures: The east-west train hall would be approximately 113,500 square feet in size. The bus facility would be approximately 210,000 square feet and the parking facility would be approximately 690,000 square feet.

Mix of Uses: Retail space would be approximately 280,000 square feet and the Amtrak support area approximately 297,400 square feet.

Parking: Parking would be southwest of H Street NE, above-ground in the multimodal surface transportation center. There would be space for approximately 1,600 cars.

Buses: A two-level facility capable of accommodating 40 bus slips (20 per level) located southwest of H Street in the multimodal surface transportation center. If not needed for buses, it could potentially be used for other activities such as for-hire and private pick-up and drop-off.

For-Hire Vehicles/Pick-up and Drop-off: For-hire and private vehicles would have around 50 spaces for pick-up and drop off. The parking facility would have storage space for for-hire vehicles. Pick-up/drop-off areas would be provided in front of WUS, on First and Second Streets NE near H Street, and at deck-level next to the train hall.

Bicycles: Bikeshare and bicycle parking options would remain at First and 2nd Streets NE and would offer more Bikeshare bicycles (approximately 105). The capacity for bike storage would increase by approximately 200 spots.

Pedestrians: Pedestrians would be able to access the station via the existing Metrorail station's First and G Street entrance, the southwest portico of the historic station, the front of the station, and from H Street NE. New entrances would be available under the H Street Bridge.

Intercity and Commuter Operations and Ridership: Levels of service would grow along with projected demand. Train volume increases relative to existing levels would range from 148 percent (Amtrak) to 187 percent (VRE) (see **Table 1-3** above).

Property Acquisition: Approximately 1.1 acres of private air rights would be acquired to accommodate various Project elements.

Potential Development of Federal Air Rights: The Federal air rights not needed for the new bus and parking facilities would be available for potential future transfer and development. The potentially developable envelope would encompass approximately 380,000 GSF.

Estimated Construction Cost: Alternative A-C would cost approximately $5.8 billion to construct. [17]

Estimated Construction Duration: Alternative A-C would take an estimated 11 years and 5 months to construct.

[17] See **Appendix A8**, *Action Alternatives Cost Estimates Memorandum* for the basis of this estimate.

2 Natural Ecological Systems

2.1 Overview

This section describes and characterizes the potential direct and indirect impacts of the No-Action and Action Alternatives on natural ecological systems. Natural ecological systems include resources such as vegetation, common and protected wildlife, wetlands, and floodplains. If applicable, it also recommends measures to avoid, minimize, or mitigate potential adverse impacts and it identifies relevant permitting and regulatory compliance requirements.

2.2 Regulatory Context

Federal policies, regulations and guidance that may pertain to natural ecological resources include:

- Endangered Species Act of 1973 (16 United States Code [USC] 1531) and implementing regulations (50 Code of Federal Regulations [CFR] 402);
- Bald and Golden Eagle Protection Act of 1940 (16 USC 668);
- Migratory Bird Treaty Act of 1918 (16 USC 703-711) and implementing regulations (50 CFR 10);
- Clean Water Act (CWA) (22 USC 1251) and implementing regulations (40 CFR 110-112);
- CWA Section 404 (33 USC 1344) and implementing regulations (33 CFR 320-330, 40 CFR 230);
- Coastal Zone Management Act of 1972 (16 USC 1451-1464);
- Executive Order (EO) 11990, Protection of Wetlands (42 FR 26961);
- EO 11988, Floodplain Management (42 Federal Register [FR] 26951);
- EO 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure; and
- Guidance for Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federally Landscaped Grounds (60 FR 40837).

2.3 Study Area

As defined in the *Washington Union Station (WUS) Expansion Project Affected Environment Report* (**Appendix C2**), the Local Study Area for natural ecological systems, shown in **Figure 2-1,** includes the Project Area along with a 150-foot buffer. The Local Study Area includes all areas in which natural resources could be directly or indirectly affected by the construction or operation of the Project. The Regional Study Area includes areas of the District surrounding the Local Project Area out to approximately 1,000 feet.

2.4 Methodology

Section 2 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on natural ecological systems. A summary of the methodology is provided below.

2.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The assessment of potential operational impacts on natural ecological systems consisted of a review of the natural ecological systems that may occur within the Study Areas to determine whether WUS operations would interfere with components of these systems.

2.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts were assessed by evaluating whether construction activities would disrupt or damage any natural ecological system components.

Figure 2-1. Natural Ecological Systems Local Study Area

2.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on natural ecological systems. Impacts are summarized in bold lettering. Because all the Action Alternatives would have the same impacts, they are addressed together to minimize redundancy.

2.5.1 No-Action Alternative

2.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no direct operational impacts on natural ecological systems.

As documented in **Appendix C2**, *WUS Expansion Project Affected Environment Report*, the Local Study Area is fully developed with transportation infrastructure and buildings. It contains no natural ecological systems. Similarly, the Regional Study Area encompasses urban neighborhoods densely developed with commercial and residential buildings, streets and roads, and paved parking areas. It is devoid of any natural habitat. Therefore, the No-Action Alternative would have no direct operational impacts on natural ecological systems.

2.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no indirect operational impacts on natural ecological systems.

For the same reasons as stated above, the No-Action Alternative would have no indirect operational impacts on natural ecological systems.

2.5.1.3 Construction Impacts

There would be no construction impacts on natural ecological systems in the No-Action Alternative.

Construction activities associated with the projects included in the No-Action would likely disturb and displace any urban-dwelling birds or mammals that may be present in the Project Area. Such disturbance is common in urban areas and would only affect birds that could easily relocate to adjacent areas or nuisance species such as rats. This would not amount to an impact on natural ecological systems.

2.5.2 Action Alternatives

2.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, none of the Action Alternatives would have direct operational impacts on natural ecological systems.

As explained for the No-Action Alternative, and documented in **Appendix C2**, *WUS Expansion Project Affected Environment Report*, the Local and Regional Study Areas are fully developed with transportation infrastructure and buildings. They contain no natural ecological systems. Therefore, the Action Alternatives would have no direct operational impacts on natural ecological systems.

2.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, the Action Alternatives would have no indirect operational impacts on natural ecological systems.

For the same reasons as stated above, none of the Action Alternatives would have indirect operational impacts on natural ecological systems.

2.5.2.3 Construction Impacts

Construction of all Action Alternatives would result in minor adverse impacts on natural ecological systems.

As documented in **Appendix C2**, *WUS Expansion Project Affected Environment Report*, there are approximately 26 ornamental trees (*Zelkova serrata*) on the east sidewalk of First Street NE between G and K Streets. Construction activities along the western edge of the Project Area and the east side of First Street NE would require the removal of those trees. The construction of pick-up and drop off spaces on the west side of 2nd Street NE south of the H Street Bridge would likely require removing four of the ten trees currently present on the sidewalk. These would be minor adverse impacts, as the trees are non-native, ornamental street trees that do not form part of a larger natural system. Tree removal would require coordination with the District Department of Transportation (DDOT) Urban Forestry Ward Arborist and permitting, as described in **Section 2.7**, *Avoidance, Minimization, and Mitigation* and **Section 2.8**, *Permits and Regulatory Compliance*.

Construction activities throughout the Project Area would likely disturb and displace any urban-dwelling birds or mammals that may be present. Such disturbance is common in urban areas and would only affect birds that could easily relocate to adjacent areas or nuisance species such as rats. This would not amount to an impact on natural ecological systems.

2.6 Comparison of Alternatives

Table 2-1 presents a comparison of the alternatives. The No-Action Alternative would have no direct operational, indirect operational, or construction impacts on natural ecological systems.

All the Action Alternatives would have the same impacts: no direct or indirect operational impacts and minor adverse construction impacts due to urban tree removal along First Street NE between G and K Streets.

Table 2-1. Comparison of Alternatives

Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
Direct Operational	No impacts	No impacts					
Indirect Operational	No impacts	No impacts					
Construction	No impacts	Minor adverse impacts					

2.7 Avoidance, Minimization, and Mitigation Evaluation

The exact number of street trees to be removed would be determined and minimized during construction planning in coordination with the DDOT Urban Forestry Ward Arborist. Compensation for removed trees would be provided in accordance with the applicable permitting requirements described in **Section 2.8**, *Permits and Regulatory Compliance*.

2.8 Permits and Regulatory Compliance

Removal of street trees would require a Public Space Tree Permit from the DDOT Urban Forestry Division.[1] Compensation for lost trees is based on the health of the tree. Non-hazardous street trees require payment of $200 per inch diameter plus planting of a new

[1] Information on the permit application process is available from: *DDOT Public Space Tree Permit*, https://ddot.dc.gov/node/500302. Accessed on May 29, 2019.

street tree per DDOT *Green Infrastructure Standards*.[2] Hazardous street trees require planting a new street tree per DDOT *Green Infrastructure Standards* at a 1:1 ratio.[3]

[2] DDOT *Green Infrastructure Standards* are available at http://ddot.dc.gov/GreenInfrastructure. Accessed on May 29, 2019.

[3] A hazardous tree is a "a tree that, in the opinion of a certified arborist, is defective, diseased, dying, or dead and should be removed; poses a high risk of failure or fracture with the potential to cause injury to people or damage to property and should be removed; or is causing damage to property or structures that cannot be mitigated in any manner other than removal of the tree." (Code of the District of Columbia, Title 8, Chapter 6B, § 8–651.02, *Definitions*.)

3 Water Resources and Water Quality

3.1 Overview

This section describes and characterizes the potential direct and indirect impacts of the No-Action and Action Alternatives on surface waters, groundwater, stormwater, wastewater, and drinking water supply. If applicable, it also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies permitting and regulatory compliance requirements.

3.2 Regulatory Context

The Project is subject to both Federal and District policies for the protection of surface water, groundwater, and drinking water supply resources. The Federal water quality regulations listed below are enforced at the District level under local regulations and design guidelines.

The District Department of Energy and Environment (DOEE) is the lead authority on environmental compliance within the District. DOEE completes reviews and issues permits for land-disturbing projects. DC Water is an independent authority that distributes drinking water and collects and treats stormwater and wastewater in the District. DC Water Permit Operations Department issues approvals for projects that directly or indirectly affect the public water or sewer systems.

Federal policies, regulations, and guidance that may pertain to water resources and are most relevant to the Project include:

- Clean Water Act (CWA), as amended (33 United States Code [USC] 1251-1376) 401 and 402;

  Safe Drinking Water Act of 1974 (42 USC 300f);
- U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit;[1]
- Energy Independence and Security Act of 2007 (EISA) (Public Law 110 – 140); and

[1] U.S. Environmental Protection Agency. 2017. National Pollutant Discharge Elimination System. Accessed from https://www.epa.gov/npdes/epas-2017-construction-general-permit-cgp-and-related-documents. Accessed on January 22, 2019.

- Executive Order (EO) 13508, Chesapeake Bay Protection and Restoration;

District policies, regulations and guidance that may pertain to water resources include:

- DC Water Pollution Control Act of 1984, as amended (DC Law 5-188);[2]
- DC Storm Water Permit Compliance Amendment Act of 2000 (DC Law 13-311);[3]
- DC Municipal Regulations, Title 21 Water and Sanitation;[4]
- DOEE Stormwater Management Guidebook;[5]
- DC Water Green Infrastructure Utility Protection Guidelines;[6] and
- DC Water Project Design Manual Volume 3, Infrastructure Design.[7]
- Discharges from DC Water stormwater and combined sewer systems are permitted under two NPDES permits:
- Municipal Separate Storm Sewer System (MS4): NPDES Permit Number DC0000221 - Authorization to Discharge under the NPDES Municipal Separate Storm Sewer System Permit. Effective October 7, 2011.
- Water Blue Plains Advanced Wastewater Treatment Facility and combined sewer system: NPDES Permit Number DC0021199. Effective September 30, 2010.

3.3 Study Area

The Local Study Area for this resource extends 500 feet from the Project Area to encompass adjacent connections to DC Water stormwater, water supply, and wastewater infrastructure (**Figure 3-1**). Because disturbance from the construction and operation of the Project would be mostly limited to the Project Area, the discussion of impacts focuses on the Project Area. The Regional Study Area includes the Chesapeake Bay Watershed within the District.

[2] District of Columbia Law 5-188. Water Pollution Control Act of 1984. Accessed from https://code.dccouncil.us/dc/council/laws/5-188.html. Accessed on January 22, 2019.

[3] District of Columbia Law 13-311. Storm Water Permit Compliance Amendment Act of 2000. Accessed from https://code.dccouncil.us/dc/council/laws/13-311.html. Accessed on January 22, 2019.

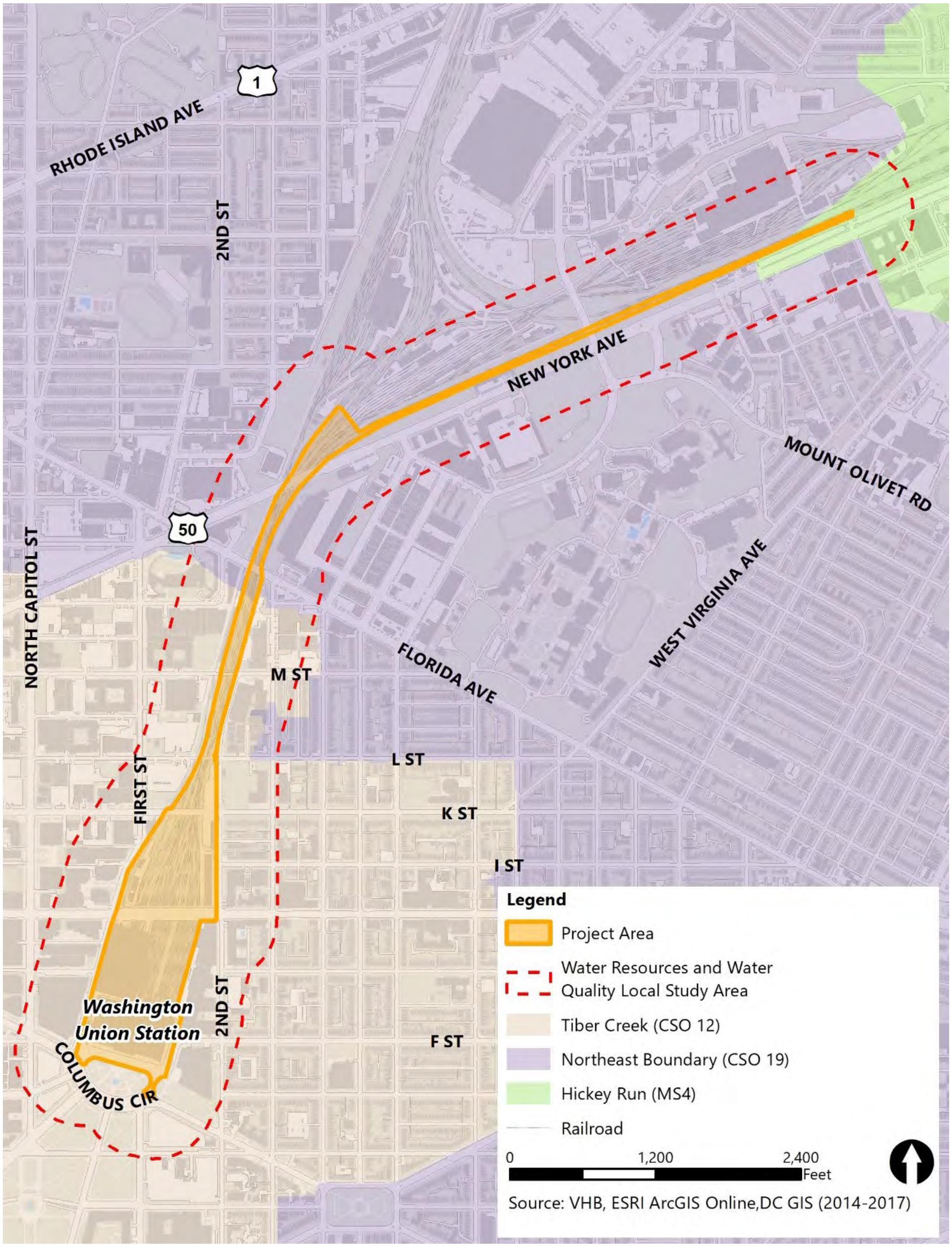
[4] District of Columbia Municipal Regulations. Title 21, Water and Sanitation. Accessed from http://dcrules.elaws.us/dcmr/t21. Accessed on January 22, 2019.

[5] District Office of Energy and Environment. 2013. *Stormwater Management Guidebook*. Accessed from https://doee.dc.gov/swguidebook. Accessed on June 6, 2017.

[6] DC Water. 2013. *Green Infrastructure Utility Protection Guidelines*. Accessed from https://www.dcwater.com/sites/default/files/Green%20Infrastructure%20Utility%20Protection%20Guidelines.pdf. Accessed on April 30, 2018.

[7] DC Water and Sewer Authority. 2001. *Project Design Manual Volume 3, Infrastructure Design.* Accessed from https://www.dcwater.com/sites/default/files/Project%20Design%20Manual%20Volume%203%20Infrastructure%20Design.pdf. Accessed on June 6, 2017.

Figure 3-1. Water Resources and Water Quality Study Area



3.4 Methodology

Section 3 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on water resources and water quality. A summary is below.

3.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The impacts of each Action Alternative, including the No-Action Alternative, were assessed based on the following information and indicators:

- Anticipated long-term dewatering needs based on preliminary geotechnical modeling.
- Spreadsheet calculation of regulated Stormwater Retention Volume (SWRv) per the DOEE Stormwater Management Guidebook.
- Projected wastewater generation compared to the available treatment capacity and qualitative assessment of DC Water's wastewater infrastructure to convey those flows.
- Projected drinking water demand compared to available supply and qualitative assessment based of DC Water's water supply infrastructure.
- Proposed mitigation strategies such as stormwater Best Management Practices (BMPs), green infrastructure, water conservation, and water reuse.

For the purposes of this section, beneficial impacts are those that would improve surface water and groundwater quality, provide groundwater recharge, reduce potable water usage and wastewater flows, or improve the level-of-service for water supply, wastewater, and/or stormwater infrastructure. Adverse impacts are those that would degrade surface water and groundwater quality, decrease groundwater recharge, increase potable water usage and wastewater flows, and/or impair the level-of-service for water supply, wastewater, and/or stormwater infrastructure.

3.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts were assessed based on the depth of excavation; dewatering needs; construction techniques for groundwater exclusion; and erosion and sediment control practices.

3.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on water resources and water quality. Impacts are summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational impacts as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

3.5.1 No-Action Alternative

3.5.1.1 Direct Operational Impacts

Surface Waters

Relative to existing conditions, the No-Action Alternative would have no adverse direct operational impacts on surface waterbodies.

There are no surface waterbodies within or adjacent to the Project Area or the Local Study Area. The No-Action Alternative has no potential to directly affect surface waters.

Groundwater

Relative to existing conditions, the No-Action Alternative would have negligible adverse direct operational impacts on groundwater.

No public groundwater supplies or wellhead protection areas[8] exist within the Project Area. The water table lies from approximately 15 feet above sea level (asl) south of the H Street Tunnel to about 25 feet asl at the northern end of the Project Area.[9]

Shafts would be drilled to provide structural support for the private air-rights development deck. The drilled shafts would range in diameter from 5 feet to 12 feet, depending on the structural load to be supported. They would extend up to 150 feet below grade[10], thereby displacing groundwater. Groundwater displacement may slightly alter localized groundwater levels within the Project Area. This would be a negligible adverse impact for the following reasons. Given the depth to water table, any localized changes to the water table would not noticeably affect infrastructure or vegetation in the Project Area. Additionally, the volume

8 Wellhead protection areas are surface and subsurface land areas regulated to prevent contamination of a well or well-field supplying a public water system. Established under the Safe Drinking Water Act (42 USC 330f-300j), this program is implemented through state governments.

9 Wood. February 2019. *Preliminary Report of Aquifer Pump Test and Seepage Analysis, Union Station, Washington, D.C.*

10 Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project. Volume 1. Constructability Report*.

occupied by the drill shafts would be very small in the context of the Project Area and the entire aquifer, making the resulting displacement negligible. For this reason, groundwater displacement from building foundations generally is not a major concern and DC Municipal Regulations do not regulate it. DC Municipal Regulations *Title 21-1150, Ground Water* establish water quality standards to protect groundwater from pollution and *Title 20-72, Environmental Policy Act Regulations* establish environmental review criteria for projects that significantly deplete or degrade groundwater resources, or that significantly interfere with groundwater recharge. Neither regulation addresses displacement.

The No-Action Alternative would not affect groundwater quality or recharge. The Project Area currently consists of impervious cover that inhibits groundwater recharge. Project Area land cover would remain impervious under the No-Action Alternative.

Stormwater

Relative to existing conditions, the No-Action Alternative would have a minor adverse direct operational impact on stormwater infrastructure. It would have no adverse direct operational impact on stormwater flows, as SWRv would remain unchanged relative to existing conditions.

Modifications to the Project Area drainage infrastructure, including roof drains, catch basins, and drainage pipes, would be necessary to accommodate the private air-rights development. These drainage modifications may necessitate minor adjustments to DC Water drainage infrastructure within the Study Area, such as new catch basins, drainage pipes, and pipe connections within District right-of-way. Such adjustments routinely occur in the context of large development projects and would be a minor adverse impact. Stormwater would continue to be collected and conveyed via DC Water combined sewer or separate stormwater infrastructure as it is currently.

Table 3-1 presents the SWRv calculated for the No-Action Alternative for each drainage area in the Local Study Area. SWRv represents the volume of stormwater that should be retained on-site to mimic pre-development hydrologic conditions and protect District waterbodies.[11] An increase in total or drainage-area level SWRv relative to existing conditions would be an adverse impact unless mitigated through stormwater BMPs.

The No-Action Alternative and existing conditions SWRv would be the same, amounting to a little more than 221,000 cubic feet. This is because the rail terminal is already entirely impervious. Constructing a deck and buildings above the tracks between WUS and K Street NE would not create any new impervious or pervious surface.

11 District Office of Energy and Environment. 2013. *Stormwater Management Guidebook*. Accessed from https://doee.dc.gov/swguidebook. Accessed on June 6, 2017.

Table 3-1. No-Action Alternative SWRv in Project Area

Drainage Area	Paved Area within LOD[1] (Acres)	Compacted Area[3] within LOD (Acres)	Natural Area[4] within LOD (Acres)	Total Area within LOD (Acres)	SWRv[5] (Cubic Feet)
Tiber Creek (CSO[2] 12)	43.4	0	0	43.4	179,799
Northeast Boundary (CSO 19)	9.8	0	0	9.8	40,571
Hickey Run (MS4)	0.2	0	0	0.2	677
TOTAL	53.4	0	0	53.4	221,047

[1] LOD: Limit of Disturbance, defined for this study as the Project Area boundary.
[2] CSO: Combined Sewer Outfall.
[3] Compacted Area: Land disturbed and/or graded for use as managed turf or landscaping.
[4] Natural Area: Undisturbed land with hydrologic properties equal to or better than meadow in good condition.
[5] Calculated using 1.2 inches of rainfall as required for Major Land Disturbing Activities.

Wastewater

Relative to existing conditions, the No-Action Alternative would have minor adverse direct operational impacts on wastewater infrastructure and on wastewater flows due to greater production of wastewater in the Project Area.

The private air-rights development would require modifications to sewer laterals in the Local Study Area to serve the new buildings. No information is available on the location and extent of these modifications, but such work is a common feature of large development projects and would be a minor adverse impact. Wastewater would continue to be collected and conveyed via DC Water sewer lines to the Blue Plains Advanced Wastewater Treatment Plant (Blue Plains), within the Regional Study Area.

Table 3-2 shows estimated increases in wastewater flows in the No-Action Alternative. Increased ridership at WUS and the private air-rights development would cause an increase in the amount of wastewater produced in the Project Area. The average daily wastewater flow would increase by approximately 464,200 gallons per day. Relative to 83,500 gallons per day under existing conditions, this would be a more than fivefold increase.

Table 3-2. No-Action Alternative Estimated Wastewater Generation Increase

Location	Use	Unit Flow Rate [1]	Total Unit (2040)	Estimated Average Daily Flow (gpd)
WUS	Rail and Bus[2]	1.7 gpd/ passenger[3]	19,000 additional passengers	32,300
Private Air-rights Development	Residential	60 gpd/ resident	2,150 residents	129,000
Private Air-rights Development	Hotel	0.25 gpd/ sf	410,000 sf	102,500
Private Air-rights Development	Office	0.09 gpd/ sf	2,160,000 sf	194,400
Private Air-rights Development	Retail	0.05 gpd/ sf	120,000 sf	6,000
Private Air-rights Development Subtotal				**431,900**
Total				**464,200**

[1] Rates based on Maryland Design Guidelines for Wastewater Facilities unless otherwise noted. [12]
[2] Amtrak + MARC + VRE + Intercity bus ridership.
[3] Per-passenger unit rate calculated for existing conditions based on 2017 station water usage.
Gpd = gallons per day; sf= square foot

This impact would be minor because wastewater from the Project Area would continue to be conveyed to the Blue Plains, which has the capacity to treat an average of 384 million gallons per day and, in peak wet weather capacity, more than one billion gallons per day.[13] Relative to Blue Plains' design capacity, the projected increase in wastewater flow would be minor, representing a little more than 0.1 percent of the average capacity.

Drinking Water

Relative to existing conditions, the No-Action Alternative would have a minor adverse direct operational impact on drinking water infrastructure and drinking water distribution due to greater demand from the Project Area.

The private air-rights development would require modifications to the water distribution infrastructure in the Local Study Area to provide the additional capacity to meet the demand from the development's occupants. There is no information on the location and extent of the

12 Maryland Department of the Environment Engineering and Capital Projects Program. 2016. *Design Guidelines for Wastewater Facilities.* Accessed from https://mde.maryland.gov/programs/Permits/WaterManagementPermits/Documents/WastewaterDesignGuidelines-2016.pdf. Accessed on July 11, 2019.

13 DC Water. *Blue Plains Advanced Wastewater Treatment Plant*. Accessed from https://www.dcwater.com/sites/default/files/Blue_Plains_Plant_brochure.pdf. Accessed on April 3, 2020.

needed modifications, but they are not expected to exceed what is commonly done for a large development project and, as such, would represent a minor impact.

Increased WUS ridership and the private air-rights requirement would place new demands on the water supply system. Water demand increase was estimated based on wastewater generation, with an added factor of 10 percent to account for consumption, system losses, and other uses. Based on an estimated additional wastewater generation of 464,200 gallons per day, additional water demand in the No-Action Alternative would be 510,620 gallons per day. This would include 35,530 gallons per day for WUS uses and 475,090 gallons per day for private air-rights development uses.

DC Water would continue to distribute water to the Project Area and the Washington Aqueduct would continue to supply the water. The Aqueduct produces an average of 155 million gallons per day in the two treatment plants located in the District.[14] The increase in demand relative to existing conditions would represent approximately 0.3 percent of the Aqueduct's average production. Adverse impacts would be minor.

3.5.1.2 Indirect Operational Impacts

Surface Waters

Relative to existing conditions, the No-Action Alternative would result in negligible adverse and beneficial indirect operational impacts to surface waterbodies, including the Anacostia River, Potomac River, and Chesapeake Bay.

In the No-Action Alternative, combined stormwater and wastewater from the Project Area would continue to flow through DC Water's combined sewer system to either Blue Plains or combined sewer overflow (CSO) outfalls in the Anacostia River during large storms. A small portion of the Project Area (approximately 7,000 square feet at the furthest northeast end) would continue to drain to the Anacostia River through the municipal separate storm sewer system (MS4). No changes to drainage subwatersheds would occur.

As described above, the No-Action Alternative would see an increase in wastewater flows from WUS and the private air-rights development. Stormwater flows would remain unchanged relative to existing conditions. Adding wastewater to DC Water's combined sewer system could increase the likelihood of untreated sewage releases from CSO outfalls into the Anacostia River during large storm events. This could exacerbate water quality impairments from bacterial and nutrient loadings in the Anacostia River and the Chesapeake Bay, a potential adverse impact. However, the reduction in CSO events that would result from DC Water's Anacostia River Tunnel and Northeast Boundary Tunnel projects would largely offset this increased risk and the adverse impact would be negligible. Completion of Clean Rivers

[14] U.S. Army Corps of Engineers. *Washington Aqueduct*. Accessed from http://www.nab.usace.army.mil/Missions/Washington-Aqueduct/. Accessed on April 3, 2020.

Project (planned for 2023) would reduce CSOs to the Anacostia River by 98 percent. The Northeast Boundary Tunnel is also expected to reduce the chance of flooding in the area served by the Northeast Boundary trunk sewer along Florida Avenue (Bloomingdale and LeDroit Park neighborhoods) from the current 50 percent chance of flooding in any given year down to a 7 percent chance.[15]

Currently, stormwater from the portion of the Project Area that drains to the MS4 is untreated and carries pollutants from the Project Area to the Anacostia River. If the projects included in the No-Action Alternative implement stormwater BMPs to the maximum extent practicable, as required by DOEE *Stormwater Management Guidebook* and, for Federal projects, the EISA and EO 13834, runoff volume, peak flow rate, and pollutant loading from the Project Area to the Anacostia River would decrease. Given the small size of the MS4 drainage area relative to the Anacostia River watershed, any potential beneficial impacts from this reduction on water quality in the Anacostia River and downstream waterbodies would be negligible.

Groundwater

Relative to existing conditions, the No-Action Alternative would have no adverse indirect operational impact on groundwater.

There would be no indirect impacts on groundwater because, as described in **Section 3.5.1.1**, *Direct Operational Impacts, Groundwater*, any impacts would be caused by localized displacement. This has no potential to indirectly affect private or public water supply wells, wetlands, or springs.

Stormwater

Relative to existing conditions, the No-Action Alternative would have no adverse indirect operational impact on stormwater.

There would be no indirect impacts on stormwater because the No-Action Alternative would result in no changes to stormwater flows in or outside the Local or Regional Study Area.

Wastewater

Relative to existing conditions, the No-Action Alternative would have no adverse indirect operational impact on wastewater.

There would be no indirect impacts on wastewater because the No-Action Alternative would result in no changes to wastewater production outside the Project Area. As explained in **Section 3.5.1.1**, *Direct Operational Impacts*, *Wastewater*, DC Water and Blue Plains would

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15 DC Water. Northeast Boundary Tunnel Project. Accessed from https://www.dcwater.com/nebp. Accessed on April 3, 2020.

have sufficient capacity to convey and treat additional wastewater flows from the Project Area.

Drinking Water

Relative to existing conditions, the No-Action Alternative would have no adverse indirect operational impact on drinking water.

There would be no indirect impacts on drinking water because the No-Action Alternative would result in no changes to demand for water outside the Study Area. As explained in **Section 3.5.1.1**, *Direct Operational Impacts*, *Drinking Water*, DC Water and the Washington Aqueduct have sufficient capacity to meet additional water demand from the Study Area.

3.5.1.3 Construction Impacts

Under the No-Action Alternative, the Project would not be built. Construction of the projects included in the No-Action Alternative, including the private air-rights development, would take place at various times and each would generate construction impacts. Because specific schedules and construction methods are still undetermined, it is only possible to describe and assess these impacts in general terms.

Surface Waters

There would be no construction impacts to surface waterbodies in the No-Action Alternative.

No surface waterbodies lie within or adjacent to the Project Area. Therefore, none of the construction activities that would occur in the No-Action Alternative would affect surface waterbodies.

Groundwater

In the No-Action Alternative, construction activities would cause minor adverse impacts on groundwater.

Construction of drilled shafts for the private air-rights development deck would necessitate dewatering. The amount of groundwater that would be pumped and disposed of cannot be estimated. Provided work is conducted in compliance with applicable NPDES construction general permit dewatering requirements, as well as with applicable District DOEE and DC Water requirements for treating and metering pumped groundwater, adverse impacts are anticipated to be minor.

Stormwater

In the No-Action Alternative, construction activities would cause minor adverse impacts on stormwater flows.

Ground-disturbing activities associated with the projects included in the No-Action Alternative could result in increased erosion and sedimentation, affecting the quality of stormwater runoff. This risk would be minimized because these projects would be required to include erosion and sediment controls in compliance with NPDES construction general permit and DOEE's *Erosion and Sediment Control Manual* requirements. [16,17] Erosion and sediment control practices would prevent the transport of sediment from the construction sites to city streets, drainage systems, and waterbodies, resulting in minor adverse impacts.

Wastewater

In the No-Action Alternative, increased wastewater flows from construction-related dewatering would cause a negligible adverse impact on wastewater.

Drilled shafts for the private air-rights development would be located within the CSO drainage area. It is likely that pumped groundwater would be pre-treated, if needed, on site and discharged to the DC Water MS4 or combined sewer system. This would generate additional flow of clean water through DC Water's conveyance infrastructure to Blue Plains. With a capacity to treat an average of 384 million gallons per day and peak wet weather capacity to treat more than one billion gallons per day, Blue Plains would have the capacity to treat the additional flow.

Drinking Water

In the No-Action Alternative, increased water demand during construction activities would result in a negligible adverse impact on the drinking water supply.

Water would be used during construction activities for dust control, equipment washing, and construction worker sanitation and consumption. DC Water would likely provide the water. Although the amount of water that would be used cannot be estimated, it would be typical of medium to large-scale construction projects in the District and is not likely to exceed the Washington Aqueduct capacity. Impacts would be negligible.

16 U.S. Environmental Protection Agency (EPA). 2017. *National Pollutant Discharge Elimination System (NPDES) Construction General Permit*. Accessed from https://www.epa.gov/npdes/2017-construction-general-permit-cgp. Accessed on April 2, 2020.

17 District Office of Energy and Environment. 2017. *Erosion and Sediment Control Manual*. Accessed from https://doee.dc.gov/esc. Accessed on April 3, 2020.

3.5.2 Alternative A

3.5.2.1 Direct Operational Impacts

Surface Waters

Relative to the No-Action Alternative, Alternative A would have no adverse direct operational impacts on surface waterbodies.

There are no bodies of surface water in or adjacent to the Project Area. Therefore, Alternative A has no potential to directly affect surface waters.

Groundwater

Relative to the No-Action Alternative, Alternative A would have a negligible adverse direct operational impact on groundwater.

There are no public groundwater supplies or wellhead protection areas within the Project Area and Alternative A would have no impacts on those resources. Land cover within the Project Area in the No-Action Alternative would consist of impervious surfaces that inhibit groundwater recharge. The Project Area's land cover would similarly be fully impervious in Alternative A. Therefore, Alternative A would have no impacts on groundwater recharge.

Alternative A would have negligible direct operational impacts on groundwater levels for the following reasons. Compared to the No-Action Alternative, Alternative A would require excavating the Project Area up to a depth of approximately 20 feet asl to construct lower-level concourses. At and south of H Street in the Project Area, the water table lies at approximately 15 feet asl. Therefore, below-ground structures in Alternative A would generally remain above groundwater levels.

Because the exact elevation of the groundwater surface has not been established and groundwater levels may vary, potential long-term groundwater seepage would remain a possibility. The construction of a secant-pile cut-off wall around the perimeter of the excavated area and the installation of concrete pressure slabs at the bottom of the excavation would prevent any significant long-term groundwater seepage. Therefore, Alternative A would require minimal long-term dewatering. Preliminary modeling indicates that in the long term, dewatering rates for the Project in Alternative A would be less than 10 gallons per minute, or less than 14,400 gallons a day that would have to be pumped and disposed of.[18] This is well below the ceiling DC Water established for the issuance of a Non-significant Non-Categorical Industrial User Wastewater Discharge Permit, which applies to industrial or commercial businesses and government agencies that have less than 25,000

[18] Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

gallons per day of process flow.[19] Additionally, inflow would occur only if and where groundwater level exceed 20 feet asl. Because of the shallow depth of Alternative A and the limited amount of groundwater that would have to be pumped out, if any, adverse impacts would be negligible.

Stormwater

Relative to the No-Action Alternative, Alternative A would have minor adverse direct operational impacts on stormwater infrastructure and no direct operational impact on stormwater flows.

Modifications to the Project Area's drainage infrastructure, including roof drains, catch basins, and drainage pipes, would be necessary to accommodate the Project. These drainage modifications may necessitate minor adjustments to DC Water drainage infrastructure in the Local Study Area, such as new catch basins, drainage pipes, and pipe connections within District right-of-way. Such adjustments would largely overlap with those that would occur in the No-Action Alternative for the private air-right development and could be coordinated with them. This would minimize the work needed to accommodate the Project. Relative to the No-Action Alternative, adverse impacts would be minor.

Because the Project Area would be entirely impervious in the No-Action Alternative and would remain so in Alternative A, this alternative would cause no change in SWRv. The SWRv would be as shown in **Table 3-1.** Alternative A would be required to implement stormwater BMPs in accordance with the DOEE's Stormwater Management Guidebook and, to the maximum extent technically feasible, Section 438 of the EISA of 2007 and EO 13834. These BMPs would decrease runoff volume, peak flow rate, and pollutant loading from the Project Area. Therefore, there would be no impacts on the quantity or quality of stormwater runoff.

Wastewater

Relative to the No-Action Alternative, Alternative A would have minor adverse direct operational impacts on wastewater infrastructure and wastewater flows.

Alternative A would likely require modifications to sewer laterals to serve the expanded station. No information is available on the location and extent of these modifications, but they would likely overlap with those that would occur in the No-Action Alternative for the private air-rights development as both projects would occur within the boundaries of the WUS terminal. Coordination would minimize the work needed to accommodate the Project. Relative to the No-Action Alternative, adverse impacts would be minor.

Table 3-3 shows estimated additional wastewater flows from the Project Area based on the number of additional passengers relative to the No-Action Alternative. The average total

[19] DC Water. *Industrial User Wastewater Discharge Permit*. Accessed from https://www.dcwater.com/industrial-user-wastewater-discharge-permit. Accessed on January 4, 2019.

additional daily flow would be approximately 90,130 gallons per day. This estimate does not include the increase due to any needed long-term groundwater disposal (see **Section 3.5.2.1**, *Direct Operational Impacts, Groundwater*) but it would be less than 14,400 gallons per day, for a total of up to 104,530 gallons per day. This would be a 22.5 percent increase relative to the No-Action Alternative.

Table 3-3. Alternative A Estimated Wastewater Generation (Average Daily Flow)

Location	Use	Unit Flow Rate	Total Unit (2040)	Estimated Average Daily Flow (gpd)
WUS	Rail and Bus[1]	1.7 gpd/ passenger[2]	50,900 additional passengers	86,530
WUS	New Retail	0.05 gpd/square foot[3]	72,000 additional square feet of retail	3,600
Total				90,130

1. Amtrak + MARC + VRE + Intercity bus ridership.
2. Per-passenger unit rate calculated for existing conditions based on 2017 station water usage.
3. Rates based on Maryland Design Guidelines for Wastewater Facilities unless otherwise noted

This impact would be minor because wastewater from the Project Area would continue to be conveyed to the Blue Plains, which has the capacity to treat an average of 384 million gallons per day and, in peak wet weather capacity, more than one billion gallons per day.[20] The increase attributable to Alternative A would represent 0.02 percent of Blue Plains' average capacity.

Drinking Water

Relative to the No-Action Alternative, Alternative A would have a minor adverse direct operational impact on drinking water infrastructure and demand.

Alternative A would likely require modifications to the water distribution infrastructure to serve the expanded station. There is no information on the location and extent of the needed modifications, but they would likely overlap with those that would occur in the No-Action Alternative for the private air-rights development and could be coordinated with them. This would minimize the work needed to accommodate the Project. Relative to the No-Action Alternative, adverse impacts would be minor.

Additional water demand from the Project Area in Alternative A, based on wastewater generation with an added factor of 10 percent to account for consumption, system losses, and other use, would be 99,143 gallons per day, a 19 percent increase relative to the No-Action Alternative. Drinking water would continue to be distributed by DC Water and

[20] DC Water. *Blue Plains Advanced Wastewater Treatment Plant*. Accessed from https://www.dcwater.com/sites/default/files/Blue_Plains_Plant_brochure.pdf. Accessed on April 3, 2020.

supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand relative to the No-Action Alternative would represent about 0.06 percent of this capacity. This would be a minor adverse impact.

3.5.2.2 Indirect Operational Impacts

Surface Waters

Relative to the No-Action Alternative, Alternative A would result in a negligible adverse indirect operational impact to surface waterbodies, including the Anacostia River, Potomac River, and Chesapeake Bay.

Relative to the No-Action Alternative, Alternative A would generate the same amount of stormwater runoff and approximately 22 percent more wastewater. This increase would have an adverse impact on the quality of water in the surface waterbodies that drain the Project Area and its surroundings. This adverse impact would be negligible because of the small size of the Project Area and net flow increase relative to those waterbodies' drainage basins.

Groundwater

Relative to the No-Action Alternative, Alternative A would have negligible adverse indirect operational impacts on groundwater.

Because of the shallow depth of Alternative A and the limited amount of groundwater, if any, that would have to be pumped out, Alternative A is not expected to cause measurable impacts on groundwater in or outside the Project Area. It has no potential to indirectly affect private or public water supply wells, wetlands, or springs.

Stormwater

Relative to the No-Action Alternative, Alternative A would have no adverse indirect operational impact on stormwater.

There would be no indirect impacts on stormwater because Alternative A would result in no changes to stormwater flows relative to the No-Action Alternative.

Wastewater

Relative to the No-Action Alternative, Alternative A would have no adverse indirect operational impact on wastewater.

The potential future development of the Federal air-rights in Alternative A as additional parking would not generate wastewater beyond what Alternative A would generate directly.

Drinking Water

Relative to the No-Action Alternative, Alternative A would have no adverse indirect operational impact on drinking water.

The potential future development of the Federal air-rights in Alternative A as additional parking would not generate drinking water demand beyond that directly resulting from the Project.

3.5.2.3 Construction Impacts

Surface Waters

Construction of Alternative A would have no adverse impacts on surface waterbodies.

No surface waterbodies lie within or adjacent to the Project Area. Therefore, the construction activities associated with Alternative A would not affect surface waterbodies.

Groundwater

Construction of Alternative A would have negligible adverse impacts on groundwater.

Because of the relative shallowness of the excavation required in Alternative A (down to 20 feet asl), and the construction of a cut-off wall around the perimeter of the Project Area, only a limited amount of dewatering would be needed during construction. Groundwater pumped out of the Project Area during construction would be discharged to the wastewater conveyance system after being treated on site if required. Preliminary modeling indicates a short-term dewatering rate of less than 10 gallons per minute, similar to the long-term dewatering rate described in **Section 3.5.2.1**, *Direct Operational Impacts, Groundwater*.[21] Construction impacts would be negligible for the reasons explained in that section. Dewatering would have to be conducted in compliance with NPDES construction general permit dewatering requirement[22] as well as DOEE and DC Water requirement for the treatment and metering of pumped groundwater.

Stormwater

Construction of Alternative A would cause minor adverse impacts on stormwater flows.

Ground-disturbing activities associated with the construction of Alternative A could result in increased erosion and sedimentation, which would affect the quality of stormwater runoff

[21] Wood. February 2019. Preliminary *Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C*.

[22] EPA. 2017. *National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Section 2.4 Construction Dewatering Requirements*. https://www.epa.gov/sites/production/files/2019-05/documents/final_2017_cgpfact_sheet.pdf. Accessed on April 3, 2020.

from the Project Area. Increased sediment loadings in stormwater conveyed by drainage systems can also result in lost conveyance capacity. These risks would be minimized because Alternative A would be required to include erosion and sediment controls in compliance with NPDES construction general permit and DOEE's *Erosion and Sediment Control Manual.* [23,24] Erosion and sediment control practices would prevent the transport of significant amounts of sediment from the construction site to city streets, drainage systems, and waterbodies. Adverse impacts would be minor.

Wastewater

Wastewater flows from Alternative A construction-related dewatering would cause a negligible adverse impact on wastewater.

Groundwater pumped out of the Project Area during construction would be discharged to the wastewater conveyance system after being treated on site. As explained above, because of the relatively shallow depth of excavation in Alternative A and the construction of a cut-off wall, the maximum amount of discharged groundwater would be less than 14,400 gallons a day. Wastewater would be conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the additional amount of wastewater generated by the construction activities associated with Alternative A would represent a negligible impact.

Drinking Water

Water demand during construction of Alternative A would result in a negligible adverse impact on drinking water.

Water would be used during construction activities for dust control, equipment washing, and construction worker sanitation and consumption. DC Water would likely provide the water. Although the amount of water that would be used cannot be estimated, it would be typical of a large-scale construction project in the District and is not likely to exceed the Washington Aqueduct capacity. Impacts would be negligible.

3.5.2.4 Comparison to Existing Conditions

The impacts of Alternative A on surface waterbodies, groundwater, and stormwater would be the same relative to existing conditions as they would be relative to the No-Action Alternative because there are no relevant differences between the two baselines.

[23] EPA. 2017. *National Pollutant Discharge Elimination System (NPDES) Construction General Permit*. Accessed from https://www.epa.gov/npdes/2017-construction-general-permit-cgp. Accessed on April 2, 2020.

[24] District Office of Energy and Environment. 2017. *Erosion and Sediment Control Manual*. Accessed from https://doee.dc.gov/esc. Accessed on April 2, 2020.

Relative to existing conditions, Alternative A would have minor adverse impacts on wastewater and drinking water. Alternative A would cause an increase in demand for these services (**Table 3-4**) that would be proportionately greater relative to existing conditions than relative to the No-Action Alternative. Impacts would be minor because the increases in demand would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The increase in wastewater demand would represent approximately 0.04 percent of Blue Plains' average daily capacity. The increase in drinking water demand would represent approximately 0.09 percent of the Washington Aqueduct's daily production.

Table 3-4. Comparison of Alternative A to Existing Conditions

Water Resource Category	Existing Conditions (gpd)	Increased Demand in Alternative A (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	83,500	136,830[1]	164%
Drinking Water	91,850	134,673[2]	147%

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.5.3 Alternative B

3.5.3.1 Direct Operational Impacts

Surface Waters

Relative to the No-Action Alternative, Alternative B would have no adverse direct operational impacts on surface waterbodies.

There are no bodies of surface water in or adjacent to the Project Area. Therefore, Alternative B has no potential to directly affect surface waters.

Groundwater

Relative to the No-Action Alternative, Alternative B would have a negligible adverse direct operational impact on groundwater.

For the same reasons as Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Groundwater*), Alternative B would have no impacts on public groundwater supplies, wellhead protection, or groundwater recharge.

Alternative B would have negligible direct operational impacts on groundwater levels for the same reasons as Alternative A. Alternative B would require excavating most of the rail terminal to a depth of approximately 10 feet below sea level to accommodate two levels of below-ground parking. This would be well below groundwater elevation, which is estimated to stand at approximately 15 asl in that area. However, the construction of a cut-off slurry wall down to bedrock around the perimeter of the excavated area and the installation of concrete pressure slabs at the bottom of the excavation would minimize any long-term groundwater seepage, though it may not eliminate it entirely. Preliminary modeling indicates that in the long term, dewatering rates for the Project in Alternative B would be less than 10 gallons per minute. Less than 14,400 gallons a day that would have to be pumped and disposed of.[25] This is similar to what would occur in Alternative A.

Stormwater

Relative to the No-Action Alternative, Alternative B would have minor adverse direct operational impacts on stormwater infrastructure. It would have no direct operational impact on stormwater flows.

The impacts of Alternative B on stormwater would be the same as those of Alternative A (see **Section 3.5.2.1,** *Direct Operational Impacts, Stormwater*). This is because the Project Area would remain entirely impervious in Alternative B, like in Alternative A and the No-Action Alternative**.**

Wastewater

Relative to the No-Action Alternative, Alternative B would have minor adverse direct operational impacts on wastewater infrastructure and wastewater flows.

The impacts of Alternative B on wastewater would be the same as Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*). This is because Alternative B would generate the same additional demand for wastewater as Alternative A.

Drinking Water

Relative to the No-Action Alternative, Alternative B would have minor adverse direct operational impacts on drinking water infrastructure and drinking water demand.

The impacts of Alternative B on the water supply would be the same as those of Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Drinking Water*). This is because Alternative B would generate the same additional demand for water as Alternative A.

[25] Wood. February 2019*. Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

3.5.3.2 Indirect Operational Impacts

Surface Waters, Groundwater, and Stormwater

Relative to the No-Action Alternative, Alternative B would have negligible adverse indirect operational impacts on surface waterbodies and groundwater. It would have no indirect operational impacts on stormwater.

The indirect operational impacts of Alternative B on surface waterbodies, groundwater, and stormwater would be as in Alternative A. These impacts are described in **Section 3.5.2.2**, *Indirect Operational Impacts*.

Wastewater

Relative to the No-Action Alternative, Alternative B would have a minor adverse indirect operational impact on wastewater.

In Alternative B, the potential Federal air-rights development would consist of approximately 917,420 square feet of office space. This office space would generate approximately 82,600 gallons per day of wastewater (assuming a unit flow rate of 0.09 gallon per square foot per day: see **Table 3-2**).

Wastewater from the Project Area would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. The additional production of 82,600 gallons per day of wastewater would be a minor adverse impact. It would represent only about 0.02 percent of Blue Plains' average daily capacity (384 million gallons per day).

Drinking Water

Relative to the No-Action Alternative, Alternative B would have a minor adverse indirect operational impact on drinking water.

In Alternative B, the potential development of the Federal air rights would increase drinking water demand by approximately 90,860 gallons per day (calculated as wastewater demand plus 10 percent for consumption, system losses, and other uses).

Drinking water would continue to be distributed by DC Water and supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand from the Federal air-rights development would represent 0.06 percent of this capacity, amounting to a minor adverse impact.

3.5.3.3 Construction Impacts

Surface Waters, Stormwater, and Drinking Water

The Construction of Alternative B would have no impacts on surface waterbodies, minor adverse impacts on stormwater, and negligible adverse impacts on drinking water.

The impacts from construction of Alternative B on surface waterbodies, stormwater, and drinking water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.3**, *Construction Impacts*.

Groundwater

Construction of Alternative B would have moderate adverse impacts on groundwater.

Because of the depth of the excavation required in Alternative B, groundwater seepage would occur during construction and require dewatering. Depending on the assumptions made with regard to ongoing dewatering in the vicinity of the Project Area, preliminary modeling indicates a short-term dewatering rate of approximately 260 to 430 gallons per minute, or 374,400 to 619,200 gallons per day.[26] This would be well above the threshold for a Significant Non-Categorical Industrial User Wastewater Discharge Permit (25,000 gpd). Dewatering would have to be conducted in compliance with NPDES construction general permit dewatering requirement[27], as well as DOEE and DC Water requirement for treatment and metering of pumped groundwater.

Groundwater withdrawal has the potential to cause soil settlement in the vicinity of the withdrawal. Due to lack of information, the extent of the area that could be affected cannot be determined at this time. Based on preliminary modeling, it can be anticipated that the greatest risk of subsidence would occur immediately adjacent to the cut-off wall, where groundwater drawdown would be greatest, and that it would decrease with increasing distance from the wall. The features at greatest risk for drawdown-induced settlement would likely be shallow utility infrastructure such as sewer lines, gas lines, or water lines in the Project Area or adjacent public roadways; the WUS Metrorail station; and adjoining buildings supported by shallow foundation systems. Most of the larger buildings adjacent to WUS are likely to sit on deep foundations and, therefore, are unlikely to experience settlement. [28] **Section 3.7**, *Avoidance, Minimization, and Mitigation Evaluation*, outlines measures to minimize the risk of settlement.

Wastewater

Wastewater flow from Alternative B construction-related dewatering would cause a minor adverse impact on wastewater.

Groundwater pumped out of the Project Area during construction would be discharged to the wastewater conveyance system after being treated on site, if needed. As explained

26 Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

27 EPA. 2017. National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Section 2.4 Construction Dewatering Requirements. https://www.epa.gov/sites/production/files/2019-05/documents/final_2017_cgpfact_sheet.pdf. Accessed on April 3, 2020.

28 Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

above, the maximum modeled amount of discharged groundwater would be approximately 619,200 gallons a day. Wastewater would be conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the additional amount from Alternative B construction would represent a minor adverse impact.

3.5.3.4 Comparison to Existing Conditions

The impacts of Alternative B on surface waters, groundwater, and stormwater would be the same relative to existing conditions as relative to the No-Action Alternative because there are no relevant differences between the two baselines.

Relative to existing conditions, Alternative B would have minor adverse impacts on wastewater and water. Alternative B would cause an increase in demand for these services in the Project Area (**Table 3-5**). The increase would be greater compared to existing conditions than compared to the No-Action Alternative. Impacts would be minor because the increase in demand would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The additional wastewater demand would represent approximately 0.06 percent of Blue Plains' average daily capacity. The additional drinking water demand would represent approximately 0.15 percent of the Washington Aqueduct's daily production.

Table 3-5. Comparison of Alternative B to Existing Conditions

Water Resource Category	Location	Existing Conditions (gpd)	Increased Demand in Alternative B (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	WUS	83,500	136,830[1]	164%
	Federal Air-rights Development	0	82,600	-
	Total	**83,500**	**219,430**	**263%**
Drinking Water	WUS	91,850	134,673[2]	147%
	Federal Air-rights Development	0	90,860	-
	Total	**91,850**	**225,533**	**246%**

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.5.4 Alternative C (Either Option)

3.5.4.1 Direct Operational Impacts

Surface Waters

Relative to the No-Action Alternative, Alternative C would have no adverse direct operational impacts on surface waterbodies.

There are no bodies of surface water within or adjacent to the Project Area. Therefore, Alternative C has no potential to directly affect surface waterbodies.

Groundwater

Relative to the No-Action Alternative, Alternative C would have moderate adverse direct operational impacts on groundwater.

For the same reasons as Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Groundwater*), Alternative C would have no impacts on public groundwater supplies, wellhead protection, or groundwater recharge.

Alternative C would have moderate direct operational impacts on groundwater levels. Alternative C would require excavating most of the rail terminal to a depth of approximately 3 feet asl to accommodate one level of below-ground parking. This would be below groundwater elevation at the site. The construction of a sheet-pile cut-off down to the Potomac Clay layer underlying the Project Area around the perimeter of the excavation and the installation of concrete pressure slabs at the bottom of the excavation would minimize any long-term groundwater seepage, though it may not eliminate it entirely. Preliminary modeling indicates that, depending on the assumptions made with regard to ongoing dewatering, long-term dewatering rates for the Project in Alternative C would range from 20 to 30 gallons per minute, that is 28,800 to 43,200 gallons a day that would have to be pumped and disposed of, after treatment if required.[29] This would be above the threshold for a Significant Non-Categorical Industrial User Wastewater Discharge Permit (25,000 gpd).[30]Groundwater withdrawal may increase the risk of soil settlement, as described in **Section 3.5.3.3**, *Construction Impacts, Groundwater*.

[29] Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

[30] DC Water. *Industrial User Wastewater Discharge Permit*. https://www.dcwater.com/industrial-user-wastewater-discharge-permit. Accessed January 4, 2019.

Stormwater

Relative to the No-Action Alternative, Alternative C would have minor adverse direct operational impacts on stormwater infrastructure and no direct operational impact on stormwater flows.

The impacts of Alternative C on stormwater would be the same as those of Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Stormwater*). This is because the Project Area would remain entirely impervious in Alternative C, like in Alternative A and the No-Action Alternative**.**

Wastewater

Relative to the No-Action Alternative, Alternative C would have minor adverse direct operational impacts on wastewater infrastructure and wastewater flows.

Like Alternative A and the other Action Alternatives, Alternative C would likely require modifications to sewer laterals to serve the expanded station. Such impacts would be minor as explained for Alternative A in **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*.

In Alternative C, the increase in WUS ridership and retail space would cause the same increase in wastewater production as in Alternative A, approximately 90,130 gallons per day (see **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*). In addition, up to 43,200 gallons per day of groundwater from long-term dewatering would be discharged to the sewer conveyance system, for a total of approximately 133,330 gallons per day. This would be a 29 percent increase relative to the No-Action Alternative.

Wastewater would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the increase in the amount of wastewater to be treated in Alternative C relative to the No-Action Alternative would be a minor adverse impact, as it would represent less than 0.03 percent of the average treatment capacity.

Drinking Water

Relative to the No-Action Alternative, Alternative C would have minor adverse direct operational impacts on drinking water infrastructure and the drinking water supply.

The impacts of Alternative C on the water supply would be the same as those of Alternative A (see **Section 3.5.2.1**, *Direct Operational Impacts, Drinking Water*). Alternative C would generate the same additional demand for water as Alternative A.

3.5.4.2 Indirect Operational Impacts

Surface Waters, Groundwater, and Stormwater

Relative to the No-Action Alternative, Alternative C would have negligible adverse indirect operational impacts on surface waterbodies and groundwater. It would have no indirect operational impacts on stormwater.

The indirect operational impacts of Alternative C on surface waterbodies, groundwater, and stormwater would be as in Alternative A. These impacts are described in **Section 3.5.2.2**, *Indirect Operational Impacts*.

Wastewater

Relative to the No-Action Alternative, Alternative C would have a minor adverse indirect operational impact on wastewater.

In Alternative C, the potential Federal air-rights development would consist of approximately 952,600 square feet of office space. This office space would generate approximately 85,700 gallons per day of wastewater (assuming a unit flow rate of 0.09 gallon per square foot per day: see **Table 3.2**).

Wastewater would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. The additional production of 85,700 gallons per day of wastewater would be a minor adverse impact. It would represent about 0.02 percent of Blue Plains' average daily capacity (384 million gallons per day).

Drinking Water

Relative to the No-Action Alternative, Alternative C would have a minor adverse indirect operational impact on drinking water.

In Alternative C, the potential development of the Federal air rights would increase drinking water demand. The Federal air-rights development, consisting of office space, would generate an additional 94,300 gallons per day of water demand (calculated as wastewater demand plus 10 percent for consumption, system losses, and other uses).

Drinking water would continue to be distributed by DC Water and supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand from the Federal air-rights development would represent 0.06 percent of this capacity, amounting to a minor adverse impact.

3.5.4.3 Construction Impacts

Surface Waters, Stormwater, and Drinking Water

Construction of Alternative C would have no impacts on surface waterbodies, minor adverse impacts on stormwater, and negligible adverse impacts on drinking water.

The impacts of constructing Alternative C on surface waterbodies, stormwater, and drinking water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.3**, *Construction Impacts*.

Groundwater

Construction of Alternative C would have moderate adverse impacts on groundwater.

Because of the depth of the excavation required in Alternative C, groundwater seepage would occur during construction and require dewatering. Depending on the assumptions made with regard to ongoing dewatering in the vicinity of the Project Area, preliminary modeling indicates a short-term dewatering rate ranging from approximately 220 gallons per minute, or 316,800 gallons per day, to 280 gallons per minute, or 403,200 gallons per day.[31] This would be well above the threshold for a Significant Non-Categorical Industrial User Wastewater Discharge Permit (25,000 gpd). Dewatering would have to be conducted in compliance with NPDES construction general permit dewatering requirement[32], as well as DOEE and DC Water requirement for treatment and metering of pumped groundwater. Groundwater withdrawal may increase the risk of soil settlement, as described in **Section 3.5.3.3**, *Construction Impacts, Groundwater*.

Wastewater

Wastewater flows from Alternative C construction-related dewatering would cause a minor adverse impact on wastewater.

Groundwater pumped out of the Project Area during construction would be discharged to the wastewater conveyance system after being treated on site, if required. As explained above, the maximum modeled amount of discharged groundwater would be approximately 403,200 gallons a day. Wastewater would be conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the additional amount from Alternative C construction would represent a minor impact.

[31] Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station, Washington, D.C.*

[32] EPA. 2017. National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Section 2.4 Construction Dewatering Requirements. https://www.epa.gov/sites/production/files/2019-05/documents/final_2017_cgpfact_sheet.pdf. Accessed on April 3, 2020

3.5.4.4 Comparison to Existing Conditions

The impacts of Alternative C on surface waters, groundwater, and stormwater would be the same relative to existing conditions as relative to the No-Action Alternative because there are no relevant differences between the two baselines.

Relative to existing conditions, Alternative C would have minor adverse impacts on wastewater and drinking water. Alternative C would cause an increase in demand for these services (**Table 3-6**) that would be proportionately greater relative to existing conditions than relative to the No-Action Alternative. Impacts would be minor because the anticipated increases in demand would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The additional wastewater demand would represent approximately 0.07 percent of Blue Plains' average daily capacity. The additional drinking water demand would represent approximately 0.15 percent of the Washington Aqueduct's daily production.

Table 3-6. Comparison of Alternative C to Existing Conditions

Water Resource Category	Location	Existing Conditions (gpd)	Increased Demand in Alternative C (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	WUS	83,500	165,630[1]	198%
	Federal Air-rights Development	0	85,700	-
	Total	**83,500**	**251,330**	**301%**
Drinking Water	WUS	91,850	134,673[2]	143%
	Federal Air-rights Development	0	94,300	-
	Total	**91,850**	**228,973**	**249%**

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.5.5 Alternative D

3.5.5.1 Direct Operational Impacts

Surface Waters and Stormwater

Relative to the No-Action Alternative, Alternative D would have no direct operational impacts on surface waterbodies; and minor adverse operational impacts on stormwater infrastructure and no impacts on stormwater flows.

The direct operational impacts of Alternative D on surface waterbodies and stormwater would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.1**, *Direct Operational Impacts*.

Groundwater

Relative to the No-Action Alternative, Alternative D would have moderate adverse direct operational impacts on groundwater.

The direct operational impacts of Alternative D on groundwater would be the same as those of Alternative C. These impacts are described in **Section 3.5.4.1**, *Direct Operational Impacts, Groundwater*.

Wastewater

Relative to the No-Action Alternative, Alternative D would have minor adverse direct operational impacts on wastewater infrastructure and wastewater flows.

Like Alternative A and the other Action Alternatives, Alternative D would likely require modifications to sewer laterals to serve the expanded station. Such impacts would be minor as explained in **Section 3.5.2.1**, *Direct Operational Impacts, Drinking Water*.

In Alternative D, the increase in WUS ridership would cause the same increase in wastewater production as in Alternative A, approximately 86,530 gallons per day (see **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*). The addition of approximately 100,000 square feet of retail space would further generate around 5,000 gallons per day of wastewater. Finally, up to 43,200 gallons per day of groundwater from long-term dewatering would be discharged to the sewer conveyance system. Altogether, Alternative D would generate up to 134,730 gallons per day of wastewater. This would be a 29 percent increase relative to the No-Action Alternative.

Wastewater would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the increase in the amount of wastewater to be treated in Alternative D relative to the No-Action Alternative would be a minor adverse impact, as it would represent about 0.04 percent of the average treatment capacity.

Drinking Water

Relative to the No-Action Alternative, Alternative D would have a minor adverse direct operational impact on drinking water infrastructure and demand.

Like Alternative A and the other Action Alternatives, Alternative D would require modifications to the water distribution infrastructure to provide the additional capacity to meet the demand from the expanded station. Such impacts would be minor as explained in **Section 3.5.2.1**, *Direct Operational Impacts, Drinking Water*.

Additional drinking water demand from the Project Area in Alternative D, based on wastewater generation with an added factor of 10 percent to account for consumption, system losses, and other use, would approximately be 100,683 gallons per day, a 20 percent increase relative to the No-Action Alternative. Drinking water would continue to be distributed by DC Water and supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand relative to the No-Action Alternative would represent about 0.06 percent of this capacity. This would be a minor adverse impact.

3.5.5.2 Indirect Operational Impacts

Surface Waters, Groundwater, and Stormwater

Relative to the No-Action Alternative, Alternative D would have negligible adverse indirect operational impacts on surface waterbodies and groundwater. It would have no indirect operational impacts on stormwater.

The indirect operational impacts of Alternative D on surface waterbodies, groundwater, and stormwater would be as in Alternative A. These impacts are described in **Section 3.5.2.2**, *Indirect Operational Impacts*.

Wastewater

Relative to the No-Action Alternative, Alternative D would have a minor adverse indirect operational impact on wastewater.

In Alternative D, the potential Federal air-rights development would consist of approximately 688,050 gross square feet of office space. This office space would generate approximately 61,900 gallons per day of wastewater (assuming a unit flow rate of 0.09 gallon per square foot per day: see **Table 3-2**).

Wastewater would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. The additional production of 61,900 gallons per day of wastewater would be a minor adverse impact. It would represent about 0.016 percent of Blue Plains' average daily capacity (384 million gallons per day).

Drinking Water

Relative to the No-Action Alternative, Alternative D would have a minor adverse indirect operational impact on drinking water.

In Alternative D, the potential development of the Federal air rights as office space would increase drinking water demand by approximately 68,100 gallons per day (calculated as wastewater demand plus 10 percent for consumption, system losses, and other uses).

Drinking water would continue to be distributed by DC Water and supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand from the Federal air-rights development would represent around 0.04 percent of this capacity, amounting to a minor adverse impact.

3.5.5.3 Construction Impacts

Surface Waters, Stormwater, and Drinking Water

Construction of Alternative D would have no impacts on surface waterbodies, minor adverse impacts on stormwater, and negligible adverse impacts on drinking water.

The construction impacts Alternative D on surface waterbodies, stormwater, and drinking water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.3**, *Construction Impacts*.

Groundwater and Wastewater

Construction of Alternative D would have moderate adverse impacts on groundwater and minor adverse impacts on wastewater.

The construction impacts of Alternative D on groundwater and wastewater would be the same as those of Alternative C. These impacts are described in **Section 3.5.4.3**, *Construction Impacts, Groundwater*.

3.5.5.4 Comparison to Existing Conditions

The impacts of Alternative D on surface waterbodies, groundwater, and stormwater would be the same relative to existing conditions as relative to the No-Action Alternative because there are no relevant differences between the two baselines.

Relative to existing conditions, Alternative D would have minor adverse impacts on wastewater and water. Alternative D would cause an increase in demand for these services (**Table 3-7**) that would be proportionately greater relative to existing conditions than relative to the No-Action Alternative. The impacts would be minor because the projected demand increases would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The additional wastewater demand would represent approximately 0.06 percent of Blue Plains' average daily capacity. The additional drinking water demand would represent approximately 0.13 percent of the Washington Aqueduct's daily production.

Table 3-7. Comparison of Alternative D to Existing Conditions

Water Resource Category	Location	Existing Conditions (gpd)	Increased Demand in Alternative D (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	WUS	83,500	167,030[1]	200%
	Federal Air-rights Development	0	61,900	-
	Total	**83,500**	**228,930**	**274%**
Drinking Water	WUS	91,850	136,213[2]	148%
	Federal Air-rights Development	0	68,100	-
	Total	**91,850**	**204,313**	**222%**

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.5.6 Alternative E

3.5.6.1 Direct Operational Impacts

Surface Waters and Stormwater

Relative to the No-Action Alternative, Alternative E would have no direct operational impacts on surface waterbodies, minor adverse operational impacts on stormwater infrastructure, and no impacts on stormwater flows.

The direct operational impacts of Alternative E on surface waterbodies and stormwater would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.1**, *Direct Operational Impacts*.

Groundwater

Relative to the No-Action Alternative, Alternative E would have negligible adverse direct operational impacts on groundwater.

The direct operational impacts of Alternative E on groundwater would be the same as those of Alternative B. These impacts are described in **Section 3.5.3.1**, *Direct Operational Impacts, Groundwater*.

Wastewater

Relative to the No-Action Alternative, Alternative E would have minor adverse direct operational impacts on wastewater infrastructure and wastewater flows.

Like Alternative A and the other Action Alternatives, Alternative E would likely require modifications to sewer laterals to serve the expanded station. Such impacts would be minor as explained for Alternative A in **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*.

In Alternative E, the increase in WUS ridership would cause the same increase in wastewater production as in Alternative A, approximately 86,530 gallons per day (see **Section 3.5.2.1**, *Direct Operational Impacts, Wastewater*). The addition of approximately 100,000 square feet of retail space would further generate around 5,000 gallons per day of wastewater. Finally, up to 14,400 gallons per day of groundwater from long-term dewatering would be discharged to the sewer conveyance system. Altogether, Alternative E would generate up to 105,930 gallons per day of wastewater. This would be a 23 percent increase relative to the No-Action Alternative.

Wastewater would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. Given Blue Plains' capacity (an average of 384 million gallons per day), the increase in the amount of wastewater to be treated in Alternative D relative to the No-Action Alternative would be a minor adverse impact, as it would represent approximately 0.03 percent of the average treatment capacity.

Drinking Water

Relative to the No-Action Alternative, Alternative E would have a minor adverse direct operational impact on drinking water infrastructure and demand.

The impacts of Alternative E on the water supply would be the same as those of Alternative D (see **Section 3.5.5.1**, *Direct Operational Impacts, Drinking Water*). Alternative E would generate the same additional demand for water as Alternative D.

3.5.6.2 Indirect Operational Impacts

Surface Waters, Groundwater, and Stormwater

Relative to the No-Action Alternative, Alternative E would have negligible adverse indirect operational impacts on surface waterbodies and groundwater. It would have no indirect operational impacts on stormwater.

The indirect operational impacts of Alternative E on surface waters, groundwater, and stormwater water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.2**, *Indirect Operational Impacts*.

Wastewater and Drinking Water

Relative to the No-Action Alternative, Alternative E would have negligible adverse indirect operational impacts on wastewater and drinking water.

The indirect operational impacts of Alternative E on wastewater and drinking water would be the same as those of Alternative D. These impacts are described in **Section 3.5.5.2**, *Indirect Operational Impacts*.

3.5.6.3 Construction Impacts

Surface Waters, Stormwater, and Drinking Water

Construction of Alternative E would have no impacts on surface waterbodies; minor adverse impacts on stormwater; and negligible adverse impacts on drinking water.

The construction impacts of Alternative E on surface waterbodies, stormwater, and drinking water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.3**, *Construction Impacts*.

Groundwater and Wastewater

Construction of Alternative E would have moderate adverse impacts on groundwater and minor adverse impacts on wastewater.

The construction impacts of Alternative E on groundwater and wastewater would be the same as those of Alternative B. These impacts are described in **Section 3.5.3.3**, *Construction Impacts*.

3.5.6.4 Comparison to Existing Conditions

The impacts of Alternative E on surface waters, groundwater, and stormwater would be the same relative to existing conditions as relative to the No-Action Alternative because there are no relevant differences between the two baselines.

Relative to existing conditions, Alternative E would have minor adverse impacts on wastewater and water. Alternative E would cause an increase in demand for these services (**Table 3-8**) that would be proportionately greater relative to existing conditions than relative to the No-Action Alternative. The impacts would be minor because the demand increases would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The additional wastewater demand would represent approximately 0.05 percent of Blue Plains' average daily capacity. The additional drinking water demand would represent approximately 0.13 percent of the Washington Aqueduct's daily production.

Table 3-8. Comparison of Alternative E to Existing Conditions

Water Resource Category	Location	Existing Conditions (gpd)	Increased Demand in Alternative E (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	WUS	83,500	138,230[1]	166%
	Federal Air-rights Development	0	61,900	-
	Total	**83,500**	**200,130**	**240%**
Drinking Water	WUS	91,850	136,213[2]	148%
	Federal Air-rights Development	0	68,100	-
	Total	**91,850**	**204,313**	**222%**

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.5.7 Alternative A-C (Preferred Alternative)

3.5.7.1 Direct Operational Impacts

Surface Waters, Groundwater, Stormwater, Wastewater, and Drinking Water

Relative to the No-Action Alternative, Alternative A-C would have no direct operational impacts on surface waterbodies; negligible adverse impacts on groundwater; minor adverse operational impacts on stormwater infrastructure and no impacts on stormwater flows; minor adverse direct operational impacts on wastewater infrastructure and wastewater flows; and minor adverse direct operational impacts on drinking water infrastructure and demand.

The direct operational impacts of Alternative A-C on surface waterbodies, groundwater, stormwater, wastewater, and drinking water would be the same as those of Alternative A. These impacts are described in **Section 3.5.2.1**, *Direct Operational Impacts*.

3.5.7.2 Indirect Operational Impacts

Surface Waters, Groundwater, and Stormwater

Relative to the No-Action Alternative, Alternative A-C would have negligible adverse indirect operational impacts on surface waterbodies and groundwater. It would have no indirect operational impacts on stormwater.

The indirect operational impacts of Alternative A-C on surface waterbodies, groundwater, and stormwater would be as in Alternative A. These impacts are described in **Section 3.5.2.2**, *Indirect Operational Impacts*.

Wastewater

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse indirect operational impact on wastewater.

In Alternative A-C, the potential Federal air-rights development would consist of approximately 380,000 square feet of office space. This office space would generate daily approximately 34,200 gallons of wastewater (assuming a unit flow rate of 0.09 gallon per square foot per day: see **Table 3.2**).

Wastewater from the Project Area would continue to be collected and conveyed via DC Water sewer lines to Blue Plains. The additional production of 34,200 gallons per day of wastewater would be a minor adverse impact. It would represent about 0.008 percent of Blue Plains' average daily capacity (384 million gallons per day).

Drinking Water

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse indirect operational impact on drinking water.

In Alternative A-C, the potential development of the Federal air rights would increase drinking water demand by approximately 37,620 gallons per day (calculated as wastewater demand plus 10 percent for consumption, system losses, and other uses).

Drinking water would continue to be distributed by DC Water and supplied by the Washington Aqueduct. The Aqueduct produces an average of 155 million gallons per day. The increase in demand from the Federal air-rights development would represent approximately 0.02 percent of this capacity, amounting to a minor adverse impact.

3.5.7.3 Construction Impacts

Surface Waters, Groundwater, Stormwater, Wastewater, and Drinking Water

Construction of Alternative A-C would have no impacts on surface waterbodies; negligible impacts on groundwater; minor adverse impacts on stormwater; negligible adverse impacts on wastewater; and negligible adverse impacts on drinking water.

The construction impacts of Alternative A-C would be the same as those of Alternative A because both alternatives are similar with respect to the relevant factors (such as depth of excavation). These impacts are described in **Section 3.5.2.3**, *Construction Impacts*.

3.5.7.4 Comparison to Existing Conditions

The impacts of Alternative A-C on surface waterbodies, groundwater, and stormwater would be the same relative to existing conditions as they would be relative to the No-Action Alternative because there are no relevant differences between the two baselines.

Relative to existing conditions, Alternative A-C would have minor adverse impacts on wastewater and drinking water. Alternative A-C would cause an increase in demand for these services (**Table 3-9**) that would be proportionately greater relative to existing conditions than relative to the No-Action Alternative. Impacts would be minor because the increases in demand would be small relative to the capacity of DC Water's water supply and wastewater infrastructure. The increase in wastewater demand would represent approximately 0.04 percent of Blue Plains' average daily capacity. The increase in drinking water demand would represent approximately 0.1 percent of the Washington Aqueduct's daily production.

Table 3-9. Comparison of Alternative A-C to Existing Conditions

Water Resource Category	Location	Existing Conditions (gpd)	Increased Demand in Alternative A-C (2040) (gpd)	Increase Relative to Existing Conditions
Wastewater	WUS	83,500	136,830[1]	164%
	Federal Air-rights Development	0	34,200	-
	Total	**83,500**	**171,030**	**205%**
Drinking Water	WUS	91,850	134,673[2]	147%
	Federal Air-rights Development	0	37,620	-
	Total	**91,850**	**172,293**	**188%**

1 Based on increase in Amtrak + MARC + VRE + Intercity bus ridership relative to existing conditions, new retail, and groundwater disposal from long-term dewatering.
2 Based on wastewater from total ridership and retail + 10 percent.

3.6 Comparison of Alternatives

Table 3-10 presents a comparison of the impacts of the No-Action Alternative and six Action Alternatives. All alternatives would have similar impacts on surface waters and stormwater. Impacts on groundwater would vary among the alternatives. Although no quantitative assessment is possible, the No-Action Alternative would likely have the smallest impact, with dewatering required only for the construction of drilled shafts to support the private air-rights development's overbuild deck. The Action Alternatives would require varying amounts of short-term and long-term dewatering depending on the depth of excavation and cut-off wall type. **Table 3-11** shows estimated amounts.

Table 3-10. Comparison of Alternatives

<table>
<tr><th>Impact Category</th><th>Type of Impact</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C (Either Option)</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred)</th></tr>
<tr><td rowspan="3">Surface Waters</td><td>Direct Operational</td><td colspan="7">No impacts</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">Negligible adverse impacts</td></tr>
<tr><td>Construction</td><td colspan="7">No impacts</td></tr>
<tr><td rowspan="3">Groundwater</td><td>Direct Operational</td><td>Negligible adverse impacts</td><td>Negligible adverse impacts</td><td>Negligible adverse impacts</td><td>Moderate adverse impacts</td><td>Moderate adverse impacts</td><td>Negligible adverse impacts</td><td>Negligible adverse impacts</td></tr>
<tr><td>Indirect Operational</td><td>No impacts</td><td colspan="6">Negligible adverse impacts</td></tr>
<tr><td>Construction</td><td>Negligible adverse impacts</td><td>Negligible adverse impacts</td><td colspan="4">Moderate adverse impacts</td><td>Negligible adverse impacts</td></tr>
<tr><td rowspan="3">Stormwater</td><td>Direct Operational</td><td colspan="7">Minor adverse impacts on infrastructure; no impacts on flows</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">No impacts</td></tr>
<tr><td>Construction</td><td colspan="7">Minor adverse impacts</td></tr>
<tr><td rowspan="3">Wastewater</td><td>Direct Operational</td><td colspan="7">Minor adverse impacts</td></tr>
<tr><td>Indirect Operational</td><td>No impacts</td><td>No impacts</td><td colspan="5">Minor adverse impacts</td></tr>
<tr><td>Construction</td><td>Negligible adverse impacts</td><td>Negligible adverse impacts</td><td colspan="4">Minor adverse impacts</td><td>Negligible adverse impacts</td></tr>
<tr><td rowspan="3">Drinking Water</td><td>Direct Operational</td><td colspan="7">Minor adverse impacts</td></tr>
<tr><td>Indirect Operational</td><td>No impacts</td><td>No impacts</td><td colspan="5">Minor adverse impacts</td></tr>
<tr><td>Construction</td><td colspan="7">Negligible adverse impacts</td></tr>
</table>

Table 3-11. Quantitative Estimates by Alternative

Impact Category	Parameter	Source of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative A-C
Construction-phase dewatering	**Dewatering rate (gpm)**	Project Area	N/A	Less than 10	260 to 430	220 to 280	220 to 280	260 to 430	Less than 10
Long-term Dewatering	**Dewatering rate (gpm)**	Project Area	N/A	Less than 10	Less than 10	20 to 30	20 to 30	Less than 10	Less than 10
Wastewater	**Additional Demand (gpd)**	WUS	32,300	104,530	104,530	133,330	134,730	105,930	104,530
		Private Air-Rights Development	431,900	0	0	0	0	0	0
		Potential Federal Air-Rights Development	0	0	82,600	85,700	61,900	61,900	34,200
		Total	**464,200**	**104,530**	**187,130**	**219,030**	**196,630**	**167,830**	**138,730**
Water	**Additional Demand (gpd)**	WUS	35,530	99,143	99,143	99,143	100,683	100,683	99,143
		Private Air-Rights Development	475,090	0	0	0	0	0	0
		Potential Federal Air-Rights Development	0	0	90,860	94,300	68,100	68,100	37,620
		Total	**510,620**	**99,143**	**190,003**	**193,443**	**168,783**	**168,783**	**136,763**

Abbreviations: gpm = gallons per minute; gpd = gallons per day; N/A = not available

Construction-phase dewatering requirements would be greatest for Alternatives B and E and smallest for Alternatives A and A-C. Long-term dewatering needs would be negligible for all Action Alternatives except for Alternatives C and D. This is because under these alternatives, the cut-off wall would extend only down to the clay layer underlying the Project Area and, as such, may not be fully effective.

With regard to wastewater and drinking water, all Action Alternatives would generate additional demand relative to the No-Action Alternative, as shown in **Table 3-11**. The differences among the Action Alternatives would result from long-term discharge of groundwater to the wastewater system and from the varying amount of Federally owned air rights that would be available for potential later development. Alternative C would generate the greatest additional demand for wastewater and drinking water capacity and Alternative A the smallest one.

With regard to wastewater, the estimated difference between these two alternatives would be 114,500 gallon per day, or about 0.03 percent of Blue Plains' average daily capacity. With regard to drinking water, the difference would be an estimated 94,300 gallons per day, or approximately 0.06 percent of the Washington Aqueduct's daily production.

3.7 Avoidance, Minimization and Mitigation Evaluation

FRA is considering the following measures to minimize or mitigate adverse impacts to surface waterbodies, groundwater, stormwater, wastewater, and water supply infrastructure, consistent with the U.S. Environmental Protection Agency (EPA)'s 2017 NPDES Construction General Permit, Section 438 of the EISA, DOEE's Stormwater Management Guidebook, District Department of Transportation (DDOT)'s *Green Infrastructure Standards*, DC Water's *Green Infrastructure Utility Protection Guidelines*, and DC Water's *Project Design Manual, Volume 3, Infrastructure Design*.

- Construction-phase measures
    - Construction contractor to develop and implement erosion and sedimentation controls.
    - Construction contractor to provide on-site treatment of pumped groundwater as needed, and discharge through the District's MS4 instead of through the combined sewer system to Blue Plains.
    - Prior to the beginning of construction, Project Proponents to conduct additional groundwater studies, including:
        - Performing additional borings to depths of 120 to 150 feet inside and along the perimeter of the Project Area to better characterize the lower aquifer's composition and extent as well as any discontinuities of the Potomac Clay layer separating the aquifers.

        - Performing research on adjacent properties to understand the local impacts of ongoing or periodic dewatering systems operating around the Project Area.
        - Performing additional pump testing that target zones of clay discontinuity in the lower aquifer.
        - If warranted by the above, performing further modeling to map the areas that have high potential to experience ground subsidence from groundwater drawdown.
    - During construction, if warranted by the studies listed above, monitoring and control of the amount of active dewatering on the site so it does not create subsidence in and around adjacent properties.
- Post-construction measures:
    - Project Proponents to ensure that stormwater management features, including green infrastructure practices such as rainwater collection and reuse, green roofs, and bioretention facilities, to manage stormwater flows are incorporated in project design as appropriate in accordance with DOEE's *Stormwater Management Guidebook*.
    - Project Proponents to incorporate in Project design o the maximum extent technically feasible additional stormwater management measures to restore, pre-development site hydrology in compliance with Section 438 of the EISA.

3.8 Permits and Regulatory Compliance

DOEE is the lead authority on environmental compliance within the District. DOEE completes reviews and issues permits for land-disturbing projects. The Project would qualify as Major Land Disturbing Activities[33] and would be required to secure permits for erosion and sediment control, dewatering, and post-construction stormwater management.

The Project would also be regulated under EPA's NPDES Construction General Permit and would need to submit a Stormwater Pollution Prevention Plan (SWPPP) to both DOEE and EPA Region 3 that is compliant with the requirements of the permit. A SWPPP is a document that identifies potential sources of stormwater pollution at a construction site, describes practices to reduce pollutants in stormwater discharge from the site, and identifies procedures to achieve compliance.

DC Water is an independent authority that distributes drinking water and collects and treats stormwater and wastewater in the District. The Project would need to secure a DC Water

[33] Major Land Disturbing Activity is considered to be any land disturbance greater than or equal to 5,000 square feet.

Permit Operations Department approval for water and wastewater connections, as well as discharge of pumped groundwater.

Construction-phase groundwater discharge is governed by DOEE and DC Water. The discharge must comply with DC Municipal Regulation, Title 21 – Water and Sanitation. Particularly relevant sections include Chapter 21-1501, Discharge Standards and Sewer Use Requirements and §21-207, Sanitary Sewer Service Charge for Groundwater: Improved Sites and Construction Sites. Treatment prior to discharge may be required. The construction groundwater discharge is metered and DC water charges $3.11 per 1,000 gallons. The Project may require a Large Industrial User Wastewater Discharge Permit (more than 25,000 gallons per day and more than six months duration), which costs $7,500 for five years.

4 Solid Waste Disposal and Hazardous Materials

4.1 Overview

This section describes and characterizes the potential direct and indirect impacts of the No-Action and Action Alternatives on solid waste production and disposal and on the use and disposal of hazardous materials. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies relevant permitting and regulatory compliance requirements.

Solid waste in general means "any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities."[1] In the case of WUS and the Project, solid waste consists primarily of municipal waste (trash or garbage). Hazardous materials are any substance or chemical that is a "health hazard" or "physical hazard" as defined by 29 Code of Federal Regulations (CFR) 1910.1200

4.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to solid waste and hazardous materials most relevant to the Project include:

- Resource Conservation Recovery Act (RCRA) Solid Waste Regulations (40 CFR 239 through 282);
- The U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) Regulations (40 CFR 61);
- Toxic Substances Control Act (TSCA) Polychlorinated Biphenyl (PCBs) regulations (40 CFR 761);

[1] United States Environmental Protection Agency. *Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions*. Accessed from https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions. Accessed on June 5, 2017.

- TSCA, 15 United States Code (USC) 2601-2692 including the Asbestos Hazard Emergency Response Action;
- Occupational Safety and Health Administration (OSHA) Lead in Construction Standard (29 CFR 1926.62);
- OSHA Standards for Hazardous Materials (29 CFR 1910 and 1926);
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended (42 USC 9601 et seq.);
- RCRA and Superfund Amendments and Reauthorization Action (42 USC 6901 et seq);
- The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 USC 116);
- The Oil Pollution Act of 1990 (OPA) (33 USC 2701 et seq); and
- U.S. Department of Transportation (U.S. DOT) Hazardous Materials Transportation act of 1975 as amended (49 USC 5101-5127).

The EPA is the Federal agency responsible for overseeing hazardous waste generation, storage, treatment, and disposal. The Hazardous Materials Transportation Act of 1975 is applicable to the transportation of hazardous materials in commerce, including inter- and intrastate carriers. Hazardous materials in rail cars can only be shipped by persons registered by the U.S. DOT and the hazardous material must be properly classed, described, packaged, marked, labeled, and in condition for shipment.

District policies, regulations, and guidance that may pertain to solid waste and hazardous materials include:

- District Department of Energy and Environment (DOEE) Control of Asbestos, Title 20 District of Columbia Municipal Regulations (DCMR) 800;
- Asbestos Notification Form, DOEE, Air Quality Division;
- District of Columbia Hazardous Waste Regulations, 20 DCMR Chapters 40 through 54;
- Green Construction Code, Sections 406 and 503 of Title 12K of the District of Columbia Municipal Regulations (12K DCMR 406, 503);
- DOEE Control of Asbestos, Title 20 DCMR 800; and
- District of Columbia Illegal Dumping Enforcement Amendment Act of 1994, DC Law 10-117, DC Official Code 8-901 et seq.

In addition, under RCRA and DC statutes, the District has the authority to ensure safe and effective hazardous waste management and to establish a program of regulation over the generation, storage, transportation, treatment, and disposal of hazardous waste under DC Law 2-64, DC Code 8-1301 through 8-1322. The DC Voluntary Cleanup Program (VCP) provides a framework for conducting the cleanup of any brownfield[2] or site contaminated by hazardous substances not listed in the EPA National Priority List during property development in the event that the property owner, developer, or other entity did not cause or contribute to the contamination.

4.3 Study Area

The Local Study Area for solid waste and hazardous materials is the Project Area (**Figure 4-1**). It is unlikely that solid waste and hazardous materials present at a regional level would require handling or storage within the Project Area; therefore, a Regional Study Area was not considered.

4.4 Methodology

Section 4 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on solid waste and hazardous materials. A summary is below.

4.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. Operational impacts on solid waste were evaluated based on estimated volumes of municipal waste the Project Area would generate in the various alternatives. Estimates of WUS-generated waste were based on available data on current waste generation. For other land uses, including the private air-rights development and the potential Federal air-rights development, the analysis used generation rates provided by the District Department of Public Works.

There is no information on the total amount of solid waste the District produces currently or would produce in 2040, nor is there any information on the number and capacity of available transfer disposal facilities at that time. As a result, waste generation estimates were compared to the most amount of waste processed through the District's two existing waste transfer stations in fiscal year 2017, which represents only a portion of the total amount of waste generated in the District as it does not include waste processed by and through private operators or facilities.

[2] A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The EPA's Brownfields Program began in 1995 and the practices, polices and guidance were codified in the 2002 Small Business Liability Relief and Brownfields Revitalization Act.

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Figure 4-1. Local Study Area for Solid Waste Disposal and Hazardous Materials

Impacts pertaining to hazardous materials were assessed qualitatively. Numerous Federal and local laws and regulations (see **Section 4.2**, *Regulatory Context*) govern the storage, use, and disposal of hazardous materials. The analysis assumed that activities at WUS do and would continue to comply with all applicable laws and regulations.

4.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts were evaluated using a similar approach to that used for the operational impacts. Waste generation estimates were derived from the *Pre-final Constructability Report* prepared for the Project. [3] The analysis assumed compliance with applicable laws and regulations pertaining to hazardous materials.

4.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on solid waste and hazardous materials. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

4.5.1 No-Action Alternative

4.5.1.1 Direct Operational Impacts

Municipal Solid Waste

Relative to existing conditions, in the No-Action Alternative, there would be a minor adverse direct operational impact on solid waste generation.

Increased activity at WUS in the No-Action Alternative would generate an increase in the amount of municipal solid waste produced at the station. Between January and August 2017, WUS generated approximately 1,145 tons of municipal solid waste and 415 tons of recyclable material, or an average of 195 tons of waste a month. This corresponds to an annual amount of 2,340 tons extrapolated from what was generated in January-August 2017.

An order-of-magnitude estimate of the increase in solid waste generation that would occur in the No-Action Alternative can be calculated based on the assumption that it would be approximately proportional to the increase in ridership. In 2040, daily WUS ridership

[3] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report*.

(Amtrak, VRE, MARC, and intercity buses) would increase by around 33 percent relative to existing conditions. A 33 percent increase in solid waste generation would result in approximately 765 more tons of municipal waste a year, for a total of 3,105 tons produced annually.

The private air-rights development would generate new municipal solid waste as well. **Table 4-1** shows an order-of-magnitude estimate based on typical generation rates for the different uses.

Table 4-1. Estimate of Annual Private Air-Rights Development Solid Waste Generation

	Waste generation Rate/Day[1]	Size	Waste Generation Estimate/Year
Residential	4.75 pounds (lbs)/unit	1,020 units[2]	872 tons
Hotel	20 lbs/room	480 rooms[2]	1,728 tons
Office	2.75 lbs/100 square feet	2,160,000 square feet	10,692 tons
Retail	5.5 lbs/100 square feet	120,000 square feet	1,188 tons
Total			**14,480 tons**

1. Developed based on generation rates provided by District Department of Public Works, Office of Waste Diversion (January 2019) and volume-to-weight conversion factors obtained from EPA (https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf)
2. Derived from May 31, 2016 letter from Akridge to FRA, Option 1 Table, Note 3.

Altogether, in the No-Action Alternative, the Project Area would annually produce approximately 15,245 more tons of solid waste than under existing condition, for a total of 17,585 tons per year.

Adverse impacts from this increase would be minor. It is not possible to determine how and by whom future waste from the Project Area would be handled. It may be processed through one of the District's two solid waste transfer stations. In fiscal year 2017, District-owned transfer station processed approximately 464,000 tons of waste.[4] The increased quantity of waste generated by the Project Area represents a small proportion of this amount (about 3.3 percent) and it is unlikely to cause capacity issues, especially since it can be anticipated that a large part would be either recycled or composted.[5]Non-recycled waste would be sent to landfill facilities in Virginia or Maryland. In Virginia alone, total sanitary landfill capacity at the end of 2017 was just under 248 million tons, with an average remaining permitted life of 23.1

[4] District Department of Public Works. *Washington DC Solid Waste Diversion Progress Report. Fiscal Year 2017*. Accessed from: https://dpw.dc.gov/wastediversionreport. Accessed on June 3, 2019. This number does not include waste collected by private operators and delivered to other facilities for processing or disposal.

[5] The District has a goal of diverting 80 percent of citywide waste from landfills and waste-to-energy facilities. To help achieve this goal, the District requires multi-family dwellings, office buildings, and restaurants to recycle a full suite of materials. Accessed from https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st. Accessed on April 3, 2020.

years.[6] Additional waste from the Project Area in the No-Action Alternative is unlikely to cause capacity issues

Hazardous Materials and Waste

Relative to existing conditions, in the No-Action Alternative, there would be a negligible adverse direct operational impact pertaining to hazardous materials.

Train operations involve the storage and use of fuel, oils, lubricants, and other hazardous or regulated materials for operation or maintenance of stationary or mobile equipment. There would be an increase in rail operations at WUS in the No-Action Alternative, from 24 percent for Amtrak operations to 6 percent for VRE operations. However, the nature of operations would remain similar to what it is currently. The same types of hazardous materials would continue to be used, though in greater amounts.[7] The storage, utilization, and disposal of these materials would continue to be performed in compliance with applicable laws, regulations, and policies.

Increased activities at WUS may slightly increase the risk of accidental spills and release of fuel or hazardous materials. All releases of hazardous materials would continue to be reported to the applicable regulatory authority in accordance with the EPCRA or OPA. In the District, this authority is the Homeland Security and Emergency Management Agency. Actions to be taken in the event of a spill would be specified in Amtrak's Spill Prevention, Control, and Countermeasure (SPCC) Plan.

The private air-rights development would not involve the storage and use of hazardous materials beyond products typically found in residential and office buildings such as batteries, solvents, paints, or detergents, among others. The District has a program for the disposal of household hazardous materials at the Fort Totten Transfer Station, which would be available to residents of the development.

4.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no indirect operational impacts on solid waste or hazardous materials.

The No-Action Alternative would not affect the production of solid waste or hazardous materials generation away from the Project Area.

[6] Commonwealth of Virginia Department of Environmental Quality. 2018 Annual Solid Waste Report for Calendar Year 2017. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

[7] See Section 4.5.1, *Project Area Data* of the July 2018 *WUS Expansion Project Affected Environment Technical Report* (**Appendix C2**) for information on the type and quantity of hazardous materials currently used or stored at WUS.

4.5.1.3 Construction Impacts

Construction activities in the No-Action Alternative would result in negligible adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. They would generate potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

In the No-Action Alternative, the Project would not be constructed and there would be no construction impacts. The construction of several of the projects included in the No-Action Alternative, such as the private air-rights development, the replacement of the H Street Bridge, the relocation of Substation 25A, and the VRE Midday Storage Replacement Facility, would generate impacts. Specific information on the construction methods and schedules for those projects is not available. This section assesses anticipated impacts in a general and qualitative manner.

Adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris during construction would be negligible because it can be reasonably anticipated that they would be conducted in compliance with applicable Federal and local laws and regulations, as explained below. These laws and regulations are intended to minimize the potential release of harmful substances in the environment.

Construction activities would involve the storage, use, and disposal of petroleum and hazardous materials such as fuel, lubricants, or solvents, among others, for the operation and maintenance of equipment during construction activities. This would create a risk of spill or release into the environment. Compliance with EPCRA, OPA, and RCRA requirements would minimize this risk.

The projects in the No-Action Alternative would generate construction spoils and debris. The excavation of drilled shafts within the WUS rail terminal for the columns supporting the private air-rights development's overbuild deck would yield soil and groundwater requiring disposal. Construction of the VRE facility would also involve some excavation.

Limited sampling suggests that soil and groundwater below the rail terminal contain contaminants in low concentrations. Some soil concentrations exceeded regulatory screening levels for total petroleum hydrocarbons, diesel range organics (TPH-DRO), PCBs, and arsenic. The presence of diesel-based hydrocarbons and some PCBs is expected in a historic railyard within a dense urban environment. Arsenic concentrations in soil are consistent with regional background concentrations and are likely not the result of site-related activities. Shallow groundwater samples from beneath the former H Street Tunnel contained some metal concentrations in excess of regulatory levels.[8]

8 Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report*.

Construction contractors would be required to handle and dispose of spoil materials and groundwater in accordance with applicable laws and regulations, including RCRA and CERCLA. This would likely involve further characterizing the environmental condition of those materials and treating them in accordance with the type of contamination present, if any. Contaminated soils would be transported in accordance with U.S. DOT regulations and disposed of at facilities permitted to receive them. Contaminated groundwater may be treated on site before being discharged to the municipal sewer system.

The replacement of Substation 25A may generate hazardous debris. Electrical substations include electrical equipment such as transformers or capacitors that contain dielectric fluids. Dielectric fluids can contain a variety of compounds, including petroleum constituents and PCBs. There is potential for release of dielectric fluid from transformers to occur during the equipment relocation process. Historical releases of dielectric fluid may also be identified during transformer decommissioning. TSCA regulates the storage and disposal of PCB-contaminated materials. Construction contractors would be required to comply with TSCA, as applicable.

Pre-1980 structures, including Substation 25A and the H Street Bridge, may contain asbestos-containing materials (ACM) as well as lead-based paints. In the event these materials are confirmed to be present, special handling during the demolition process would be required and materials would have to be removed in accordance with the regulations and standard abatement protocols.

In the aggregate, the removal of contaminated materials from the Project Area would constitute a minor beneficial impact. This impact would be minor because of the likely limited level of contamination that is potentially present and would be removed.

4.5.2 Alternative A

4.5.2.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative A would have a minor adverse direct operational impact on solid waste generation.

Increased activity and ridership at WUS in Alternative A would generate an increase in the amount of municipal solid waste produced by the station. An order-of-magnitude estimate of the increase in solid waste generation that would occur can be calculated based on the assumption that it would be approximately proportional to the increase in ridership.

In 2040, daily WUS ridership (Amtrak, VRE, MARC, and intercity buses) would increase by around 65 percent relative to the No-Action Alternative (see **Table 1-5**). A proportional increase in solid waste generation would result in approximately 2,031 more tons of municipal waste. Alternative A would also add 72,000 square feet of retail to the approximately 208,000 square feet that are currently at WUS and would remain unchanged in the No-Action Alternative. This would contribute approximately 713 tons of additional waste per year, bringing the total increase to 2,744 tons per year. This would be a 16 percent increase relative to the No-Action Alternative.

This impact would be minor. The increase would amount to only approximately 0.6 percent of the 464,000 tons of waste processed District's transfer stations in fiscal year 2017 and, consistent with the District's goals for waste diversion, a large part of it would likely be recycled or composted.[9] The rest would be sent to facilities in Maryland and Virginia, according to availability. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248 million tons.[10] The additional solid waste generated in Alternative A is not likely to cause capacity issues at landfills.

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative A would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Train operations involve the storage and use of fuel, oils, lubricants, and other hazardous or regulated materials for operation or maintenance of stationary or mobile equipment. There would be an increase in rail operations at WUS in Alternative A relative to the No-Action Alternative (see **Tables 5-34**, **5-40**, and **5-44** of this report). However, the nature of operations would remain similar to what it is currently. The same type of hazardous materials would continue to be used, though in greater quantities. The storage, utilization, and disposal of these materials would continue to be performed in compliance with applicable laws, regulations, and policies.

Increased activities at WUS may slightly increase the risk of accidental spills and release of fuels or hazardous materials. All releases of hazardous materials would continue to be reported to the applicable regulatory authority in accordance with the EPCRA, OPA, and other applicable laws and regulations. Actions to be taken in case of spill would continue to be specified in Amtrak's SPCC Plan.

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[9] District Department of Public Works. *Washington DC Solid Waste Diversion Progress Report. Fiscal Year 2017*. Accessed from: https://dpw.dc.gov/wastediversionreport. Accessed on June 3, 2019

[10] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

4.5.2.2 Indirect Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, in Alternative A, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on solid waste generation.

The potential use of the Federal air rights into additional parking would generate a small amount of solid waste, mostly from the users of the parking throwing away materials such as common paper or plastic products and containers on their way to or from their cars. This would be a negligible adverse impact, as it would represent a very small increment to the amount of waste produced in Alternative A.

Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative A, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on hazardous material and waste.

Development of the Federal air rights into two levels of parking above the new parking facility would add to the amount of hazardous materials and waste– such as oils and lubricants - used or produced in the Project Area. Because of the moderate size of facility and its likely integration with the new parking facility below, this increase would be proportionally small and impacts would be negligible.

4.5.2.3 Construction Impacts

Construction of Alternative A would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

Constructing Alternative A would require the storage, use and disposal of petroleum products and hazardous materials. Examples include fuel, lubricants, antifreeze, fire retardants, brake fluid, adhesives, or solvents for the operation and maintenance of construction equipment and vehicles. This would create a risk of spill or release into the environment. Compliance with the requirements of EPCRA, OPA, RCRA, and other applicable Federal and local laws and regulations would minimize these risks. These laws and regulations are intended to minimize the potential release of harmful substances in the environment. The implementation of standard best management practices by the construction contractor, including spill prevention plans and the construction and maintenance of containment systems, would contribute to minimizing the risk of spills. Adverse impacts would be minor.

Alternative A would require excavating the rail terminal to a depth of approximately 20 feet above sea level (asl).[11] It would also involve demolishing existing infrastructure such as tracks, platforms, and catenaries as well as the Claytor Concourse and the existing parking garage. Over the entire construction period (approximately 11 years and 5 months), this would generate a substantial amount of spoils and debris – approximately 1.16 million cubic yards - that would need to be transported and disposed of offsite. However, excavation and associated disposal needs would not occur all at once. Instead, it would occur in four separate steps, as each construction phase (except the Intermediate Phase) would include a period of significant excavation early in the phase. The shortest period of continuous, major excavation work would be in Phase 1 (approximately 5 months out of a total duration of 2 years and 5 months) and the longest in Phase 4 (approximately 1 year and 5 months out of a total duration of 3 years and 1 month). The amount of spoil produced in each phase would vary proportionately, from a total of approximately 141,000 cubic yard during Phase 1 to a total of approximately 524,000 cubic yards during Phase 4.

As noted above, some of the excavated soil may contain TPH-DRO, PCBs, and arsenic in excess of regulatory levels. Shallow groundwater samples from beneath the former H Street Tunnel may contain some metals concentrations in excess of regulatory levels.[12] Construction contractors would be required to handle and dispose of spoil materials and groundwater in accordance with applicable laws and regulations, including RCRA and CERCLA, and other Federal and District laws and regulations, as applicable. This would likely involve further characterizing the environmental condition of those materials and treating them in accordance with the type of contamination present, if any. Contaminated soils would be transported in accordance with U.S. DOT regulations and disposed of at facilities permitted to receive them. Contaminated groundwater may be treated on site before being discharged to the municipal sewer system.[13]

Construction debris would include platforms and railroad tracks. Used wooden railroad ties are typically coated with chemical preservatives including creosote, which contains semi-volatile organic compounds. Materials would have to be characterized, managed, and disposed of in accordance with RCRA and other applicable regulations. This would also be the case of debris that, based on age, may contain ACM or lead-based paint. All such waste would be disposed of at facilities permitted for this type of material.

Spoil generated under each phase by excavation activities would be disposed of at regional disposal facilities based on the type of waste, facility capacity, and waste characterization requirements. Receiving facilities may include: solid waste landfills; soil reclamation areas;

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[11] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report*, Section V.D.1, *Washington Union Station SOE Logistics Drawings*.

[12] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report*.

[13] Estimates of the amount of groundwater that would be withdrawn and disposed of are provided in **Section 4**, *Water Resources and Water Quality*, of this report.

soil recycling facilities; asbestos receiving landfills; hazardous waste landfills; hazardous waste incinerators; and TSCA incinerators. The appropriate transport methods and disposal locations would be identified as part of construction planning.

The removal of contaminated media materials from the Project Area would constitute a minor beneficial impact. This impact would be minor because of the likely limited level of contamination that would be encountered and removed. All fill used during construction would be certified-clean material.

4.5.2.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A would result in an operational, long-term increase in solid waste generation of approximately 117 percent instead of 16 percent relative to the No-Action Alternative. While this would be a proportionately greater increase, the total amount of additional waste that would require processing would remain the same and it is not likely to exceed the capacity of the District's waste transfer facilities or the capacity of potential receiving facilities in the region. Impacts would be minor.

In Alternative A, there would be an increase in the amount of hazardous materials stored, used, and disposed of in the Project Area relative to existing conditions. This would represent a negligible adverse direct operational impact. The greater number of operations in Alternative A than in existing conditions would involve an increase in the storage and use of fuel, oils, lubricants, and other hazardous or regulated materials. However, the nature of operations would remain similar to what it is currently. The same type of hazardous materials would continue to be used, though in greater amounts. The storage, utilization, and disposal of these materials would continue to be performed in compliance with applicable laws, regulations, and policies.

4.5.3 Alternative B

4.5.3.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative B would have a minor adverse direct operational impact on solid waste generation.

Impacts on solid waste generation would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative B would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Impacts would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

4.5.3.2 Indirect Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, in Alternative B, the potential development of the Federal air rights would result in a minor adverse indirect operational impact on solid waste generation.

In Alternative B, the potential Federal air-rights development would consist of approximately 917,420 square feet of office space. It would generate an estimated 4,532 tons per year of additional solid waste.[14] The impact would be minor. While this would more than double the amount of additional waste Alternative B would generate, it would be a small increase (about 0.97 percent) relative to the 464,000 tons of waste processed through the District's transfer stations alone in fiscal year 2017. Additionally, a large part of it would likely be recycled, in keeping with the policies in place to achieve the District's goals of diverting 80 percent of the citywide waste stream from landfills or waste-to-energy facilities.[15] Non-recycled waste would be sent to landfills in Maryland and Virginia. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248 million tons, with a remaining permitted life of 23.1 years. [16] The additional solid waste generated by the potential Federal air-rights development in Alternative B is not likely to cause capacity issues.

Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative B, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on hazardous material and waste.

[14] Developed based on generation rates provided by District Department of Public Works, Office of Waste Diversion (January 2019) and volume-to-weight conversion factors obtained from EPA (https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf).

[15] See https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st. Accessed on April 2, 2020.

[16] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

Development of the Federal air rights into office space would not involve the storage and use of hazardous materials beyond products typically found in office buildings such as batteries, solvents, paints, or detergents, among others. Impacts would be negligible.

4.5.3.3 Construction Impacts

Construction of Alternative B would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

Construction of Alternative B would require the storage, use, and disposal of petroleum products and hazardous materials. This would result in minor adverse impacts as in Alternative A (see **Section 4.5.2.3**, *Construction Impacts*).

Alternative B would require excavating the rail terminal to a depth of approximately 10 feet above sea level. It would also involve demolishing existing infrastructure such as tracks, platforms, and catenaries as well as the Claytor Concourse and the existing parking garage. This would generate a substantial amount of spoils and debris – approximately 1.85 million cubic yards - that would need to be transported and disposed of offsite over the entire construction period (approximately 14 years and 4 months). However, as in the other Action Alternatives, excavation would not occur all at once but in four separate steps. Each construction phase (except the Intermediate Phase) would include a period of significant excavation early in the phase. The shortest period of continuous, major excavation work in Alternative B would be in Phase 1 (approximately 5 months out of a total duration of 2 years and 5 months) and the longest in Phase 4 (approximately 2 years and 7 months out of a total duration of 4 years and 11 months). The amount of spoil produced in each phase would vary proportionately, from a total of approximately 141,000 cubic yard during Phase 1 to a total of approximately 957,000 cubic yards during Phase 4. Appropriate transport methods and disposal locations would be identified during construction planning.

For the same reasons as stated for Alternative A, the removal of contaminated media materials from the Project Area would constitute a minor beneficial impact. All fill used during construction would be certified-clean material.

4.5.3.4 Comparison to Existing Conditions

Like Alternative A, Alternative B would result in an operational, long-term increase in solid waste generation of approximately 117 percent relative to existing condition instead of 16 percent relative to the No-Action Alternative. Factoring in the indirect impacts from the potential Federal air-rights development, the increases would be 299 percent and 40 percent, respectively. While the increase would be proportionately greater relative to existing conditions than relative to the No-Action Alternative, the total amount of additional waste that would require processing would remain the same regardless of the comparison baseline. It is not likely to exceed the capacity of the District's waste transfer facilities or regional receiving facilities. The impact would be minor.

In Alternative B, there would be an increase in the amount of hazardous materials stored, used, and disposed of in the Project Area relative to existing conditions. This would represent a negligible adverse direct operational impact like in Alternative A and for the same reasons (see **Section 4.5.2.4**, *Comparison to Existing Conditions*).

4.5.4 Alternative C (Either Option)

4.5.4.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative C would have a minor adverse direct operational impact on solid waste generation.

Impacts on solid waste generation would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative C would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Impacts would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Indirect Operational Impacts*).

4.5.4.2 Indirect Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, in Alternative C, the potential development of the Federal air rights would result in a minor adverse indirect operational impact on solid waste generation.

In Alternative C, the potential Federal air-rights development would consist of approximately 952,600 square feet of office space. This would generate an estimated 4,700 tons per year of additional solid waste. The impact would be minor. It would more than double the amount of additional waste Alternative C would generate, but it would be a small increment (about 1 percent) relative to the 464,000 tons of waste processed in the District in fiscal year 2017. A large part of it would likely be recycled, in keeping with the policies in place to achieve the District's goals of diverting 80 percent of the citywide waste stream from landfills or waste-to-energy facilities. [17] Non-recycled waste would be sent to landfills in Maryland and Virginia. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248 million tons, with a remaining permitted life of 23.1 years.[18] The additional solid waste generated by the potential Federal air-rights development in Alternative C is not likely to cause capacity issues.

Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative C, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on hazardous material and waste.

Development of the Federal air rights into office space would not involve the storage and use of hazardous materials beyond products typically found in office buildings such as batteries, solvents, paints, or detergents, among others. Impacts would be negligible.

4.5.4.3 Construction Impacts

Construction of Alternative C would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

Construction of Alternative C would require the storage, use and disposal of petroleum products and hazardous materials. This would result in minor adverse impacts as in Alternative A (see **Section 4.5.2.3**, *Construction Impacts*).

Alternative C would require excavating the rail terminal to approximately 3 feet asl. It would also involve demolishing existing infrastructure such as tracks, platforms, and catenaries as well as the Claytor Concourse and the existing parking garage. This would generate a substantial amount of spoils and debris – approximately 1.5 million cubic yards that would need to be transported and disposed of offsite over the entire construction period (12 years and 3 months). As in the other Action Alternatives, excavation would not occur all at once but in four separate steps. Each construction phase (except the Intermediate Phase) would include a period of significant excavation early in the phase. The shortest period of continuous, major excavation work in Alternative C would be in Phase 1 (approximately 5 months out of a total duration of 2 years and 5 months) and the longest in Phase 4 (approximately 2 years out of a total duration of 4 years). The amount of spoil produced in

[17] See https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st.

[18] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

each phase would vary proportionately, from a total of approximately 141,000 cubic yard during Phase 1 to a total of approximately 753,000 cubic yards during Phase 4. Appropriate transport methods and disposal locations would be identified during construction planning.

For the same reasons as stated for Alternative A, the removal of contaminated media materials from the Project Area would constitute a minor beneficial impact. All fill used during construction would be certified-clean material.

4.5.4.4 Comparison to Existing Conditions

Like in Alternatives A and B, in Alternative C solid waste generation would increase by approximately 117 percent relative to existing conditions, compared to 16 percent relative to the No-Action Alternative. Factoring in the indirect impacts from the potential Federal air-rights development, the increments would be 318 percent and 42 percent, respectively. While the increase would be proportionately greater relative to existing conditions than relative to the No-Action Alternative, the total amount of additional waste that would require processing would remain the same regardless of the comparison baseline. It is not likely to exceed the capacity of the District's waste transfer facilities or regional receiving facilities. The impacts would be minor.

In Alternative C, there would be an increase in the amount of hazardous materials stored, used, and disposed of in the Project Area relative to existing conditions. This would represent a negligible adverse direct operational impact like in Alternative A and for the same reasons (see **Section 4.5.2.4**, *Comparison to Existing Conditions*).

4.5.5 Alternative D

4.5.5.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative D would have a minor adverse direct operational impact on solid waste generation.

Increased activity and ridership at WUS would generate an increase in the amount of municipal solid waste produced by the station similar to what would occur in Alternative A and the other Action Alternatives. As explained in **Section 4.5.2.1**, *Direct Operational Impacts*, this would result in a total of 2,031 additional tons of solid waste produced annually.

The addition of approximately 100,000 square feet of retail would contribute approximately 990 tons of waste per year, bringing the total increase to 3,021 tons every year. This would be a 17 percent increment relative to what the No-Action Alternative would generate.

This adverse impact would be minor. The increase would amount to about 0.65 percent of the 464,000 tons of waste processed in the District's transfer stations in fiscal year 2017.[19] Much of it would likely be recycled, in keeping with the District's goal of diverting 80 percent of citywide waste from landfills or waste-to-energy facilities. [20] Non-recycled waste would be sent to facilities in Maryland and Virginia. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248 million tons, with a remaining permitted life of 23.1 years. [21] The projected increase in waste production is unlikely to cause capacity issues.

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative D would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Impacts would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

4.5.5.2 Indirect Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, in Alternative D, the potential development of the Federal air rights would result in a minor adverse indirect operational impact on solid waste generation.

In Alternative D, the potential Federal air-rights development would consist of approximately 688,050 square feet of office space. This would generate an estimated 3,410 tons per year of additional solid waste. The impact would be minor. While it would more than double the amount of additional waste Alternative D would generate, it would be a small increment (about 0.7 percent) relative to the 464,000 tons of waste processed in the District in fiscal year 2017. A large part of it would likely be recycled, in keeping with the policies in place to achieve the District's goals of diverting 80 percent of the citywide waste stream from landfills or waste-to-energy facilities. [22] Non-recycled waste would be sent to landfills in Maryland and Virginia. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248

[19] District Department of Public Works. *Washington DC Solid Waste Diversion Progress Report. Fiscal Year 2017*. Accessed from: https://dpw.dc.gov/wastediversionreport. Accessed on June 3, 2019.

[20] See https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st.

[21] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

[22] See https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st.

million tons, with a remaining permitted life of 23.1 years. [23] The additional solid waste generated by the potential Federal air-rights development in Alternative D is not likely to cause capacity issues.

Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative D, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on hazardous material and waste.

Development of the Federal air rights into office space would not involve the storage and use of hazardous materials beyond products typically found in office buildings such as batteries, solvents, paints, or detergents, among others. Impacts would be negligible.

4.5.5.3 Construction Impacts

Construction of Alternative D would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

The construction impacts of Alternative D would be the same as those of Alternative C (see **Section 4.5.4.3**, *Construction Impacts*).

4.5.5.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative D would result in an increase in solid waste generation of approximately 129 percent instead of 17 percent relative to the No-Action Alternative. Factoring in the indirect impacts from the potential Federal air-rights development, the increments would be 275 percent and 37 percent, respectively. While the increase would be proportionately greater relative to existing conditions than relative to the No-Action Alternative, the total amount of non-recycled, additional waste that would require processing would remain the same regardless of the comparison baseline. It is not likely to exceed the capacity of the District's waste transfer facilities or regional receiving facilities. Adverse impacts would be minor.

In Alternative D, there would be an increase in the amount of hazardous materials stored, used, and disposed of in the Project Area relative to existing conditions. This would represent a negligible adverse direct operational impact like for Alternative A and for the same reasons (see **Section 4.5.2.4**, *Comparison to Existing Conditions*).

[23] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

4.5.6 Alternative E

4.5.6.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative E would have a minor adverse direct operational impact on solid waste generation.

Impacts on solid waste generation would be the same as in Alternative D because the increase in WUS activities would be the same (see **Section 4.5.5.1**, *Direct Operational Impacts*).

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative E would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Impacts would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

4.5.6.2 Indirect Operational Impacts

Municipal Solid Waste and Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative E, the potential development of the Federal air-rights would result in a minor adverse indirect impact on municipal solid waste generation and negligible indirect operational impacts on hazardous materials and waste.

Impacts would be the same as in Alternative D because the potential Federal air-rights development would be the same (see **Section 4.5.5.2**, *Indirect Operational Impacts*).

4.5.6.3 Construction Impacts

Construction of Alternative E would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

The construction impacts of Alternative E would be the same as those of Alternative B (see **Section 4.5.3.3**, *Construction Impacts*).

4.5.6.4 Comparison to Existing Conditions

Alternative E would compare to existing conditions as Alternative D would (see **Section 4.5.5.4**, *Comparison to Existing Conditions*).

4.5.7 Alternative A-C (Preferred Alternative)

4.5.7.1 Direct Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse direct operational impact on solid waste generation.

Impacts on solid waste generation would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

Hazardous Materials and Waste

Relative to the No-Action Alternative, Alternative A-C would have negligible adverse direct operational impacts pertaining to hazardous materials and waste.

Impacts would be the same as in Alternative A because the increase in WUS activities would be the same (see **Section 4.5.2.1**, *Direct Operational Impacts*).

4.5.7.2 Indirect Operational Impacts

Municipal Solid Waste

Relative to the No-Action Alternative, in Alternative A-C, the potential development of the Federal air rights would result in a minor adverse indirect operational impact on solid waste generation.

In Alternative A-C, the potential Federal air-rights development would consist of approximately 380,000 square feet of office space. It would generate an estimated 1,881 tons per year of additional solid waste.[24] The impact would be minor. While this would increase the amount of additional waste Alternative A-C would generate by about 68 percent, this increase would be small relative to the 464,000 tons of waste processed through the District's transfer stations alone in fiscal year 2017 (approximately 0.4 percent). Additionally, a large part of it would likely be recycled, in keeping with the policies in place to achieve the District's goals of diverting 80 percent of the citywide waste stream from landfills or waste-to-energy facilities.[25] Non-recycled waste would be sent to landfills in Maryland and Virginia. In Virginia alone, as of the end of 2017, sanitary landfill capacity was just under 248

[24] Developed based on generation rates provided by District Department of Public Works, Office of Waste Diversion (January 2019) and volume-to-weight conversion factors obtained from EPA (https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf).

[25] See https://dpw.dc.gov/release/new-dc-recycling-requirements-begin-january-1st.

million tons, with a remaining permitted life of 23.1 years. [26] The additional solid waste generated by the potential Federal air-rights development in Alternative A-C is not likely to cause capacity issues.

Hazardous Materials and Waste

Relative to the No-Action Alternative, in Alternative A-C, the potential development of the Federal air rights would result in a negligible indirect operational adverse impact on hazardous material and waste.

Development of the Federal air rights into office space would not involve the storage and use of hazardous materials beyond products typically found in office buildings such as batteries, solvents, paints, or detergents, among others. Impacts would be negligible.

4.5.7.3 Construction Impacts

Construction of Alternative A-C would result in minor adverse impacts from the storage and use of hazardous materials and the generation and disposal of hazardous and non-hazardous waste and debris. It would have potential minor beneficial impacts from the removal of contaminated materials or media from the Project Area.

The impacts of constructing Alternative A-C would be the same as those as constructing Alternative A. These impacts are described in **Section 4.5.2.3**, *Construction Impacts*.

4.5.7.4 Comparison to Existing Conditions

Like Alternatives A through C, Alternative A-C would result in an operational, long-term increase in solid waste generation of approximately 117 percent relative to existing condition instead of 16 percent relative to the No-Action Alternative. Factoring in the indirect impacts from the potential Federal air-rights development, the increases would be 198 percent and 26 percent, respectively. While the increase would be proportionately greater relative to existing conditions than relative to the No-Action Alternative, the total amount of additional waste that would require processing would remain the same regardless of the comparison baseline. It is not likely to exceed the capacity of the District's waste transfer facilities or regional receiving facilities. The impact would be minor.

In Alternative A-C, there would be an increase in the amount of hazardous materials stored, used, and disposed of in the Project Area relative to existing conditions. This would represent

[26] Commonwealth of Virginia Department of Environmental Quality. *2018 Annual Solid Waste Report for Calendar Year 2017*. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

a negligible adverse direct operational impact like in Alternative A and for the same reasons (see **Section 4.5.2.4**, *Comparison to Existing Conditions*).

4.6 Comparison of Alternatives

As shown in **Table 4-2**, the alternatives generally have similar impacts, with the main quantifiable difference being the amount of municipal solid waste and construction-related spoil and debris they would generate (**Table 4-3**).

The differences in municipal waste generation among the Action Alternatives arise from the amount of new retail included in each Action Alternative as well as the function and size of the potential Federal air-rights development. Overall, based on the order-of-magnitude estimates provided in the above analysis, Alternative A would cause the smallest increase in the amount of waste and Alternative C the largest one. Alternative A would generate substantially less solid waste than the other Action Alternatives. All Action Alternatives would generate additional waste relative to the No-Action Alternative.

The amount of construction spoil and debris that would require transportation and disposal would vary according to the depth of excavation required by each Alternative, with Alternative A and Alternative A-C generating the least amount and Alternatives B and E the most.

There would be no substantive differences among the alternatives with regard to hazardous materials. While the quantities of such substances stored, used, or disposed of in the Project Area would vary, the same regulations and procedures would apply to ensure that any potential adverse effects are negligible, regardless of the alternative

4.7 Avoidance, Minimization and Mitigation Evaluation

The following recommended measures would avoid and minimize adverse impacts pertaining to solid waste and hazardous materials are being considered by FRA:

- WUS' existing SPCC Plan would be updated to reflect any major changes to on-site petroleum product or liquid hazardous waste storage.
- For the construction phase of the Project, the contractor would be required to prepare and implement a construction-specific SPCC.
- The construction contractor would identify hazardous building materials (ACM, lead-based paint, PCBs, mercury, etc.) prior to any demolition work. If such materials are present, they would be properly abated by a licensed contractor in accordance with state and local regulations. Debris would go to a receiving facility licensed to handle the relevant type of waste in compliance with applicable shipping regulations.

- The construction contractor would develop a Soil Management Plan (SMP) based upon subsurface investigations, as needed. The purpose of these investigations would be to pre-characterize the soils to be removed during the construction of the Project. An SMP typically outlines standards and procedures for the identification and disposal of contaminated materials encountered during construction.
- The construction contractor would use only certified clean fill to replace excavated soils.
- During soil disturbing activities, the construction contractor would control fugitive dust through wetting, sweeping, and other suppression techniques.
- The construction contractor would develop a Health and Safety Plan to provide the minimum health and safety specifications that must be met during construction, including requirements for environmental monitoring, personnel protective equipment, site control and security, and training.
- The District of Columbia has adopted a vision to divert 80% of all solid waste generated in the District through source reduction, reuse, recycling, composting, and anaerobic digestion. USRC would require that municipal solid waste generated at WUS be managed to maximize opportunities for recycling or other waste diversion methods in support of the District's vision.

Table 4-2. Comparison of Alternatives

<table>
<tr><th>Impact Category</th><th>Type of Impact</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C (Either Option)</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred)</th></tr>
<tr><td rowspan="3">Municipal Solid Waste</td><td>Direct operational</td><td colspan="7">Minor adverse impacts</td></tr>
<tr><td>Indirect operational</td><td>No impacts</td><td>Negligible adverse impacts</td><td colspan="5">Minor adverse impacts</td></tr>
<tr><td>Construction</td><td colspan="7">Minor adverse impacts</td></tr>
<tr><td rowspan="3">Hazardous Materials and Waste</td><td>Direct operational</td><td colspan="7">Negligible adverse impacts</td></tr>
<tr><td>Indirect operational</td><td colspan="7">Negligible impacts</td></tr>
<tr><td>Construction</td><td>Negligible adverse / minor beneficial impacts</td><td colspan="6">Minor adverse and beneficial impacts</td></tr>
</table>

Table 4-3. Quantitative Estimates by Alternative

Source	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C
Operational							
WUS	765 tpy	2,744 tpy	2,744 tpy	2,744 tpy	3,021 tpy	3,021 tpy	2,744 tpy
Private Air-Rights Development	14,480 tpy	-	-	-	-	-	
Potential Federal Air-Rights Development	-	Negligible	4,532 tpy	4,700 tpy	3,410 tpy	3,410 tpy	1,881 tpy
Total	15,245 tpy	2,744 tpy	7,276 tpy	7,444 tpy	6,431 tpy	6,431 tpy	4,625 tpy
Construction Spoils and Debris[1]							
Construction Spoils and Debris	-	1,160,885 cy	1,845,224 cy	1,507,102 cy	1,507,102 cy	1,845,224 cy	1,160,885 cy

tpy = tons per year; cy = cubic yards

4.8 Permits and Regulatory Compliance

Spill management to prevent the release of hazardous materials due to inappropriate storage and handling is dictated by the local and federal authorities. A SPCC Plan per Title 40 CFR, Part 112, Oil Pollution Prevention, is currently in place at WUS and must be updated as needed. Updates are required when there is a change in the facility design, construction, operation, or maintenance that materially affects its potential for a discharge as described in 40 CFR Part 112.1(b). SPCC plans must meet standard engineering practices and be certified by a licensed Professional Engineer. During construction, the contractor would be responsible for implementing a construction-specific spill prevention program. Should release notification be required by the EPA, U.S. DOT, or National Response Center, notice shall also be given to the District's Emergency Management Agency and Department of the Environment, Hazardous Waste Division per 20 DCMR Chapter 42.

Underground storage tanks that are covered under 20 DCMR Chapter 55 must be registered in accordance with 20 DCMR Chapter 56. Heating oil underground storage tanks (USTs) less than 1,100 gallons and petroleum USTs that are less than 110 gallons need not be registered with the District. Aboveground storage tanks are primarily regulated by the DC Fire code. Inspections are required by the Office of the Fire Marshall's Fire Prevention Division.

The abatement of hazardous building materials requires a licensed contractor and prior notification to the District. The DOEE provides an Asbestos Notification Form for the removal of asbestos and a Lead Abatement and Renovation permit for the abatement of lead-based paints. Other fixtures containing hazardous materials such as light ballasts, thermostats, etc. should only be removed by a qualified contractor and must be disposed to a facility that will accept these types of wastes via manifest or other appropriate shipping documentation.

The on-site management of contaminated soil must be performed in accordance with a SMP that will dictate appropriate handling and storage procedures. Contaminated soils may only be consigned, conveyed, and/or transported to facilities and locations licensed, permitted, or approved to accept such materials by appropriate federal, state or local authorities. Soils that meet the criteria defining a listed or characteristic hazardous waste may only be disposed of at a RCRA hazardous waste landfill, TSCA facility, or RCRA hazardous waste incinerator.

Municipal solid waste can only be sent to a facility that is appropriately licensed under RCRA Subtitle D and must be managed per 21 DCMR Chapters 7-8. To meet the District's sustainability goals, commercial properties must separate for recycling paper, paperboard, cardboard, and clean and rinsed metal, glass and plastic containers per 21 DCMR Chapter 20.

5 Transportation

5.1 Overview

This section describes the potential impacts of the No-Action Alternative and the Action Alternatives on the multiple transportation modes (modes) in and around Washington Union Station (WUS). These include:

- Railroad (National Railroad Passenger Corporation [Amtrak], Virginia Railway Express [VRE], and Maryland Area Regional Commuter [MARC] Train);
- Intercity, tour/charter, and sightseeing buses (including hop-on/hop-off buses and daily sightseeing coaches);[1]
- Private vehicles;
- For-hire vehicles;[2]
- Bicycles;
- Transit (Metrorail, Streetcar, and Metrobus); and
- Pedestrians

If applicable, this section recommends measures to avoid, minimize, or mitigate potential adverse impacts. It also identifies applicable permitting and regulatory compliance requirements.

5.2 Regulatory Context

Federal, Washington, DC (District), and regional policies, regulations, and guidance that pertain to transportation include:

[1] Hop-on/hop-off sightseeing buses provide scheduled routes that allow tourists to visit different sites in Washington, DC and surrounding areas either by continuously riding the bus in a loop, or by getting off the bus at certain stops and then getting back on to continue with their visit. Daily sightseeing buses are coach-style buses that provide scheduled service to certain tourist destinations. Currently, hop-on/hop-off buses serve the front of WUS while daily buses are located in the existing bus facility.

[2] “For-hire” refers to licensed taxicabs, livery cars, and transportation networking companies like Uber and Lyft.

- Federal Railroad Administration's (FRA) *Procedures for Considering Environmental Impacts*; [3]
- *The Comprehensive Plan for the National Capital: Federal Elements, Transportation*, adopted in 2016, prepared by the National Capital Planning Commission (NCPC). [4]
- *The Comprehensive Plan for the National Capital: District Elements, Transportation*, adopted in 2006 and amended in 2011, prepared by the District of Columbia Office of Planning; [5]
- District Department of Transportation (DDOT) *Design and Engineering Manual*;[6]
- DDOT *Pedestrian Safety and Work Zone Standards – Covered and Open Walkways*;[7]
- DDOT *Public Realm Manual*;[8]
- DDOT *DC Temporary Traffic Control Manual*;[9]
- DDOT *Guidelines for Comprehensive Transportation Review*;[10] and
- DDOT *Environmental Policy and Process Manual*, 2nd Edition.[11]

[3] U.S. Department of Transportation, Federal Railroad Administration. 1999. Procedures for Considering Environmental Impacts (64 Federal Register 28545). Accessed from https://www.fra.dot.gov/eLib/Details/L02710. Accessed on June 6, 2017.

[4] National Capital Planning Commission. 2016. *The Comprehensive Plan for the National Capital: Federal Elements.* Accessed from https://www.ncpc.gov/plans/compplan/. Accessed on March 3, 2020.

[5] DC Office of Planning. 2006. *The Comprehensive Plan for the National Capital: District Elements.* Accessed from https://planning.dc.gov/page/comprehensive-plan. Accessed on March 3, 2020.

[6] District Department of Transportation. 2019. *Design and Engineering Manual.* Accessed from https://ddot.dc.gov/page/design-and-engineering-manual. Accessed on February 28, 2020.

[7] District Department of Transportation. 2007. *Pedestrian Safety and Work Zone Standards – Covered and Open Walkways.* Accessed from https://dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/pedestrian_safety_and_work_zone_standards_covered_and_open_walkways_july_2010.pdf. Accessed on April 3, 2020.

[8] District Department of Transportation. 2011. *Public Realm Manual.* Accessed from https://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/ddot_public_realm_design_manual_2011.pdf. Accessed on April 3, 2020.

[9] District Department of Transportation. 2006. *D.C. Temporary Traffic Control Manual – Guidelines and Standards.* Accessed from https://comp.ddot.dc.gov/Documents/Temporary%20Traffic%20Control%20Manual.pdf. Accessed on April 3, 2020.

[10] District Department of Transportation. 2019. *DDOT Guidelines for Comprehensive Transportation Review (CTR) Requirements*. Accessed from https://ddot.dc.gov/publication/ddot-guidelines-comprehensive-transportation-review-ctr-requirements. Accessed on February 28, 2020.

[11] District Department of Transportation. 2012. DDOT Environmental Policy and Process Manual. Accessed from https://ddot.dc.gov/page/ddot-environmentalpolicy-and-process-manual-0. Accessed on April 3, 2020.

- Transportation Planning Board's (TPB) 2014 Constrained Long-Range Transportation Plan (CLRP). [12]

5.3 Study Area

The Local Study Area for transportation impacts includes the Project Area and immediately adjacent roadway network along with key roadway intersections (study intersections) near WUS (**Figure 5-1**). Traffic conditions and coordination with DDOT were the basis for the identification of the study intersections. These intersection are listed below (numbers refer to **Figure 5-1**):

1. North Capitol and K Street
2. First Street and K Street NE
3. 2nd Street and K Street NE
4. 2nd Street and I Street NE
5. North Capitol Street and H Street
6. WUS Garage Entrance and H Street NE
7. WUS Bus Exit and H Street NE
8. Kaiser Permanente Entrance and H Street NE
9. H Street and 3rd Street NE
10. North Capitol Street and G Street
11. First Street and G Street NE
12. 2nd Street and G Street NE
13. North Capitol Street, Massachusetts Avenue, and F Street
14. E Street, Massachusetts Avenue, and First Street NE
15. Louisiana Avenue and Massachusetts Avenue NE
16. Delaware Avenue and Massachusetts Avenue NE
17. First Street and Massachusetts Avenue NE (at WUS entrance)
18. 2nd Street and F Street NE

[12] Metropolitan Washington Council of Governments (MWCOG). *TPB Constrained Long-Range Transportation Plan. 2014 CLRP and FY 2015-2020 TIP*. Accessed from http://www1.mwcog.org/clrp/resources/KeyDocs_2014.asp. Accessed on April 3, 2020.

19. North Capitol Street and E Street
20. Louisiana Avenue and D Street NW
21. Louisiana Avenue and North Capitol Street
22. 2nd Street and D Street NE
23. 2nd Street and Massachusetts Avenue NE
24. Massachusetts Avenue and Delaware Avenue NE
25. 4th Street and H Street NE
26. Massachusetts Avenue, C Street NE, and 4th Street NE
27. Louisiana Avenue and C Street NW
28. First Street and D Street NW
29. I-395 Tunnel at 2nd Street and D Street NW
30. 3rd Street and I-395 On-Ramp and Indiana Avenue and D Street NW
31. 3rd Street and E Street NW
32. 3rd Street, Massachusetts Avenue, and H Street NW
33. North Capitol Street (Southbound Ramp) and New York Avenue
34. North Capitol Street (Northbound Ramp) and New York Avenue

Given transportation patterns in the District, the impacts of the various alternatives on the transportation network would quickly dissipate outside the Local Study Area. Therefore, the Regional Study Area identified in the *Methodology Report* was used for the purposes of understanding the regional distribution of vehicular and transit trips originating at WUS but it was not used for the analysis of impacts.[13]

[13] In the 2018 Methodology Report, FRA stated that "The regional study area for transportation is the area of the jurisdictions that are members of the MWCOG—the local Metropolitan Planning Organization (MPO)—in Maryland, the District of Columbia, and Virginia. This regional study area is being selected because Washington Union Station (WUS) is a Project of regional significance that has an impact on transportation movements in different modes across the MWCOG area. It is at the geography of MWCOG that the Constrained Long-Range Plan and regional modeling efforts are conducted." Further assessment indicated that this regional view was not necessary to capture the impacts of the Project.

Figure 5-1. Transportation Local Study Area

5.4 Methodology

This section presents the methodology used for the multimodal transportation impact analysis. It complements the approaches outlined in Section 5 of the April 2018 *Final Environmental Impact Statement Methodology Report* (**Appendix C1**), which FRA developed in coordination with the Cooperating Agencies. This analysis identifies the impacts of the alternatives on the transportation system due to changes in the volume or patterns of railroad, bus, private vehicle, for-hire vehicle, bicycle, transit, and pedestrian trips.

5.4.1 General Methodology

The transportation impact analysis used existing and anticipated trip generation information to estimate future transportation volumes and the resulting impacts on the various modes. Transportation agencies, private operators, and site visits provided the data informing the analysis. The limitations of certain sources are noted in the analysis. Key inputs included:

- Projected ridership, service frequency, and schedule data (provided by Amtrak, DDOT, MARC, Washington Metropolitan Area Transit Authority [WMATA], and VRE);
- National Capital Region Transportation Planning Board (TPB) travel demand model;
- TPB 2040 Constrained Long-Range Transportation Plan;
- Reasonable assumptions about future private and Federal air-rights development programs, including office, residential, and retail uses;
- Projected local transit ridership;
- Projected pedestrian and bicycle activity;
- Projected intercity bus ridership;
- WUS retail uses; and
- Growth from planned private development projects within one ½ mile of WUS and general background growth.

FRA developed projections for each mode through a detailed multimodal model (model) using existing and projected ridership and developments, and estimated mode splits.[14] Projections included morning (AM) and evening (PM) peak-hour rail, intercity and tour/charter bus, shuttle bus, and transit ridership, traffic,[15] bicycle, and pedestrian information.

[14] Mode splits are the percentage of trips that are taken via a certain mode. For example, if twenty percent of station users take transit, their “transit mode split” is twenty percent.

[15] Traffic in this context refers to the movements of different vehicular modes, including private vehicles, for-hire vehicles, trucks for loading and delivering, and buses, on roadways.

Data sources for the mode projections included:

- Amtrak, MARC, and VRE ridership, and Intercity bus projections from the *Northeast Corridor (NEC) FUTURE Tier 1 FEIS*;[16]
- Amtrak Terminal Infrastructure Study and Operations Plan;
- VRE 2040 System Plan;[17]
- MARC Train 2040 Growth and Investment Plan;[18]
- WMATA Land Use Ridership Model;
- Metropolitan Washington Council of Governments (MWCOG) Regional Bus Staging, Layover, and Parking Location Study;[19]
- MWCOG Cooperative Forecast – WMATA ridership;
- MWCOG 2040 Cooperative Forecast - local Transportation Activity Zone data;
- DDOT DC Circulator ridership;
- DDOT Streetcar Ridership projections;
- District land use sources including the Office of Planning (OP), Zoning Commission, Board of Zoning Appeals, Department of Consumer and Regulatory Affairs (DCRA), the North of Massachusetts Avenue (NoMA) Business Improvement District (BID), the Mount Vernon Triangle BID, the Capitol Hill BID, and local Advisory Neighborhood Commissions;
- Destination DC visitor statistics;[20] and
- Submissions from the private air-rights developer to FRA.

The model was constructed specifically for the context of WUS. However, industry standards, including the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 9th Edition were the basis for developing trip generation and origin-destination outputs. The model is similar to a standard trip generation model for a development project but with added complexity because of the different transportation modes and trip generators present at

[16] Federal Railroad Administration. 2017. *NEC FUTURE Tier I Final Environmental Impact Statement*. Accessed from https://www.fra.dot.gov/necfuture/. Accessed on May 10, 2020.

[17] Virginia Railway Express. 2014. *System Plan 2040*. Accessed from http://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf. Accessed on May 10, 2020.

[18] Maryland Transit Administration. 2013. *MARC Growth and Improvement Plan Update: 2013 to 2050*.

[19] Metropolitan Washington Council of Governments. 2015. *Regional Bus Staging, Layover, and Parking Location Study*.

[20] Destination DC. *Washington, DC Visitor Research*. Accessed from https://washington.org/press/DC-information/washington-dc-visitor-research. Accessed on July 24, 2017.

WUS. FRA and DDOT reviewed the model and underlying assumptions for accuracy and validity.

FRA used the model to forecast anticipated multimodal transportation demands from WUS, the private air-rights development, and rail, intercity bus, and transit services at WUS. Mode splits were used to estimate how trips would be distributed from transportation and land use generators into the broader transportation network. FRA derived the transit mode splits from Amtrak, VRE, MARC, and WMATA ridership surveys. It derived the land use mode splits from American Community Survey Census data and data from other developments in the District. Using this current data, FRA adjusted 2040 mode splits by reducing by 10 percent single occupancy vehicles in favor of transit and bicycle/pedestrian modes compared to existing conditions. This adjustment reflects the long-term shift predicted in the MWCOG model estimates. **Table 5-1** and **Table 5-2** show the mode splits used for the analysis. They differ among the alternatives based on the amount of parking provided in the alternative. FRA developed a set of assumptions for each transportation generator to inform the resulting analysis (see *5.4.1.1 Land Use Generators* and *5.4.1.2 Transportation Generators).*

Information generated by the model served as input for a more detailed analysis of the transportation network and the pedestrian flows in and near WUS. This more detailed analysis was conducted using the modeling programs Synchro and MassMotion.

The data presented in the tables throughout this section derive from the above-listed sources and are outputs of the FRA NEC FUTURE FEIS, the TPB Constrained Long-Range Transportation Plan, WUS Multimodal Model, or the Synchro model used for traffic impact analysis.

Table 5-1. Transportation Generator Mode Splits for Action and No-Action Alternatives

Receiving Mode	Amtrak		MARC		VRE		Intercity Bus		Metrorail[2]	
	Mode Share (%)	Vehicle Occupancy Ratio (VOR)[1]	Mode Share (%)	VOR[1]	Mode Share (%)	VOR[1]	Mode Share (%)	VOR[1]	Mode Share (%)	VOR[1]
Amtrak - Acela	3		0		0		1		4	
Amtrak - Long Distance	2		0		0		0		0	
Amtrak - Regional	6		0		0		0		5	
MARC	5		0		1		1		12	
VRE	2		0		0		0		6	
Metrorail	17-19[3]		45		26		40		0	
Intercity Bus	1		0		0		1		1	
Local Bus	5		7		8		11		5	
Shuttle Bus	0		0		0		1		1	
Streetcar	3		5		2		3		1	
Tour Bus	1		0		0		1		0	
Parking	4-8[4]	1.20	0	1.20	0	1.20	3	1.20	1	1.20
Private Pick-up/Drop-off	17-18[5]	1.20	2	1.20	0	1.20	21	1.20	2	1.20
Rental Car	2	1.20	0	1.20	0	1.20	1	1.20	0	1.20
For-Hire Vehicle	22-23[6]	1.20	0	1.20	1	1.20	10	1.20	0	1.20
Walk	6		41		60		4		61	
Bike	1		0		1		2		1	
Total[7]	100		100		100		100		100	

[1] VOR refers to the number of passengers per vehicle.
[2] These mode splits derive from WMATA's access surveys. Connections between other WUS transportation generators and Metro are accounted for in the Metro mode splits under those generators when the model is run. For example, the number of intercity bus-Metro passengers is based on the 40 percent mode share explained under the intercity bus column.
[3] The Metrorail mode split varies with the amount of parking provided. When there is less parking, fewer people would drive to WUS. Approximately 50 percent of these people are assumed to use Metrorail instead.
[4] The parking mode split is a function of the amount of parking provided by each alternative.
[5] Private pick-up/drop-off refers to pick-up and drop-off by a friend or family member. This mode split varies with the amount of parking provided. With less parking, fewer people would drive and park at WUS. Approximately 25 percent of these people are assumed to use the private pick-up/drop-off mode instead.
[6] The taxi/car service mode split varies with the of parking provided. With less parking, fewer people would drive and park at WUS. Approximately 25 percent of these people are assumed to use a taxi/car service instead.
[7] Some totals may not add to 100 percent due to rounding.

Table 5-2. Land Use Generator Mode Splits for the Action and No-Action Alternatives

Mode	Retail		Office		Residential		Hotel	
	Mode Share (%)	VOR	Mode Share (%)	VOR	Mode Share (%)	VOR	Mode Share (%)	VOR
Amtrak – Acela	2		1		1		9	
Amtrak - Long Distance	0		0		0		1	
Amtrak – Regional	2		0		0		7	
MARC	1		14		7		1	
VRE	0		8		0		0	
Metrorail	29		40		28		39	
Intercity Bus	2		0		1		1	
Local Bus	5		6		5		5	
Shuttle Bus	1		0		1		1	
Streetcar	4		3		5		5	
Tour Bus	3		0		0		0	
Private Vehicle	22	1.20	18	1.06	25	1.20	20	1.20
Private Pick-up/Drop-off[1]	0	1.20	0	1.20	0	1.20	0	1.20
Rental Car	0	1.20	0	1.06	0	1.20	0	1.20
For-hire Vehicle	9	1.20	2	1.20	2	1.20	10	1.20
Walk	16		4		20		1	
Bike	4		4		5		0	
Total	**100**		**100**		**100**		**100**	

[1] This refers to pick-up and drop-off by a friend or family member. This mode split would be negligible compared to for-hire vehicle or private parking.

Synchro analysis, which assesses the performance of intersections based on vehicle volumes, was performed using Synchro 8.0. This tool provided a macroscopic overview of traffic conditions at key intersections near WUS (**Figure 5-1** shows these intersections).

The MassMotion program served to analyze internal pedestrian flow at WUS. This analysis tested the ability of the WUS concourses and exits to handle anticipated pedestrian flows and the overall pedestrian volumes in and out of the station (see *Action Alternatives Refinement Report*, *Appendix A* for more detailed information on pedestrian flow analysis).

5.4.1.1 Land Use Generators

The model considered the transportation demand associated with the following land uses:

- Retail, office, and Amtrak "back of house" space at WUS; [21]
- Potential Federal air-rights development consisting of parking (Alternative A) or office uses (other Action Alternatives);[22] and
- Private air-rights development consisting of retail, office, and residential uses.[23]

The purpose of the analysis is to determine the impacts attributable to the Project, separately from those of nearby private projects including the private air-rights development.

WUS Retail

In the No-Action Alternative, the WUS retail program would be the existing approximately 208,000 square feet of existing retail at WUS. In the Action Alternatives, that square footage would increase to 280,000 square feet or 308,000 square feet depending on the alternative. Parking for retail would include at least 600 spaces in all alternatives. This is consistent with existing lease requirements through 2084.

WUS Office and Back of House

The existing office and back of house programs would remain the same in the No-Action Alternative (approximately 85,600 square feet). All Action Alternatives would increase the amount of back of house areas to a total of approximately 297,000 square feet.

Federal Air-rights Development

The Action Alternatives would make space available for potential future development by government or private entities in the Federally owned air-rights area above the rail terminal. The existing WUS parking garage and bus facility currently occupy this area. In Alternatives B through A-C, it was assumed that this potential development would consist of office space (from approximately 380,000 to approximately 917,420 gross square feet depending on the Action Alternative) to provide a more conservative estimate of transportation impacts.[24] In

21 "Back of house" refers to areas that support Amtrak and WUS operational needs.

22 Expect for Alternative A, the transportation analysis assumes an office program to maximize trip generation and provide a conservative estimate of travel demand because the specific program of this development is not known. In Alternative A, because of the limited amount of Federal air rights available and their location above the parking facility with no opportunity for direct street access, the assumption was that the Federal air rights would be used for additional parking.

23 The private air-rights development is included in the impact analysis because, although separate and independent from the Project, it is assumed to have occurred in the No-Action Alternative and the Action Alternatives. Its inclusion ensures that the analysis provides a comprehensive description of the potential impacts of the Project in the context of all activities in the Local Study Area.

24 Trip generation models generally produce more trips per square foot for office versus apartments or hotels. Additionally, trip generation in office development derives from square footages directly as opposed to rooms or keys. With no program

Alternative A, as the available Federal air-rights area would be entirely above a multi-story parking facility with no opportunity for direct street access, it was assumed that the potential development would consist of additional daily parking.

Adjacent Planned Land Uses

Adjacent planned land uses were factored in through a uniform background growth rate in traffic (as described below in **Section 5.4.1.3**, *Vehicular Traffic Analysis*) and through background growth in WMATA Metrorail ridership per the MWCOG model estimate. Background growth includes growth from projects identified by a District government agency or BID as being in the "development pipeline."[25] Background growth also included MWCOG regional land use forecasts, which estimate future population and employment levels.

Private Air-rights Development

The private air-rights development is characterized in **Section 1.7.1**, *No-Action Alternative,* Table 1-4) of this report. In each Action Alternative, the placement of the Project elements would affect the size of the private air-rights development. **Table 5-3** shows the estimated reductions in trip volumes associated with these differences. These trip reductions are intended to account for the approximate amount of private air-rights development capacity the various Action Alternatives would displace.

Table 5-3. Alterations to Private Air-rights Development Trip Generation by Alternative

	North Parcel[1]	South Parcel[1]
No-Action Alternative	Baseline, no reduction	Baseline, no reduction
Alternative A	No reduction	25% reduction in trips
Alternative B	No reduction	25% reduction in trips
Alternative C	25% reduction in trips	25% reduction in trips
Alternative D	25% reduction in trips	No reduction
Alternative E	No reduction	No reduction
Alternative A-C	No reduction	25% reduction in trips

[1] "North parcel" refers to areas north of H Street NE owned by the private air-rights developer and "South parcel" refers to areas south of H Street NE owned by the private air-rights developer.

known for this area, the office represents a conservative approach both in its consideration of the number of trips and in the ability to relate a potential program to an estimated number of trips.

25 These are projects under construction or development that can be reasonably expected to occur due to their levels of planning and public approvals. Sources include: The Deputy Mayor for Planning and Economic Development, DCRA, the District of Columbia Housing Authority, DCOP, the District of Columbia Board of Zoning Appeals, the District of Columbia Zoning Commission, Advisory Neighborhood Commission 6E, Mount Vernon Triangle Community Improvement District, NoMA BID, and Capitol Hill BID.

5.4.1.2 Transportation Generators

The model also considered the demand associated with the transportation modes listed below. The modes in italics are trip generators.

Generators

- *Amtrak* (Express, Long Distance, Corridor) and Metropolitan;[26]
- *MARC*;
- *VRE*;
- *Metrorail*; and
- *Intercity buses* (Greyhound Megabus, BoltBus, Best Bus, Washington Deluxe).

The modes below were not generators in the model but they would be used to access the land use and transportation generators. Therefore, the analysis provided volume estimates for these modes. Trip assignments to the other services were based on mode choice as indicated in the transportation operator mode splits.

- Bicycle;[27]
- Commuter buses (Maryland Transit Administration [MTA], Loudoun County Transit [LCT], PRTC OmniRide);
- Local buses (Metrobus, DC Circulator);
- Local shuttles;
- DC Streetcar; and
- Tour/charter and sightseeing buses (including hop-on/hop-off buses).

The model considered existing ridership levels and projected growth by service. The model checked transportation mode trip generation against targeted capacity and occupancy levels and eliminated double counting. Capacity levels were based on operator standards. Pedestrian, bicycle, shuttle, commuter and local bus, and Streetcar volumes were estimated based on the generator mode splits. The following sections describe key assumptions for the various modes.

[26] The Metropolitan service, proposed in the *NEC FUTURE FEIS*, is a future low-cost unreserved service in the Northeast Corridor. This service would provide more intermediate stops than the Northeast Regional does today.

[27] Local Capital Bikeshare stations considered were North Capitol Street and F Street NW; Columbus Circle/Union Station, North Capitol Street and G Place NE; 2nd and G Street NE; and 2nd Street and Massachusetts Avenue NE.

Intercity and Commuter Railroad

Amtrak, Metropolitan, MARC, and VRE operations in the No-Action Alternative, the Action Alternatives, and during construction are those described in the *Terminal Infrastructure (TI) Report*.

WMATA Metrorail

The analysis assumed that during the peak hour, all Red Line trains would be eight-car trains and would arrive at the WUS Metrorail station every 3 minutes.[28] This frequency would amount to 20 peak-hour eight-car trains. WMATA standards assume 120 passengers per car. On this basis, the estimated peak capacity would be 19,200 riders during peak hour. An increase in ridership that would result in a volume to capacity (V/C) ratio equal to or greater than 100 percent would be a major adverse impact (see also the discussion of peak hour factors below). Where the V/C ratio would reach or exceed 100 percent, additional service would be needed to prevent overcrowding.

WMATA begins to consider the need for service improvements once volumes in a segment reach 100 passengers per car. Therefore, for disclosure purposes, the impact analysis also identifies when this threshold would be reached or exceeded.

Metrorail volumes at WUS were distributed by direction based on existing peak flows. **Table 5-4** shows the assumed directional distribution of peak-hour passengers in 2040 in all alternatives.

Table 5-4. Directional Distributions by Peak Hour at WUS Metrorail Station

	Boardings		Alightings	
	Direction	**%**	**Direction**	**%**
AM Peak Hour	**Shady Grove**	84	**Shady Grove**	60
	Glenmont	16	**Glenmont**	40
PM Peak Hour	**Shady Grove**	40	**Shady Grove**	16
	Glenmont	60	**Glenmont**	84

Source: MWCOG Model

FRA calculated a peak-hour factor to reflect the demand during the most congested 15-minute period of each peak hour. The peak-hour factor was obtained by multiplying the highest peak 15-minute volume by 4 and then dividing by the actual peak-hour total. The peak-hour factor for No-Action Alternative trip volumes (boardings and alightings) was used

[28] FRA made this assumption based on input from WMATA staff provided during a coordination meeting held on April 23, 2019.

to scale down the peak capacity for the peak hours in all alternatives.[29] **Table 5-5** shows the peak-hour factor for each peak hour, calculated using current 15-minute entry and exit volumes at WUS.

Table 5-5. Metrorail Peak-Hour Factors

Time Period	Peak Hour Factor (Highest Peak)
AM	1.12
PM	1.22

Background growth[30] of WMATA ridership under all alternatives was initially estimated based on MWCOG model outputs.[31] The MWCOG model estimates directional growth in Red Line ridership. **Table 5-6** shows station-specific background growth. The background growth accounts for the increase in trips to and from the WUS Metrorail station associated with increased development and activity in the surrounding neighborhoods. This estimated was further adjusted based on coordination with DDOT in order to better comport with historical trends at WUS and to take into account changes in WMATA ridership over the past decade.

Table 5-6. WMATA Background Growth

Model	WUS Station Growth	Red Line Segment Growth
MWCOG Regional Model, Adjusted	26%	12% westbound 26% eastbound

Based on coordination with DDOT, FRA assumed that by 2040 the introduction of MARC through-running service to south of WUS would cause some shift in transit ridership away from WMATA to one-seat ride on commuter rail. This is because it can be assumed that with through-running service being available, passengers whose destination is served by a MARC or VRE station, or by a WMATA station adjacent to a MARC or VRE-served station, would not need to use Metrorail to or from WUS. This assumption was incorporated into the ridership numbers presented for each Alternative in this section

FRA also assumed that increased traffic congestion along the North Capitol Street corridor by 2040 would lead to shifts in mode choice from personal vehicles to Metrorail. For this reason,

[29] In a crowded system subject to queueing behavior, capacity is constrained during peak periods to levels below the theoretical capacity of the system. The No-Action trip volumes provide a reliable baseline to estimate how much peak demand would constrain capacity during the peak period.

[30] Background growth represents increases in traffic volumes caused over time by local development projects (other than WUS) and general increases in population and employment.

[31] Amazon announced in 2018 that it would be locating part of its “HQ2” in the Crystal City area of Arlington, Virginia. That development is expected to occur within existing master planned development limits and is not expected to affect WMATA ridership, or other transportation modes, beyond what is already accounted for in the MWCOG model.

based on vehicle trip distribution and congestion levels, 4% of the trips that would otherwise be bound for the North Capitol Street corridor to points beyond were assigned to Metrorail.

Intercity Buses

Based on modeling conducted for the *NEC FUTURE FEIS*, the growth in intercity bus ridership in the No-Action Alternative and all Action Alternatives was assumed to be 27 percent and 19 percent, respectively. Per current operations, approximately 60 percent of buses would be traveling to and from the east and 40 percent to and from the west.

Local Buses

The bus routes serving the Local Study Area were grouped by the directions in which they currently operate during each peak period. Bus volumes were distributed first to each directional group based on the results of the model, then further distributed to specific routes within each directional group. All alternatives assumed existing levels of service.

DC Streetcar

The analysis assumed that the DC Streetcar would be extended east to Benning Road Metrorail Station and west to Georgetown. Based on coordination with DDOT, it was estimated that Streetcar headways west to Georgetown would be 5 minutes and headways east to Benning Road would be 10 minutes. Passenger distribution was derived from the traffic distribution (described below).

In all Action Alternatives, the connectivity of the DC Streetcar to WUS would be enhanced due to new concourses and a station entrance on the H Street Bridge, adjacent to the Streetcar station. Therefore, FRA expects that this would boost the number of WUS users that would use the Streetcar. On this basis, based on the traffic distribution, approximately 3% of WUS vehicular demand would shift to the Streetcar.[32]

5.4.1.3 Vehicular Traffic Analysis

The traffic impact analysis involved the determination of traffic volumes, future forecasts, trip distribution, private and for-hire vehicle trips, lane use, and internal capture rates.

Traffic volumes in the MWCOG TPB regional model[33] informed the development of an average annual growth rate and background growth for the Local Study Area's roadways. Comparison with historic Average Daily Traffic (ADT) rates ensured consistency. Based on this information, future traffic forecasts with an assumed 0.5 percent annual background growth were developed. Based on findings from the model, FRA estimated that the number of

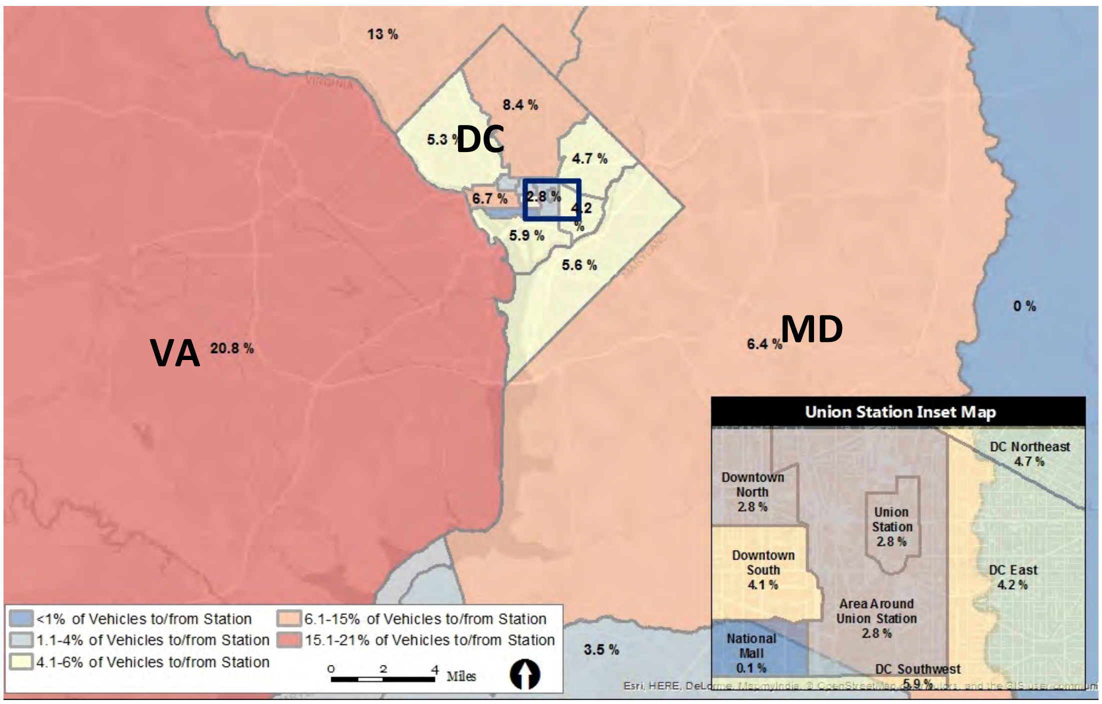
[32] As a result of coordination with DDOT, FRA assumed no shift in demand along the potential west extension of the DC Streetcar.

[33] Transportation Planning Board. 2016. Model Version 2.3.66.

Amtrak passengers seeking to drive to WUS would decline by 15 percent by 2040 due to changing travel behavior and the continued urbanization of the Washington, DC region.

WUS-related vehicle trips were distributed through the street network based on Amtrak and MWCOG data on WUS user origins and destinations, conformity with current and future travel patterns in the region, and consultation with DDOT. Based on this information, it was assumed that 56 percent of the trips would originate from the District, 21 percent from Virginia, and 23 percent from Maryland (**Figure 5-2**).

Figure 5-2. Regional Distribution for New WUS-related Trips



Local private and for-hire vehicle directional distribution to and from WUS is heavily skewed because most regional highway connections lie to the west of WUS. For buses, the directional distribution is more balanced and features heavier volumes to the east of WUS[34] (shown in **Table 5-7**).

[34] These directional distributions were developed in concert with DDOT.

Table 5-7. Directional Distribution by Trip Type to and from WUS

	Westbound	Eastbound
Cars/Taxis In	20%	80%
Cars/Taxis Out	80%	20%
Buses in	60%	40%
Buses Out	40%	60%

A level of service (LOS) capacity analysis was performed using:

- Methodologies based on the *Highway Capacity Manual* (HCM) 2010 (using Synchro 8.0 software);
- Historic peak-hour traffic volumes extrapolated to 2040 using a network-wide 0.5 percent growth rate;
- Projected WUS-related and air-rights-related (Federal and private) peak-hour trips.

The analysis assumed that lane use and traffic controls would be the same in 2040 as currently and estimated the internal capture rate[35] for land use generators based on ITE guidance. Because of the density of uses within WUS and the potential future private and Federal air-rights developments, there likely would be small but non-negligible internal capture.

5.4.1.4 Pedestrian Flows

Pedestrian flows or foot traffic to and from land use and transportation generators inside WUS were modeled into an origin-destination matrix. Also considered was the potential for the future redistribution of existing pedestrian flows around WUS because of pedestrian access improvements. The results informed the MassMotion analysis and modeling of internal WUS pedestrian access points/facilities operation (such as platforms, elevators, concourses, stairs, doors, etc.). Pedestrian facilities immediately adjacent to WUS (sidewalks, queuing areas, etc.) were also analyzed.

The distribution of pedestrian trips between a transit or land use generator and a door was determined based on existing pedestrian flows, shortest-distance estimates, and the existing distribution of bus ridership.

5.4.1.5 Bicycle Flows

Bicycle flows to and from WUS were estimated based on land use and transportation generator mode splits. The direction of bicyclist demands as they relate to WUS entrances

[35] Internal capture rate is the portion of trips generated by a mixed-use development that both begin and end within the development.

were modeled into an origin-destination matrix. Bicycle activity at WUS was considered both in terms of absolute volume of demand associated with bicycles regardless of type (privately-owned, docked bikeshare, and dockless bikeshare) and in terms of the number of bikeshare docks that may be needed to accommodate levels of demand.

5.4.1.6 Vehicle Flows

Vehicle demand from land use and transit generators was estimated by translating person-trips to vehicle trips. The distribution of trips was determined by the location of key WUS entrances and elements. The vehicle trips and distribution informed the Synchro Model and analysis. The modeling was further informed by the anticipated redistribution and growth of transit services in the local roadway network.

The Synchro analysis considered the various vehicular flows to and from WUS. These flows included parking demand, for-hire vehicle demand, and private pick-up and drop-off demand. Also incorporated were intercity, tour/charter, and sightseeing bus movements within the Local Study Area.

The alternatives were tested for how they would handle anticipated vehicle volumes. Queueing and delay immediately around WUS and potential impacts on the broader transportation network were considered.

5.4.1.7 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The following mode-specific impacts are assessed:

- Amtrak, VRE, and MARC commuter railroads: Increases or decreases in, and ability to meet, expected service levels and ridership;
- WMATA Metrorail: Increases or decreases in passenger demand, impacts on passenger flow, capacity issues that may result from increases;
- DC Streetcar: Increases or decreases in passenger demand and capacity issues that may result from increases;
- Intercity, tour, and charter bus: Increases or decreases in service capacity level and ridership, ability to meet future service capacity levels;
- Loading: Availability and accessibility of loading docks and ability to meet WUS needs;
- Pedestrian and bicycle activity: Increases or decreases in pedestrian and bicycle activity, ability to meet activity demands, and impacts on safety;

- WMATA Metrobus, DC Circulator, and commuter buses: Increases or decreases in passenger demand, impacts on access to transit buses, and qualitative assessment of bus speeds and reliability;
- Parking and rental cars: Increases or decreases in space available for parking (including from rental car companies); [36]
- Ride-for-hire circulation: Increases or decreases in traffic volumes on nearby streets, and ability to meet demands at the WUS curbside space;[37]
- Private pick-up and drop-off activity: Increases or decreases in traffic volumes on nearby streets, and ability to meet demands at the WUS curbside space;[38] and
- Vehicular traffic: Increases and decreases in traffic volumes on nearby streets, LOS impacts, and queuing impacts at key intersections. LOS, increases in average delay, and queuing are the three measures of effectiveness (MOE) on which the assessment of traffic impacts is based.

5.4.1.8 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. The potential impacts from the construction of the Action Alternatives were assessed for each transportation mode. Because construction planning is still in its early stages, the impact analysis is qualitative. In All Action Alternatives, construction of the Project would take place in four phases. The analysis focuses particularly on Phase 4 of construction (beginning 8 to 9 years after the start of construction) because Phase 4 has the greatest potential to affect transportation conditions in the Local Study Area. Demolition of the existing bus facility and parking garage would occur in Phase 4 and the west ramp would be closed for repurposing. This would disrupt bus, parking, and for-hire operations. Phase 4 is also the longest construction phase in all Action Alternatives.

[36] The parking impact analysis addresses parking as a resource for which there is a demand. Therefore, a reduction in parking availability is considered an adverse impact on parking. A reduction in parking availability may also have adverse or beneficial consequences for other resources or transportation modes. Such consequences are incorporated into the impact analyses for those other resources or transportation modes.

[37] A single for-hire vehicle generates two trips: one arriving and one departing from WUS, regardless of whether it is picking up or dropping off a passenger. For the purposes of the impact analysis, a single for-hire pick-up or drop-off was estimated to produce 1.5 trips due to linking of trips in the WUS circulation network.

[38] A single private pick-up/drop-off trip generates two trips: one arriving and one departing from WUS, regardless of whether it is picking up or dropping off a passenger. For the purposes of the impact analysis, a single private pick-up or drop-off is estimated to produce 2 trips because no linking is assumed.

5.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on the various transportation modes at WUS. For each alternative, direct and indirect, operational and construction impacts are considered. Within each alternative, for each mode, impacts are first summarized in bold lettering, followed by a supporting description and analysis. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. A briefer assessment of the impacts relative to existing conditions is also provided. The organization of this section differs slightly from that of the other *Impact Analysis* sections in this report in that the assessment relative to existing conditions is provided for each mode rather than for the alternative as a whole. This organization is due to the high number of modes being evaluated.

5.5.1 No-Action Alternative

5.5.1.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to existing conditions, the No-Action Alternative would have major adverse direct operational impacts on commuter and intercity rail service because their ability to meet future demand would be severely constrained.

Amtrak, MARC, and VRE would continue to provide rail service to and from WUS in 2040. However, concourse and track conditions would be constrained and limit the growth of rail transportation in the Washington, D.C. area. The train volumes in **Table 5-8**, **Table 5-9**, and **Table 5-10** below represent the maximum levels of service that the existing track and platform plan can accommodate. The constraints on infrastructure in the No-Action Alternative would cause only 50 percent of the 2040 unconstrained Amtrak service levels and 68 percent of the unconstrained ridership levels to be realized. Only 42 percent of MARC service and 53 percent of MARC ridership would be achieved. Only 37 percent of VRE service and 36 percent of VRE ridership would be achieved.

Any modifications to the tracks and platforms required for the construction of the private air-rights development would be subject to approval by Amtrak and would have to be designed in a manner that does not affect capacity. While improvements to the Claytor Concourse through the Concourse Modernization Project would improve circulation and passenger experience, the lack of substantial improvements to the tracks and platforms would lead to increasingly poor conditions because of excessive crowding and accessibility challenges. The existing platforms are antiquated and deteriorated, have inadequate width for passenger volumes, and do not meet current Americans with Disabilities (ADA) or life safety standards. Track and concourse conditions would limit the ability of all three train services to adequately accommodate ridership growth.

Intercity Railroad Service

The types of service Amtrak would offer at WUS in 2040 would be similar to current conditions (as of 2017). They would include long-distance service; regional through-service; regional service originating/terminating at WUS; and Acela Express service. Amtrak would nearly double the number of daily Acela trains by 2040—using the Acela II (Avelia) trains currently under procurement—while holding the other service types close to existing levels.

Table 5-8 shows Amtrak's projected average weekday revenue trains at WUS in 2040. Overall, the average number of Amtrak weekday trains would increase by approximately 24 percent. Over that same period, average Amtrak weekday ridership would increase by 33 percent, to 21,800 passengers, as a result of planned service improvements and regional and local growth.

Table 5-8. Amtrak Daily Train Service and Ridership, No-Action Alternative

Service Type	No-Action Alternative	Existing Conditions	Projected Change
Amtrak Express	60	32	88%
Amtrak Corridor	60	56	7%
Amtrak Long Distance	24	28	-14%
Total Service	**144**	**116**	**24%**
Total Ridership	**21,800**	**16,400**	**33%**

Source: Train volumes derived from Amtrak's 2025 Operating Plan. Ridership volumes derived from existing Amtrak-provided ridership data and modeling done for the *NEC FUTURE FEIS.*

MARC

In the No-Action Alternative, MARC would see a modest increase in service, with an 11 percent average increase in weekday trains across the three lines serving WUS. The Brunswick Line, which would add five trains to and from WUS by 2040, is slated for the largest increase. **Table 5-9** shows MARC's projected average weekday revenue trains serving WUS in 2040.

MARC would see a 35 percent growth in ridership over that same period, with approximately 37,900 average daily riders in 2040.

Table 5-9. MARC Daily Trains by Line and Total Ridership, No-Action Alternative

Line	No-Action Alternative	Existing Conditions	Projected Change
Penn Line	58	55	7%
Camden Line	24	21	14%
Brunswick Line	24	19	26%
Total Service	**106**	**95**	**11%**
Total Ridership	**37,900**	**28,100**	**35%**

Source: Train volumes derived from Amtrak's 2025 Operating Plan. Ridership volumes derived from existing MARC ridership data and modeling done for the *NEC FUTURE FEIS.*

VRE

As shown in **Table 5-10**, in the No-Action Alternative, VRE would see a 6 percent average increase in weekday revenue trains serving WUS (currently 32, to increase to 34),[39] accompanied by a 26 percent increase in average weekday ridership by 2040. This increase would bring daily VRE ridership to 4,900 daily riders. VRE plans to accommodate the increase by running longer trains and using more double-deck train cars.

Table 5-10. VRE Daily Trains by Line and Total Ridership, No-Action Alternative

Line	No-Action Alternative	Existing Conditions	Projected Change
Fredericksburg Line	17	16	6%
Manassas Line	17	16	6%
Total Service	**34**	**32**	**6%**
Total Ridership	**4,900**	**3,900**	**26%**

WMATA Metrorail

Relative to existing conditions, the No-Action Alternative would result in a moderate adverse direct operational impact on WMATA Metrorail operations at WUS because increased demand would exceed capacity in the PM peak and would exacerbate station circulation issues at the WMATA platform level.

Table 5-11 and **Table 5-12** show projected No-Action Alternative volumes at the WUS Metrorail station. WMATA ridership growth would result in an adverse operational impact because, compared to existing conditions, volumes at the WUS Metrorail station would exceed capacity in the Glenmont direction during the PM peak. This adverse impact would be moderate as only one direction and one peak period would be affected.

[39] FRA is also the lead Federal agency for two nearby rail corridor planning projects: The Long Bridge Project EIS and the Washington DC to Richmond Southeast High Speed Rail (DC2RVa) EIS. In both documents, the VRE train volume in the No-Action Alternative is 38 daily trains. The discrepancy between these numbers and the number in this document is the result of the different focus of the studies. Long Bridge and DC2RVa rely on the maximum number of train slots (38) for which VRE has track rights along the studied corridors. The WUS No-Action Alternative train volumes are determined based on the 2025 Operating Plan developed by Amtrak (available in the *TI Report*). This operating plan provides maximum train volumes constrained by current operating conditions at WUS in the absence of the Project's track and platform changes. This constraint sets the maximum number of VRE trains in the No-Action Alternative at 34 for the WUS EIS.

Table 5-11. AM Peak WUS-related Metrorail Activity, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	Shady Grove	**Glenmont**	**Shady Grove**	**Glenmont**
Ridership Arriving at WUS	13,651	4,250	8,499	5,071
V/C Arriving at WUS[40]	80%	25%	57%	34%
WUS Boardings	5,202	1,010	2,802	528
WUS Alightings	4,128	2,803	923	3,644
Through Ridership[41]	9,523	1,447	7,576	1,427
Ridership Departing WUS	14,725	2,457	10,378	1,955
V/C After WUS	86%	14%	69%	13%
Excess Demand	0	0	0	0

Table 5-12. PM Peak WUS-related Metrorail Activity, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	Shady Grove	**Glenmont**	**Shady Grove**	**Glenmont**
Ridership Arriving at WUS	3,107	16,848	2,592	9,948
V/C Arriving at WUS	20%	107%	19%	72%
WUS Boardings	2,559	3,661	3,265	918
WUS Alightings	1,154	6,126	582	3,090
Through Ridership	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,512	14,383	5,275	7,776
V/C After WUS	29%	91%	38%	56%
Excess Demand	0	1,110	0	0

By 2040, peak-hour train loads in 2040 would follow the same pattern as currently, with higher utilization in the westbound direction (Shady Grove) in the AM peak and in the eastbound direction (Glenmont) in the PM peak. During both the AM and PM peak, there would be more than 13,000 boardings and alightings, against less than 8,000 in existing conditions.

Volumes would remain below capacity in the Shady Grove direction during the AM peak and exceed capacity in the Glenmont direction during the PM peak (107 percent arriving). As a

40 Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

41 "Through ridership" refers to riders who neither board nor alight at WUS but ride the Red Line train through the WUS Metrorail Station.

result, there would be a need for additional capacity for approximately 1,110 passengers in the PM peak, Glenmont direction. Volumes would also exceed 100 passengers per car (84 percent of capacity) in the Shady Grover direction (departing) in the AM peak and the Glenmont direction (departing) in the PM peak.[42]

The increase in Metrorail ridership at WUS in the No-Action Alternative would adversely affect passenger circulation on the WMATA platform level relative to existing conditions. Passenger circulation is an existing issue at the station. WMATA has indicated that it can take up to 8 minutes for passengers to clear the two sets of escalators from the platform level. The improvements to circulation included in the planned Concourse Modernization Project incorporated in the No-Action Alternative would have a beneficial impact on circulation at the WMATA mezzanine level and between the mezzanine level and the rail concourse. However, the existing circulation between the WMATA platform and the WMATA mezzanine would remain a constraint. Increased passenger volumes in the No-Action Alternative relative to existing conditions would further degrade conditions.

DC Streetcar

Relative to existing conditions, the No-Action Alternative would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Table 5-13 shows projected Streetcar demand at WUS in 2040. Streetcar operations would remain well below capacity. No direct comparison with existing conditions can be conducted because by 2040, the Streetcar line would be extended eastward to the Benning Road Metro Station and, per the *TPB 2040 Constrained Long-Range Transportation Plan*, westward to Georgetown. However, it is likely that ridership growth at WUS and nearby development projects, including the private air-rights development, would generate additional demand. This demand would contribute to supporting the operation of the Streetcar without creating capacity issues, amounting to a beneficial impact.

Table 5-13. 2040 DC Streetcar Ridership, No-Action Alternative

	AM Peak		PM Peak	
	Westbound	**Eastbound**	**Westbound**	**Eastbound**
Car Capacity (passengers per car)	157	157	157	157
Cars per Run	1	1	1	1
Frequency - Runs per Hour	12	6	12	6
Peak Capacity	1,884	942	1,884	942
Prior Segment Ridership	475	274	159	378
V/C Arriving	25%	29%	8%	40%

42 As noted above (**Section 5.4.1.2**, *Transportation Generators, WMATA Metrorail*), 100 passengers per car is the threshold at which WMATA begins to consider service improvements.

	AM Peak		PM Peak	
	Westbound	**Eastbound**	**Westbound**	**Eastbound**
Alightings at WUS	155	34	79	318
Through Volume	320	240	80	60
Boardings at WUS	284	71	43	195
Total Volume	604	311	123	255
V/C Departing	32%	33%	7%	27%

This beneficial impact would be minor because the introduction of new signalized intersections on the H Street Bridge for the roadways that would serve the private air-rights development and greater traffic volumes may create operational delays, which would partially offset the benefits of increased ridership.

Intercity, Tour/Charter, and Sightseeing Buses

Relative to existing conditions, the No-Action Alternative would have a major adverse direct operational impact on bus passenger facilities' ability to accommodate projected increases in users.

In the No-Action Alternative, intercity, tour, daily sightseeing, and charter buses would continue to use the 61-slip (parking space) bus facility located in the WUS parking garage. Hop-on/hop-off sightseeing buses would continue to serve the front of WUS. **Table 5-14** shows existing (2017) and projected 2040 peak-hour bus movements in the No-Action Alternative.

Table 5-14. Projected Average Peak Hour Bus Movements, No-Action Alternative

	No-Action Alternative			Existing Conditions		
	AM Peak	**PM Peak**	**Total**	**AM Peak**	**PM Peak**	**Total**
Intercity	19	22	41	15	17	32
Tour/Charter	9	17	26	6	11	17
Total	**28**	**39**	**67**	**21**	**28**	**49**
Total Ins	14	20	34	11	14	25
Total Outs	14	19	33	10	14	24

Intercity bus ridership is anticipated to increase by 27 percent by 2040. The average peak-hour intercity, tour, daily sightseeing, and charter bus movements—buses entering and exiting the bus facility – would increase by 37 percent. The existing bus facility, which would continue to be used in the No-Action Alternative, would be sufficient to accommodate the increase in bus movements.

However, when completed, the extension of the DC Streetcar to the west would make it impossible for buses exiting the facility to turn left (westward) onto H Street NE. Buses heading to points west would be forced to take an indirect route to their destination. Additionally, the proximity to the exit ramp to the private air-rights development's center road with H Street would create a complex intersection that may complicate bus exiting movements. Additionally, buses coming from the east and making a left turn into the facility would have to navigate an offset intersection created by the road that would run along the northwest side of the private air-rights development.

Existing bus facility passenger accommodations are deficient, and the No-Action Alternative would exacerbate this situation. Passengers must use cramped and crowded walkways to access the Greyhound and Bolt Bus bays and have to cross an active busway to reach other services, including Megabus. Bolt Bus and Megabus lack adequate queueing space. The projected increase in passengers would make these conditions worse. This, together with the constraint on exiting buses, would amount to a major adverse impact. This, together with the constraint on exiting buses, would amount to a major adverse impact.

Loading

In the No-Action Alternative, there would be no direct operational impacts on loading dock operations. The retail and event programs would not change. Loading levels would remain as in existing conditions.

WUS would continue to receive deliveries and service through two existing primary loading locations. One, on First Street NE between Massachusetts Avenue NE and G Street NE, provides access to the train tracks. The other, on H Street NE to the east of the railroad tracks, is shared with the existing Station Place development. Based on existing conditions, eight truck movements would occur in the AM peak and two would occur in the PM peak. Loading dock activity would continue to peak in the mid-morning (10:00 AM to 11:00 AM). Future loading dock activities would mirror existing conditions. Amtrak service access to operations would remain on First and 2nd Streets.

Pedestrians

Relative to existing conditions, the No-Action Alternative would have a major adverse direct operational impact on pedestrian circulation within WUS due to overcrowded conditions in concourses and at access points. Pedestrian volumes near WUS would also increase, with no change to existing pedestrian infrastructure, resulting in a minor adverse direct operational impact.

As shown in **Table 5-15**, interior pedestrian volumes at WUS would increase substantially relative to existing conditions in the No-Action Alternative. In both the AM and PM peaks, volumes would be 33 percent greater. The largest generator of internal pedestrian trips would be passengers transferring between commuter rail and Metrorail. While the Concourse Modernization Project would enhance capacity at WUS, it would not provide sufficient space to handle anticipated 2040 volumes without overcrowding. This would constrain any further growth.

Table 5-15. Interior Pedestrian Volumes, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Pedestrians	47,703	61,416	35,867	46,178

While a number of pedestrians would remain within WUS to connect to other modes or immediately adjacent land uses, many would exit the station through the existing doors on First Street NE and the front of the historic station building. **Table 5-16** shows the projected total number of WUS passengers who would be entering and exiting WUS by foot from or to local destinations (excluding the private air-rights development) in the No-Action Alternative.

Table 5-16. Exterior Pedestrian Volumes, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	3,753	6,587	3,419	6,736
Outs	7,370	4,232	4,927	3,654
Total	**11,123**	**10,819**	**8,346**	**10,390**

To assess the potential impacts of these increases in pedestrian volumes, two signalized pedestrian crossings were analyzed: the east-west crossing of First Street NE and the east-west crossing of Union Station Drive. These crossings are where pedestrian volumes would be highest as a result of increased activity at WUS. Anticipated volumes were compared to the cycle times of traffic signals to calculate the maximum queue of pedestrians during each peak hour. **Table 5-17** shows the results of the analysis. Queues at each crossing would increase relative to existing conditions. However, there would be sufficient sidewalk space to accommodate queueing pedestrians and the adverse impact would be minor.

Anticipated increases in vehicular traffic near WUS, including pick-up and drop-off activities, along with the increases in pedestrian volumes, may cause a greater risk of conflict between pedestrians and vehicles. Two locations would be most likely to be affected based on the projected number and distribution of new multimodal trips: G Street NE between North Capitol Street and First Street NE and Union Station Drive in front of WUS.

Table 5-17. Pedestrian Queue Analysis, No-Action Alternative

			No-Action Peak Hour Volumes		Cycles Per Peak Hour		Maximum Queue in Peak Hour	
Intersection Name	**Direction**	**Cycle Time (sec)**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
First Street NE at Massachusetts Avenue NE	**Eastbound**	110	598	1,402	33	33	18	43
Union Station Drive NE and Columbus Monument Drive NE (West Corner)	**Northbound**	110	478	160	33	33	15	5
First Street NE at Massachusetts Avenue NE	**Westbound**	110	389	461	33	33	12	14
Union Station Drive NE and Columbus Monument Drive NE (West Corner)	**Southbound**	110	270	401	33	33	8	12

Bicycle Activity

Relative to existing conditions, the No-Action Alternative would result in a moderate adverse direct operational impact on bicycle activity. Demand for bikeshare spaces[43] and private bicycle parking and storage near WUS would increase with no additional bicycle facilities being provided. No impact to bicycle facilities would occur.

In the No-Action Alternative, existing bicycle facilities near WUS would remain in their current condition: a cycle track along First Street NE; bicycle lanes on the south and east sides of WUS; a secure bike storage facility; and multiple nearby Capital Bikeshare docking stations.

Bicycle traffic would grow by 2040 due to increased activity at WUS and the growing use of bicycle as a mode of transportation in the District. **Table 5-18** shows projected 2040 bicycle volumes. Of these volumes, 80 percent would be westbound and 20 percent eastbound. First Street, D Street, and Louisiana Avenue would see the largest westbound volumes. F Street, 2nd Street, and Massachusetts Avenue would see the largest eastbound volumes.

[43] For the purposes of this analysis, dockless bikeshare was not directly considered. Dockless bikeshare is new to the District and has been marked by volatile market conditions, with several firms ending service only months after starting it. The demand for bikeshare shown in this analysis can be understood as the demand for private bikesharing services generally.

Table 5-18. Peak-hour Private Bicycle Activity, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	89	124	67	93
Outs	118	117	89	88
Total	**207**	**241**	**156**	**181**

The growth of bicycle as a transportation mode has implications for the Capital Bikeshare system. To maintain functionality, Bikeshare stations rely on a balance between trips starting and trips ending at the station. When more trips start than end in a given time, the station empties out. When more trips end than start, the station runs out of docking spaces. Evaluating impacts on Bikeshare requires predicting station imbalance and calculating the number of new docks necessary to accommodate peak-hour demand. **Table 5-19** summarizes the results of such an analysis.

Table 5-19. Bikeshare Analysis, No-Action Alternative

Bicycle Station	Trip Starts		Trip Ends		AM Peak Imbalance	PM Peak Imbalance
	AM Peak Daily	**PM Peak Daily**	**AM Peak Daily**	**PM Peak Daily**		
2nd Street/G Street NE	1	1	1	1	1	1
3rd Street/H Street NE	18	8	6	19	13	12
Columbus Circle/WUS	76	51	72	75	5	25
North Capitol Street/ F Street NW	24	29	38	33	14	4
North Capitol Street / G Place NE	11	14	14	9	4	6

Overall, the Columbus Circle station, which is closest to WUS, would see the largest imbalance during the PM peak. The station at the intersection of North Capitol Street and F Street NW would see the largest imbalance during the AM peak.

To eliminate the potential deficit in Bikeshare bicycle docking stations and reduce the need to rebalance by trucking bicycles from station to station, it would be necessary to provide new bicycle docks in equal number to the maximum potential peak-hour imbalance—a projected 59 docks in the No-Action Alternative. **Table 5-20** shows the number of new docks needed at each Bikeshare station.

Table 5-20. Estimated Deficit in Bikeshare Bicycle Docks, No-Action Alternative

Bikeshare Station	New Docks Needed
2nd Street / G Street NE	1
3rd Street / H Street NE	13
Columbus Circle / WUS	25
North Capitol St / F St NW	14
North Capitol St / G Pl NE	6
Total	**59**

The No-Action Alternative includes no new Bikeshare bicycle docks and the anticipated imbalance would not be remedied. While this would be an adverse impact, this impact would be moderate as Bikeshare stations could nevertheless continue to operate and it is possible that docks would be added through future upgrades or projects.

In terms of bicycle facilities, the greater vehicular and bicycle volumes in the No-Action Alternative may result in more conflicts between bicycles and vehicles. However, planned DDOT bicycle facility improvements, such as on Louisiana Avenue NE and K Street NE, would help to provide safe accommodations for bicyclists.

City and Commuter Buses

Relative to existing conditions, in the No-Action Alternative, anticipated increases in ridership and traffic volumes would cause a moderate adverse direct operational impact due to overcrowding of some WMATA buses and likely decreases in bus speeds and reliability.

Based on available, information, in the No-Action Alternative, there would be no changes to commuter bus or WMATA Metrobus routes or stop locations. The WMATA Metrobus stops with highest activity would continue to be Massachusetts Avenue NE at Columbus Circle NE (both eastbound and westbound directions) and North Capitol Street at Massachusetts Avenue. The DC Circulator that currently runs between WUS and Georgetown (GT-US route) would likely be discontinued to avoid redundancy with the expanded DC Streetcar. Most existing DC Circulator GT-US route boardings and alightings at WUS would divert to the DC Streetcar. [44] The other DC Circulator routes serving WUS would continue to operate as at present, as would all other local and commuter bus services in the Study Area. Employee shuttles serving the United States Citizenship and Immigration Service (USCIS) and Gallaudet University could continue to operate out of the WUS bus facility.

[44] Conversely, if the DC Streetcar extension to Georgetown was not constructed, the GT-US route may be maintained and other bus routes created to accommodate the transit demand the Streetcar could not serve.

Table 5-21 shows overall projected WUS-generated activity at Metrobus stops in the Study Area in 2040.

Table 5-21. Peak-hour Metrobus Activity, No-Action Alternative

	AM Peak	PM Peak
Boardings	950	614
Alightings	481	978
Total	**1,431**	**1,592**

Total peak-hour Metrobus activity generated by WUS by 2040 would be 1,431 in the AM peak and 1,592 in the PM peak. In keeping with commuting patterns, the AM peak would feature higher volumes of riders exiting WUS and boarding Metrobus, while the PM peak would feature higher volumes alighting at and entering WUS.

Table 5-22 shows the results of the ridership analysis for local and commuter buses serving WUS (Metrobus, DC Circulator, and Maryland Transit Administration [MTA] and Loudoun County Transit [LCT] commuter buses[45]). Collectively, as shown by V/C estimates, buses would operate below capacity.

Table 5-22. Peak-hour Bus Ridership, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Capacity	7,837	7,471	7,837	7,471
Volume Prior to WUS	3,887	3,863	3,723	3,593
V/C Arriving	50%	52%	48%	48%
Alightings for WUS	476	854	394	719
Through Volume	3,411	3,009	3,329	2,874
Boardings from WUS	829	612	717	501
Total Volume	4,240	3,621	4,046	3,375
V/C Departing	54%	48%	52%	45%

However, assuming service levels remain the same as currently, six WMATA Metrobus routes (out of 13 serving the Local Study Area) would experience overcrowding in the AM peak and five would experience overcrowding in the PM peak. The affected routes are listed in **Table 5-23**.

45 The analysis assumed that Circulator buses have a capacity of 48 passengers and commuter buses a capacity of 55 passengers. Due to lack of ridership data for the DC Circulator National Mall route and commuter bus routes, buses for these two services were assumed to have average maximum loads of 15 and 35, respectively.

Table 5-23. Bus Routes Over Capacity,[1] No-Action Alternative

	No-Action Alternative	Existing Conditions
AM Peak	80 (Southbound), D4 (Westbound), D6 (Westbound), P6 (Both directions) X1 (Westbound), X2 (Westbound), X9 (Both directions)	X2 (Westbound), X9 (Both directions)
PM Peak	96 (Eastbound), D6 (Eastbound), P6 (Northbound), X2 (Both directions), X9 (Both directions)	X2 (Both directions), X9 (Both directions)

[1] Over capacity is in relation to the stated capacity in WMATA's service standards, which is 1.2 times the number of seats on a bus.

Increases in vehicle delay and queue because of greater traffic volumes would likely affect bus reliability and speeds. For the purposes of the analysis, it was assumed that bus routes that would pass through two intersections that would degrade to LOS F in the No-Action Alternative relative to existing conditions would experience an adverse impact. **Table 5-24** shows which bus routes would pass through at least two such intersections. As shown in **Table 5-24**, out of 13 Metrobus routes that pass through the Local Study Area, four Metrobus routes would go through at least two intersections degrading to LOS F in the AM peak and five in the PM peak. One DC Circulator routes and seven commuter buses routes (out of nine) would be similarly affected in the PM peak hour.

Table 5-24. Bus Routes Passing Through Two LOS F Intersections

	No-Action Alternative	Existing Conditions
AM Peak	D4, D8, X1, X2, X9, 80, 97 National Mall (NM) Circulator LCT MTA 220, MTA 230, MTA 240, MTA 250, MTA 260, MTA 735	D4, X1, 97 NM LCT MTA 220, MTA 230, MTA 240, MTA 250, MTA 260, MTA 735
PM Peak	X1, X2, X9, 80, 97 NM LCT MTA 220, MTA 230, MTA 240, MTA 250, MTA 260, MTA 735	-

Both city and commuter buses would experience adverse impacts in the No-Action Alternative from overcrowding or delays due to traffic conditions or both. Based on the number of affected routes, these adverse impacts would be moderate.

Vehicular Parking and Rental Cars

Relative to existing conditions, the No-Action Alternative would have no direct operational impact on parking. It would have a minor adverse direct operational impact on rental car operations at WUS because the existing, already challenged, rental car facility would have to accommodate additional trips.

The existing WUS parking garage would continue to operate in the No-Action Alternative. The private air-rights development would provide new parking facilities. Access to all parking would be via H Street NE, with private air-rights development parking located both to the north and south of the street.

The WUS parking garage capacity would remain unchanged, with room for approximately 2,450 vehicles, including rental cars. The private air-rights development parking facilities would include an estimated 1,320 new parking spaces. [46] These spaces would accommodate the parking needs the development would generate.

Trip generation modeling shows that relative to existing conditions, in 2040, there would be an estimated 61 additional AM peak-hour trips and 92 PM peak-hour trips from parking activity in the No-Action Alternative (**Table 5-25**). The additional parking demand could be accommodated in the existing garage.

Table 5-25. Peak-hour Parking Trips, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	127	102	104	53
Outs	62	197	24	154
Total	**189**	**299**	**128**	**207**

The capacity and configuration of the rental car facility located in the WUS garage would not significantly change in the No-Action Alternative. The rental car facility would generate an additional 14 peak-hour trips—5 trips in the AM peak and 9 trips in the PM peak—in 2040 relative to existing conditions (**Table 5-26**). These new trips would all be associated with WUS.

[46] Letter from Akridge to FRA dated May 31, 2016.

Table 5-26. Peak-hour Rental Car Trips, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	28	17	26	13
Outs	18	28	15	23
Total	**46**	**45**	**41**	**36**

The projected increase in rental car trips would be small enough for the existing rental car facility (which would remain unchanged in the No-Action Alternative) to accommodate it. However, this facility already makes use of "stacked parking" and existing conditions are cramped. With the additional trips, conditions at the unchanged rental car facility would become more challenging, an adverse impact. This adverse impact would be minor, as the facility could accommodate the increase and remain functional.

For-hire Vehicles

Relative to existing conditions, the No-Action Alternative would have a major adverse direct operational impact on for-hire vehicle operations at the front of WUS. The existing lane configuration would remain unchanged and additional for-hire areas would not be provided. As a result, the available curb and circulation space would fail to adequately accommodate anticipated increases in the use of for-hire vehicles.

For-hire vehicles, including traditional taxis, limousines, and transportation networking companies (TNCs) such as Uber and Lyft, would continue to use the existing designated pick-up and drop-off locations at the front of WUS. As shown in **Table 5-27**, growth in TNCs would continue through 2040. A projected total of 524 AM peak-hour for-hire vehicle trips and 862 PM peak-hour for-hire vehicle trips would occur in 2040.[47]

Table 5-27. Peak-hour For-hire vehicle Trips, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	262	431	197	324
Outs	262	431	197	324
Total	**524**	**862**	**394**	**648**

With only a single designated location available to for-hire vehicles serving WUS (in front of the historic station building), conditions would deteriorate relative to existing conditions. Existing taxi queues would lengthen during peak periods, leading to increased queueing on H

[47] New for-hire vehicle trips would also be generated by background development growth and the private air-rights development, in addition to the WUS-generated trips shown in Table 5-27.

Street NE. Combined with the increase in private pick-up and drop-off (see next section), the outside drop-off lanes would become more congested than they are today. This congestion would create queueing issues at both the entry and exit of the lanes, with potential spillover onto Massachusetts Avenue, amounting to a major adverse impact. A modest increase in the use of informal pick-up and drop-off locations on First Street NE, 2nd Street NE, and H Street NE would likely occur. For-hire vehicles would also serve the private air-rights development via the private roadways off both sides of the H Street Bridge.

Private Pick-up and Drop-off[48]

Relative to existing conditions, the No-Action Alternative would have a major adverse direct operational impact on private pick-up and drop-off operations at the front of WUS. The existing lane configuration would remain unchanged and no additional private pick-up and drop-off areas would be provided. As a result, the available curb and circulation space would fail to adequately accommodate anticipated increases in private pick-up and drop-off.

The outermost lanes of Union Station Drive NE, at the front of WUS, would remain designated for private pick-up and drop-off activity. Private vehicles would likely also continue to use informal pick-up and drop-off locations on First Street NE, 2nd Street NE, and H Street NE.

A projected total of 872 AM peak-hour and 948 PM peak-hour private pick-up and drop-off trips would occur at WUS in 2040 (**Table 5-28**). Relative to existing conditions, this would represent a 33 percent increase in the AM peak and a 65 percent increase in the PM peak.

Table 5-28. Private Pick-up and Drop-off Activity, No-Action Alternative

	No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
Ins	436	474	328	356
Outs	436	474	328	356
Total	**872**	**948**	**656**	**712**

The continued use of a single location for private pick-ups and drop-offs, in front of WUS, would further exacerbate existing congested conditions. The size of the private pick-up and drop-off curb spaces and the storage capacity of the lanes are very constrained and would remain so. The increased volumes would exceed capacity. Queues during both the AM and PM peak would extend beyond Union Station Drive and spill back into both eastbound and

48 "Private pick-up and drop-off" refers to private vehicle transporting passengers to WUS without parking at the station or charging a fare.

westbound Massachusetts Avenue NE. This spill back would lead to congestion and conflicts on that major thoroughfare.

Vehicular Traffic

Relative to the No-Action Alternative, in the No-Action Alternative, there would be major adverse direct operational impacts on traffic operations at several intersections near WUS. During at least one of the peak periods, out of 35 intersections in the Local Study Area, six would degrade to LOS F; 21 would experience an increase in queue length of more than 150 feet; and 18 would experience an increase in average delay of more than 5 seconds.

Table 5-29 and **Table 5-30** show AM and PM peak WUS-related traffic volumes in the No-Action Alternative, along with the corresponding information for existing conditions. Compared to existing conditions, the No-Action Alternative would generate 412 additional AM peak trips (a 34 percent increase) and 551 additional PM peak trips (a 34 percent increase). These volume increases, combined with background growth and trips from the private air-rights development, would affect traffic operations in the Local Study Area.

Table 5-29. AM Peak-hour Traffic Volumes, No-Action Alternative

	No-Action Alternative			**Existing Conditions**		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	189	127	62	128	104	24
Private Pick-Up/Drop-Off	872	436	436	656	328	328
For-hire Vehicles	524	262	262	394	197	197
Car Rental	46	28	18	41	26	15
Total Trips	**1,631**	**853**	**778**	**1,219**	**655**	**564**

Table 5-30. PM Peak-hour Traffic Volumes, No-Action Alternative

	No-Action Alternative			**Existing Conditions**		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	299	102	197	207	53	154
Private Pick-Up/Drop-Off	948	474	474	712	356	356
For-hire Vehicles	862	431	431	648	324	324
Car Rental	45	17	28	36	13	23
Total Trips	**2,154**	**1,024**	**1,130**	**1,603**	**746**	**857**

The impacts of the No-Action Alternative on traffic operations were assessed through Synchro modeling. Three indicators were used to assess impacts relative to existing conditions at each study intersection:

- Degradation of intersection LOS to F from a better LOS;
- Increase in average vehicle delay of more than five seconds; and
- Increase in 95th-percentile queue lengths of more than 150 feet for any lane group.[49]

Table 5-31 shows LOS and average delays for the No-Action Alternative and existing conditions for the 35 study intersections. **Figure 5-3** shows the No-Action Alternative LOS for each intersection.

While six out of the 35 intersections would operate at a better LOS than under existing conditions during at least one peak hour (marked by asterisk [*] in **Table 5-31**), in general, LOS would deteriorate in the No-Action Alternative due to an increase in vehicular traffic from local projects (including the private air-rights development) and regional growth. Similarly, average delays in the AM and PM peaks would increase for a majority of intersections, but several would experience shorter delays. Reduced delays (ten intersections in the AM peak and eleven in the PM peak) are marked with an asterisk (*) in **Table 5-31**.

In the No-Action Alternative, relative to existing conditions, six intersections would degrade to LOS F from a better LOS in at least one peak hour: four intersections in the AM peak hour (8:00 AM to 9:00 AM) and three in the PM peak hour (5:00 PM to 6:00 PM). **Table 5-31** shows the LOS for these intersections in bold lettering. Three intersections already operating at LOS F under existing conditions would experience longer delays in the AM peak. LOS for these intersections are shown in italics.

Eighteen of the 35 study intersections would experience an increase in average delay of more than 5 seconds for at least one peak period relative to existing conditions: 14 intersections in the AM peak period and ten in the PM peak period (**Table 5-31** shows these delays in bold lettering). Some of the increases would be substantial. In the AM peak, average delay at three intersections – North Capitol Street with H Street (#5); Louisiana Avenue with North Capitol Street (#21); and the WUS East Intersection at H Street (#8) – would increase by more than 120 seconds. Two of these intersections - North Capitol Street with H Street (#5) and Louisiana Avenue with North Capitol Street (#21) would experience a similar increase in the PM peak.

49 These indicators align with those used by DDOT in identifying traffic operations impacts as included in *DDOT Guidelines for Comprehensive Transportation Review (CTR) Requirements* available at https://ddot.dc.gov/publication/ddot-guidelines-comprehensive-transportation-review-ctr-requirements.

Figure 5-3. Projected Intersection Level of Service, No Action Alternative

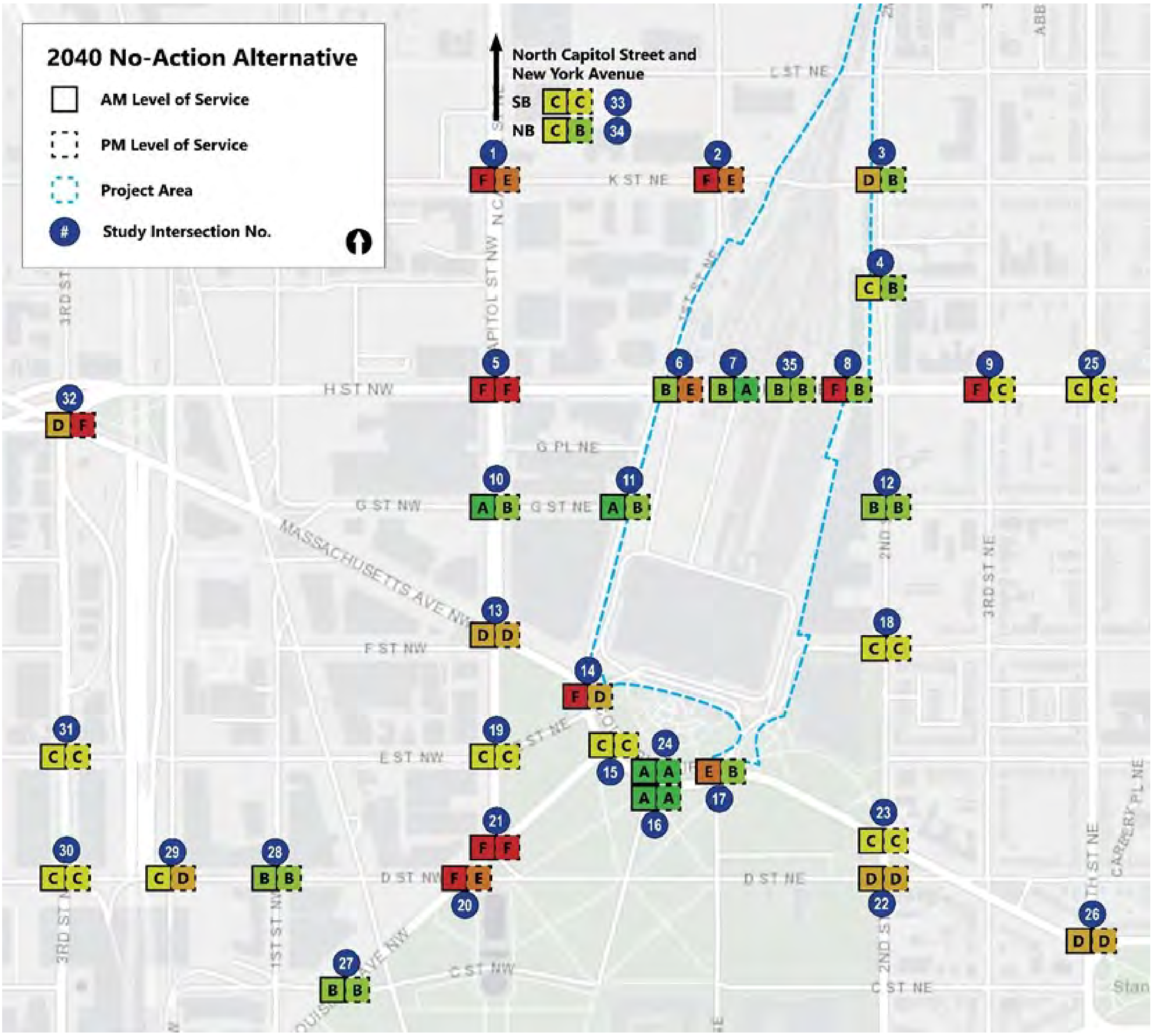


Table 5-31. Intersection Levels of Service, No-Action Alternative

Intersection #	Intersection Name	No-Action Alternative				Existing Conditions			
		AM		PM		AM		PM	
		LOS	Delay/ Change	LOS	Delay/ Change	LOS	Delay	LOS	Delay
1	**North Capitol Street / K Street**	*F*	**135.2/ 47**	E	**71.4/ 35.5**	F	88.2	D	35.9
2	**First Street / K Street NE**	*F*	**166.9/ 71.8**	E	**78.1/ 18.4**	F	95.1	E	59.7
3	**2nd Street / K Street NE**	D	**37.9/ 11.3**	B	13.0/ 1.0	C	26.6	B	12.0
4	**2nd Street / I Street NE**	C	15.3/ 2.5	B	11.7/ 1.0	B	12.8	B	10.7
5	**North Capitol Street / H Street**	**F**	**178.8/ 161.2**	**F**	**292.9/ 265.6**	C	17.6	C	27.3
6	**WUS West Intersection / H Street NE**	B	**12.3/ 10.5**	E	**57.1/ 49.3**	A	1.8	A	7.8
7	**WUS Bus Exit / H Street NE**	B	**14.2/ 11.9**	A	7.0/ 1.5	A	2.3	A	5.5
8	**WUS East Intersection / H Street NE**	**F**	**160.8/ 149.9**	B	13.7/ 3.9	B	10.9	B	9.8
9	**3rd Street / H Street NE**	**F**	**102.8/ 44.7**	C	**32.0/ 7.2**	E	58.1	C	24.8
10	**North Capitol Street / G Street**	A	6.4/ -1.3*	B	14.1/ 3.3	A	7.7	B	10.8
11	**First Street / G Street NE**	A	9.5/ 0.1	B	10.3/ 0.8	A	9.4	A	9.5
12	**2nd Street / G Street NE**	B	14.3/ 1.9	B	11.4/ 0.8	B	12.4	B	10.6
13	**North Capitol Street / Massachusetts Avenue**	D	39.3/3. 9	D	**46.1/ 10**	D	35.4	D	36.1
14	**Massachusetts Avenue/ E Street / First St NE**	**F**	**86.8/ 13.9**	D*	45.6/ -27*	E	72.9	E	72.6

Intersection #	Intersection Name	No-Action Alternative				Existing Conditions			
		AM		PM		AM		PM	
		LOS	Delay/ Change	LOS	Delay/ Change	LOS	Delay	LOS	Delay
15	**Louisiana Avenue/Massachusetts Avenue NE**	C	**27.8/ 8.9**	C	26.3/ -1.7*	B	18.9	C	28.0
16	**Delaware Avenue/Massachusetts Avenue NE**	A	2.1/ -1.2*	A	1.9/ -2.7*	A	3.3	A	4.6
17	**First Street / E Street / Massachusetts Avenue NE**	E	**62.6/ 22.1**	B	19.3/ 0.8	D	40.5	B	18.5
18	**2nd Street / F Street NE**	C	18.8/ 4.4	C	15.3/ 1.9	B	14.4	B	13.4
19	**North Capitol Street / E Street**	C	22.2/ 3.3	C*	27.9/ -13.8*	B	18.9	D	41.7
20	**Louisiana Avenue / D Street NW**	F	93.5/ -174.8*	E*	60.1/ -117.2*	F	268.3	F	177.3
21	**Louisiana Avenue / North Capitol Street**	*F*	**262.1/ 177.8**	**F**	**203.4/ 161.4**	F	84.3	D	42.0
22	**2nd Street / D Street NE**	D	35.4/ -4.1*	D*	37.4/ -145.7*	D	39.5	F	183.1
23	**2nd Street / Massachusetts Avenue NE**	C	27.8/ -0.5*	C	33.8/ 3.8	C	28.3	C	30.0
24	**Massachusetts Avenue NE / Delaware Avenue NE**	A	0.1/ 0.0	A	0.3/ -0.7*	A	0.1	A	1.0
25	**4th Street / H Street NE**	C	21.5/ 4.5	C	**22.0/ 10.1**	B	17.0	B	11.9
26	**Massachusetts Avenue / C Street / 4th St NE**	D	**40.9/ 11.3**	D	44.3/ 1.3	C	29.6	D	43.0

Intersection #	Intersection Name	No-Action Alternative				Existing Conditions			
		AM		PM		AM		PM	
		LOS	Delay/ Change	LOS	Delay/ Change	LOS	Delay	LOS	Delay
27	**Louisiana Avenue / C Street NW**	B	**18.4/ 6.1**	B	14.0/ 4.1	B	12.3	A	9.9
28	**First Street / D Street NW**	B	15.5/ -3.3*	B*	16.6/ -16.9*	B	18.8	C	33.5
29	**2nd Street / D Street NW**	C*	30.0/ -19.2*	D	36.2/ -1.3*	D	49.2	D	37.5
30	**3rd Street / Indiana Avenue/ D Street NW**	C	25.1/ -1.5*	C	23.3/ -5.4*	C	26.6	C	28.7
31	**3rd Street / E Street NW**	C	28.3/ 2.0	C	**30.0/ 6.8**	C	26.3	C	23.2
32	**3rd Street / Massachusetts Avenue / H St NW**	D	42.7/ -14.1*	**F**	**81.4/ 32.6**	E	56.8	D	48.8
33	**North Capitol Street (Southbound [SB] Ramp) / New York Avenue**	C	25.5/ -1.8*	C	30.7/ 5	C	27.3	C	25.7
34	**North Capitol Street (Northbound [NB] Ramp) / New York Avenue**	C	21.4/ 2.7	B	15.7/ -0.2*	B	18.7	B	15.9
35	**H Street Access #2/#3 & H Street**	B	19.7/ na	B	12.8/ na	-	-	-	-

Bold = Degradation to LOS F from a better LOS or increase in delay greater than 5 seconds relative to existing conditions
Italics = LOS F as in existing conditions but greater average delay relative to existing conditions
* = Improved LOS or reduced delay relative to existing conditions
na = not applicable

Table 5-32 shows intersections that would experience queue increases greater than 150 feet in the No-Action Alternative relative to existing conditions. Twenty-one intersections out of 35 study intersections would experience such an increase for one or more lane groups. Ten would experience such a queue increase in both peak hours.

Table 5-32. Intersections with Queue Increase Greater than 150 Feet, No Action Alternative

Int. No	Intersection Name	Relative to Existing	
		AM Peak	PM Peak
1	North Capitol Street / K Street	4 / 10	2 / 10
5	North Capitol Street / H Street	9 / 9	6 / 6
6	WUS West Intersection / H Street NE	2 / 6	3 / 6
7	WUS Bus Exit / H Street NE	1 / 3	0 / 3
8	WUS East Intersection / H Street NE	1 / 3	1 / 3
9	3rd Street / H Street NE	4 / 7	2 / 7
13	North Capitol Street / Massachusetts Avenue	1 / 10	3 / 10
15	Louisiana Avenue/Massachusetts Avenue NE	1 / 5	0 / 5
19	North Capitol Street / E Street	0 / 10	2 / 10
20	Louisiana Avenue / D Street NW	2 / 8	0 / 8
21	Louisiana Avenue / North Capitol Street	1 / 5	3 / 5
22	2nd Street / D Street NE	0 / 4	1 / 4
23	2nd Street / Massachusetts Avenue NE	2 / 7	0 / 6
25	4th Street / H Street NE	2 / 6	0 / 6
26	Massachusetts Avenue / C Street / 4th St NE	0 / 5	1 / 5
27	Louisiana Avenue / C Street NW	1 / 11	0 / 10
29	2nd Street / D Street NW	1 / 4	0 / 4
30	3rd Street / Indiana Avenue/ D Street NW	0 / 10	1 / 10
31	3rd Street / E Street NW	1 / 11	3 / 10
32	3rd Street / Massachusetts Avenue / H St NW	0 / 6	1 / 6
33	North Capitol Street (Southbound [SB] Ramp) / New York Avenue	3 / 6	2 / 6

5.5.1.2 Indirect Operational Impacts

There would be no indirect impacts in the No-Action Alternative. No actions would be taken that would induce other transportation changes.

5.5.1.3 Construction Impacts

In the No-Action Alternative, the WUS Expansion Project would not be constructed. The construction of other projects in the Project Area would cause a range of potential

construction-related adverse impacts. The intensity of those impacts would depend on schedules, durations, and methods of construction, which are not known at this time.

The paragraphs below provide a qualitative summary description of the likely potential construction impacts of the projects included in the No-Action Alternative that have the most potential to generate construction impacts on the transportation system.

Concourse Modernization Project and WMATA Metrorail Station Improvements

The Concourse Modernization Project would cause disruptions to passenger circulation in both the Claytor Concourse and the WMATA Metrorail Station mezzanine level. Passengers may have to walk longer distances because of construction activities in the passenger areas. The WMATA Metrorail north mezzanine may be temporarily closed, which would concentrate pedestrian flows at the south entrance and may cause overcrowded conditions.

VRE Midday Storage Replacement Facility

The construction of the VRE Midday Storage Replacement Facility would cause temporary disruptions to the railroad infrastructure north of K Street NE and to railroad service in the rail terminal when the facility's tracks are connected into the existing system. These disruptions may include track outages and reduced speed limits and may require temporary modifications to rail terminal operations.

Other Station and Track Improvements

The other station and track improvements listed in **Table 1-3** of this report may cause minor disruptions to the transportation infrastructure from short-term track closures, the temporary unavailability of passenger circulation areas, and temporary disruptions to passenger service including cancellations, delays, and reduced speeds in the rail terminal.

H Street Bridge Replacement

The replacement of the H Street Bridge is a project proposed by DDOT in conjunction with the Federal Highway Administration that would reconstruct the bridge on its existing alignment and within DDOT's right of way. [50] DDOT's construction approach would avoid or minimize transportation impacts. The bridge would remain open to traffic during construction but with one travel lane in each direction. As a result, it is expected that some vehicular traffic would divert to nearby parallel routes. As construction occurs on the bridge deck, existing transit stops would temporarily close. This includes the DC Streetcar WUS stop and two WMATA bus stops. The streetcar would continue to operate between 3rd Street NE and Oklahoma Avenue. A shuttle service between 3rd Street and Union Station would be considered. Pedestrian access across the bridge would be maintained during construction, but it would be limited to one side. Access to the WUS Parking Garage would remain but it may be intermittently rerouted to accommodate construction activities.

[50] As of March 2020, preparation of a Categorical Exclusion for this project was ongoing.

The new bridge design was closely coordinated with Amtrak and WMATA to avoid any impacts to the track alignment. The approach to bridge construction would be closely coordinated with Amtrak and WMATA to ensure construction is scheduled to avoid impacts to rail and transit operations.

DC Streetcar Extension

The extension of the DC Streetcar to Georgetown would require construction along H Street NE. This may require lane closures and disrupt traffic operations on H Street. Temporary detours for vehicular traffic may have to be put in place, which could cause delays and inconvenience to WUS users, the persons residing or working in the vicinity of the project, and commuters.

Private Air-rights Development

The development of the privately-owned air rights above the rail terminal is the project with the most potential to cause substantial construction-related impacts at and near WUS. The methods and duration of construction are not known at this time. However, construction would likely take place in phases over several years. It would entail building an overbuild deck within the air rights to support buildings and infrastructure. Columns to support the deck would be constructed in the rail terminal. Modifications to tracks and platforms would likely be needed to accommodate the columns. Depending on the duration of any the construction-related shutdowns, there could adverse impacts on rail terminal operations, with implications for Amtrak, MARC, and VRE operations. However, Amtrak would have approval authority over the construction activity and would minimize impacts to operations as much as possible.

Construction on the west side of the rail terminal (north of H Street, as the air rights on the west side south of the bridge are Federally owned) may affect the operation of the Metrorail Red Line. Temporary single-tracking or partial closures may be required, although it is possible that these could be limited to non-revenue hours.

Construction activities on the west side in proximity to the existing bus facility may affect tour and intercity bus operations. Temporary shutdowns during the construction of the adjacent parts of the air-rights deck and buildings could be required and, if so, would need to be coordinated with WUS. If they occur, such shutdowns would disrupt bus operations and an interim bus terminal may have to be established. They may also affect parking garage access. The construction of new intersections on H Street may temporary affect DC Streetcar operations.

Pedestrian circulation to and from WUS may be affected by construction activities along First Street NE and 2nd Street NE. Access to H Street and the DC Streetcar station may be blocked or complicated by construction activities.

Construction-generated traffic would affect the local transportation network. However, no significant amount of excavation would be required, reducing the number of trucks that would travel to and from the site. There may be some short-term lane closures along First and 2nd Streets NE, but in general, the construction traffic generated by this project can be expected to be commensurate with, and typical of, any large downtown mixed-use development.

5.5.2 Alternative A

The following sections present the direct and indirect, operational and construction impacts of Alternative A. **Figure 5-4** illustrates the key transportation elements of Alternative A.

5.5.2.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative A would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

The reconstruction of the tracks and platforms included in Alternative A as well as the other Action Alternatives would allow for a substantial expansion of rail capacity at WUS. The new tracks and platforms would support simultaneous boarding of trains, quicker turnaround times for trains, and double berthing.[51] Alternative A would make these procedures possible by providing wider platforms that can safely accommodate more passengers; longer usable edges along the platforms that would lengthen the amount of space that can be effectively used for passenger activity;[52] and greater redundancy in the track system. These changes would allow for longer trains and for more frequent trains because trains could unload and load passengers more quickly.

Based on the resulting additional capacity, Amtrak developed an operating plan that would accommodate the growth in ridership estimated by NEC FUTURE while taking into account physical constraints at WUS, including capacity constraints of the rail terminal and the First Street Tunnel. This section describes the increased volumes and ridership associated with this plan that Alternative A and all Action Alternatives would accommodate. This operating plan would allow for two new services: a new low-cost intercity service called the "Metropolitan," and MARC through-running trains to Virginia (**Table 5-33**).

[51] "Double berthing" is when two trains are lined up, one in front of the other, on the same track.

[52] While some platforms may retain the same total lengths as today, they would differ greatly in how much of that length is actively used. Portions of platforms are currently unused due to lack of accessibility, insufficient width, and other issues.

Figure 5-4. Key Transportation Elements, Alternative A

Table 5-33. 2040 Rail Service at WUS, All Action Alternatives

Service	Description
Amtrak Express	Higher Speed Intercity Service
Amtrak Corridor	Intercity Service Providing More Stops than Express Service
Metropolitan	Unreserved intercity service providing lower cost option and access to locations not currently served by intercity rail. The future operator has not yet been identified.
MARC	Commuter service on three lines (Brunswick, Camden, and Penn) in Maryland
VRE	Commuter service on two lines (Fredericksburg and Manassas) in Virginia
Marc Through-Running	Commuter service connecting Maryland and Virginia. The operator has not yet been identified.

The Metropolitan service, introduced in the *NEC FUTURE FEIS*, is a proposed unreserved intercity service between Washington, DC and Boston. This service would be less expensive than most Northeast Regional service and would make more frequent intermediate stops. As planned, it would provide intercity service to new markets and attract riders who might otherwise drive or take the bus, potentially reducing vehicular traffic along the northeast corridor. It would also provide some commuter service for longer distance commuters. *NEC FUTURE* did not identify an operator for this service.

MARC Through-Running would provide regional commuter rail service between the District, Maryland, and Virginia, with trains connecting from the MARC Penn Line to the two VRE lines. For the purposes of this report, this new service is labeled as "MARC Through-Running;" however, MARC and VRE have not yet reached an agreement on how this service would be operated.

Intercity Railroad Service

Relative to the No-Action Alternative, Alternative A and all other Action Alternatives would have a major beneficial direct operational impact on intercity railroad service. Anticipated daily and peak-hour train volumes for intercity service under Alternative A and all other Action Alternatives are shown in **Table 5-34** and **Table 5-35**. Estimated daily intercity ridership are shown in **Table 5-36**. No-Action Alternative and existing conditions data are also provided for comparison.

Table 5-34. Daily Intercity Train Volumes by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Amtrak Express	114	60	32
Amtrak Corridor	46	60	56
Amtrak Long Distance	12	24	28
Metropolitan	116	-	-
Total	**288**	**144**	**116**

Table 5-35. Peak Hour Intercity Train Volumes by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Amtrak Express	8	6	4
Amtrak Corridor	3	8	8
Amtrak Long Distance	1	3	4
Metropolitan	8	0	0
Total	**20**	**17**	**16**

Table 5-36. Intercity Daily Ridership by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Amtrak Express	10,800	6,000	4,500
Amtrak Corridor and Metropolitan	14,800	11,600	8,700
Amtrak Long Distance	6,400	4,200	3,200
Total	32,000	21,800	16,400

In Alternative A and all Action Alternatives, Amtrak would operate 288 trains per day (144 in each direction), including 20 during both peak hours (8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM). This would amount to a substantial increase in intercity service (100 percent above the No-Action Alternative). Peak hour increases in train volumes would be more modest, with train volumes increasing by 24 percent in the AM and PM peaks.

In Alternative A and the other Action Alternatives, increased intercity train service could accommodate 47 percent more daily passengers than in the No-Action Alternative. Peak-hour passenger volumes (8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM), shown in **Table 5-37** and **Table 5-38**, would increase by 276 percent in the AM peak and 127 percent in the PM peak.

Table 5-37. AM Peak Intercity Ridership by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Amtrak Express	1,700	528	406
Amtrak Corridor	2,117	878	660
Amtrak Long Distance	-	265	199
Metropolitan	2,462	-	-
Total	**6,279**	**1,671**	**1,265**

Table 5-38. PM Peak Intercity Ridership by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Amtrak Express	1,276	543	408
Amtrak Corridor	2,369	2,326	1,749
Amtrak Long Distance	-	-	-
Metropolitan	2,872	-	-
Total	**6,517**	**2,869**	**2,157**

In contrast to the No-Action Alternative, where increased train and passenger volumes would further stress the existing, constrained infrastructure at WUS, Alternative A and the other Action Alternatives would provide WUS with the infrastructure needed to adequately accommodate more trains and more passengers, including improved tracks, widened platforms, additional baggage handling areas and lounge space, improved check-in areas, and more concourse space.[53]

Comparison to Existing Conditions

Relative to existing condition, Alternative A and all other Action Alternatives would also have a major beneficial direct operational impact on intercity railroad service. In Alternative A and the other Action Alternatives, Intercity train services could accommodate 95 percent more passengers than under existing conditions (**Table 5-36**). AM peak (8:00 AM to 9:00 AM) and PM peak (4:30 PM to 5:30 PM) passenger volumes would increase by 396 percent and 202 percent, respectively (**Table 5-37** and **Table 5-38**).

Train volumes would also substantially increase relative to existing conditions. In Alternative A and the other Action Alternatives, daily intercity train volumes would increase by 148 percent relative to existing conditions. Peak hour increases in train volumes would be more modest, at 25 percent in the AM and PM peaks (**Table 5-35**).

<u>MARC</u>

Relative to the No-Action Alternative, Alternative A and all other Action Alternatives would have a major beneficial direct operational impact on MARC commuter service. Alternative A would allow for a substantial increase in MARC commuter rail service and passenger volumes. It would provide WUS with the infrastructure needed to adequately accommodate these increases. In particular, consistent with *NEC FUTURE* planning, it would allow MARC to introduce through-running service connecting Maryland and Virginia.

Table 5-39 and **Table 5-40** show MARC train volumes in Alternative A and all Action Alternatives, along with No-Action Alternative volumes and existing ones for comparison. **Table 5-41** shows all day and peak-hour ridership levels.

[53] Specific elements of train infrastructure improvements at WUS are further described in *Chapter 3.*

Table 5-39. Peak MARC Train Volumes by Line, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Penn Line	14	7	7
Camden Line	8	4	2
Brunswick Line	12	4	5
Total	**34**	**15**	**14**

Table 5-40. All Day MARC Train Volumes by Line, All Alternatives

Service	All Action Alternative	No-Action Alternative	Existing Conditions
Penn Line	114	58	55
Camden Line	60	24	21
Brunswick Line	76	24	19
Total	**250**	**106**	**95**

Table 5-41. All Day and Peak MARC Ridership by Line, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
MARC – All-Day	70,700	37,900	28,100
MARC – AM Peak	9,940	4,093	3,032
MARC Through-Running – AM Peak	4,932	-	-
Total MARC AM Peak	14,872	4,093	3,032
MARC – PM Peak	7,703	4,605	3,411
MARC Through-Running – PM Peak	6,248	-	-
Total MARC PM Peak	13,951	4,605	3,411
MARC Peak Total	28,823	8,698	6,443

MARC would operate 34 daily peak-hour (8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM) trains (17 in each direction). This would represent an increase of 127 percent relative to the No-Action Alternative. Fourteen of the trains would be Penn Line trains, eight Camden Line trains, and 12 Brunswick Line trains (**Table 5-39**). Through the entire day, there would be 144 Penn Line trains, 60 Camden Line trains, and 76 Brunswick Line trains (**Table 5-40**), for a total of 250 trains, or an increase of 136 percent relative to the No-Action Alternative. Of the 14-peak hour Penn Line trains, it is anticipated that eight would continue to Virginia.

In Alternative A and all other Action Alternatives, MARC ridership would increase substantially over the No-Action Alternative (**Table 5-41**). Total daily ridership would increase by 87 percent. Peak hour ridership would increase by 263 percent in the AM peak and 203 percent in the PM peak. Much of the peak-hour increases would be a result of the introduction of through-running service.

In contrast to the No-Action Alternative, where increases in train and passenger volumes would further stress already constrained infrastructure, the track, platform, and concourse elements in Alternative A would support and accommodate these increased volumes.

Comparison to Existing Conditions

Relative to existing conditions, Alternative A and all other Action Alternatives would also have a major beneficial direct operational impact on MARC commuter service. In Alternative A and all other Action Alternatives, MARC ridership would increase substantially compared to existing conditions. Total ridership would increase by 152 percent relative to existing conditions. Peak hour ridership would increase by 391 percent in the AM peak and 309 percent in the PM peak.

Train volumes would also increase relative to existing conditions. All day train volumes would increase by 163 percent while peak hour train volumes would increase by 143 percent in both the AM and PM peaks.

VRE

Relative to the No-Action Alternative, Alternative A and all other Action Alternatives would have a major beneficial direct operational impact on VRE commuter service. Alternative A would allow for a substantial increase in VRE commuter rail service and passenger volumes. It would provide WUS with the infrastructure needed to adequately accommodate these increases, including through-running service connecting Maryland and Virginia.

Table 5-42 shows all day and peak VRE ridership in Alternative A and other Action Alternatives. Ridership would increase substantially over the No-Action Alternative. Total daily ridership would increase by 178 percent. Peak hour ridership would increase by 327 percent in the AM peak and 287 percent in the PM peak.

Train volumes would also increase relative to the No-Action Alternative, as shown in **Table 5-43** and **Table 5-44**. All day train volumes would increase by 171 percent. Peak hour train volumes would increase by 300 percent.

In contract to the No-Action Alternative, in which increases in train and passenger volumes would further stress already constrained infrastructure, in Alternative A, the new track, platform, and concourse elements would accommodate these increased volumes.

Table 5-42. All-Day and Peak Hour VRE Ridership by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
VRE All-Day	13,600	4,900	3,900
VRE – AM Peak	3,091	724	557
VRE – PM Peak	2,123	549	422
Total Peak Hour	5,214	1,273	979

Table 5-43. Peak VRE Train Volumes by Service, All Alternatives

Service	All Action Alternatives	No-Action Alternative	Existing Conditions
Fredericksburg Line	8	2	2
Manassas Line	8	2	2
Total	**16**	**4**	**4**

Table 5-44. All-Day VRE Train Volumes by Service by Alternative

Service	All Action Alternatives	No-Action Alternative	Existing Conditions[1]
Fredericksburg Line	46	17	16
Manassas Line	46	17	16
All-Day Total	**92**	**34**	**32**

1. This number refers to the number of revenue trains. VRE operates a total of 34 trains on the infrastructure.

Comparison to Existing Conditions

Relative to existing conditions, Alternative A and all other Action Alternatives would also have a major beneficial direct operational impact on VRE commuter service. In Alternative A and all other Action Alternatives, VRE ridership would increase substantially compared to existing conditions. Total daily ridership would increase by 249 percent. Peak hour ridership would increase by 455 percent in the AM peak and 403 percent in the PM peak. Train volumes would also increase relative to existing conditions. All day train volumes would increase by 188 percent while peak hour train volumes would increase by 300 percent in both the AM and PM peaks.

Private Train Cars

Relative to the No-Action Alternative, Alternative A would have no direct operational impact on private train car operations.

Currently, Amtrak allows private train cars to be stored at WUS. Under the reconfiguration of the rail terminal in Alternative A and all Action Alternatives, Amtrak has identified space for 8 private train cars to be stored at a time. Therefore, private car storage could continue.

Comparison to Existing Conditions

Impacts relative to existing conditions would be the same as relative to the No-Action Alternative because there would be no difference between the two baselines with regard to private train cars.

WMATA Metrorail

Relative to the No-Action Alternative, Alternative A would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would aggravate train overcapacity and station circulation issues at the WMATA platform level.

Increased train service and ridership in Alternative A, as well as the reduction in the number of parking capacity and new retail uses, would generate increased demand on Metrorail at WUS.[54] **Table 5-45** and **Table 5-46** show modeled activity in the AM peak and PM peak**,** respectively, along with corresponding data for existing conditions and the No-Action Alternative. When the projected V/C ratio would exceed 100 percent, measures would be needed to address overcrowding. [55]

Table 5-45. AM Peak WUS-related Metrorail Activity, Alternative A[56]

	Alternative A		No-Action Alternative		Existing Conditions	
	Shady Grove	**Glenmont**	**Shady Grove**	**Glenmont**	**Shady Grove**	**Glenmont**
Passengers Arriving at WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[57]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,390	1,623	5,202	1,010	2,802	528
WUS Alightings	5,042	3,423	4,128	2,803	923	3,644
Through Ridership[58]	9,222	1,296	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,612	2,919	14,725	2,457	10,378	1,955
V/C Departing WUS	103%	17%	86%	14%	69%	13%
Excess Demand	469	0	0	0	0	0

54 The introduction of MARC through-running service to Virginia would likely reduce demands on the Red Line at Union Station. For the purposes of the present analysis, by 2040, it was projected that an estimated 620 AM peak and 640 PM peak passengers would travel through WUS on the Red Line, with an origin-destination at two stations served by commuter rail. With the through-running service, some ridership may switch from Metrorail to MARC. For the purposes of a conservative estimate and due to limited information about the broader trip-making effects of MARC through-running service, no such mode switching has been assumed.

55 WMATA capacity standards are based on WMATA's operating manual. The capacity reported in this DEIS (all alternatives) is less than the "crush load" of WMATA trains. Capacity represents the level at which WMATA believes they can operate effectively without delays to trains and passengers due to overcrowding.

56 Estimates of WMATA peak hour capacity are consistent with TPB Constrained Long-Range Transportation Plan elements and direction from WMATA (all alternatives).

57 Red Line hourly nominal capacity at peak hour is 19,200 passengers (trains every 3 minutes, 120-passenger per car, and 100 percent 8-car train operations). However, for this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

58 "Through ridership" refers to riders who neither board nor alight at WUS but ride the Red Line train through the WUS Metrorail Station.

Table 5-46. PM Peak WUS-related Metrorail Activity, Alternative A

	Alternative A		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS	20%	115%	20%	107%	19%	72%
WUS Boardings	3,170	4,536	2,559	3,661	3,265	918
WUS Alightings	1,553	8,240	1,154	6,126	582	3,090
Through Ridership	1,647	9,919	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,817	14,455	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Demand	0	2,421	0	1,110	0	0

By 2040, volumes in Alternative A would exceed capacity in the Shady Grove direction during the AM peak (departing WUS) and in the Glenmont direction during the PM peak (arriving at WUS).

Relative to the No-Action Alternative, in the AM peak, Alternative A would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 86 percent in the No-Action Alternative, creating additional demand of an estimated 469 passengers. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate within the Red Line core. [59]

In the PM peak, capacity exceedance toward Glenmont (115 percent arriving) would be greater in Alternative A than in the No-Action Alternative (107 percent). Alternative A would aggravate the level of crowding, generating an additional excess demand of approximately 1,311 passengers, for a total excess demand of around 2,421.

In the PM peak departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative A would cause no additional exceedance of this threshold relative to the No-Action Alternative.

Relative to the No-Action Alternative, the increase in Metrorail ridership at WUS would further adversely affect passenger circulation at the WMATA platform level. The North Mezzanine improvements included in the Concourse Modernization Project, which would occur in Alternative A as well as in the No-Action Alternative, would improve circulation. The construction of the First Street Concourse and the reconfiguration of Metrorail access to the rail platform level of Concourse A in Alternative A would accommodate circulation between

[59] The Red Line core, as defined by WMATA, consists of the line segment between Dupont Circle and WUS.

the WMATA mezzanine and WUS rail platform levels.[60] However, vertical circulation between the WMATA platform and the WMATA mezzanine would remain as in the No-Action Alternative. This connection would be a constraint on circulation in the No-Action Alternative and would remain one in Alternative A. It is likely that in Alternative A, circulation conditions on the WMATA platform for passengers seeking to access the North Mezzanine would further degrade compared to the No-Action Alternative as a result of increased volumes.

Comparison to Existing Conditions

Relative to existing conditions, Alternative A would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

In the AM peak, Alternative A would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 69 percent in existing conditions. Alternative A would increase the overall demand in the AM peak in the Shady Grove direction by 7,234 passengers. In the PM peak, the Alternative A V/C ratio toward Glenmont would be 115 percent arriving at WUS, against 72 percent in existing conditions. Alternative A would increase overall demand in the PM peak by 8,211 passengers.

The increase in Metrorail ridership at WUS would also adversely affect passenger circulation on the Metrorail platform relative to existing conditions. Passenger circulation is an existing issue at the Metrorail station, with WMATA indicating that it can take up to 8 minutes for passengers to clear the two sets of escalators from the platform level. The construction of the First Street Concourse and the reconfiguration of Metrorail access to the rail platform level of Concourse A in Alternative A would accommodate circulation between the Metrorail mezzanine and the WUS rail platforms.[61] However, vertical circulation between the Metrorail platform and the Metrorail mezzanine would remain unchanged compared to existing conditions and the existing constrained conditions would further degrade in Alternative A.

DC Streetcar

Relative to the No-Action Alternative, Alternative A would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Table 5-47 shows the projected impacts of Alternative A on streetcar operations at WUS in 2040, along with the corresponding data for the No-Action Alternative. In Alternative A, there would be no capacity exceedance. Passenger volumes departing WUS would increase by 344 in the westbound direction and 86 in the eastbound direction in the AM peak relative to the

[60] Pedestrian flow analysis within WUS indicated that the new vertical circulation elements in Concourse A would accommodate peak volumes associated with WMATA Metrorail passengers.

[61] Pedestrian flow analysis within WUS indicated that the new vertical circulation elements in Concourse A would accommodate peak volumes associated with WMATA Metrorail passengers.

No-Action Alternative. In the PM peak, passenger volumes would increase by 53 in the westbound direction and 137 in the eastbound direction. Alternative A would result in greater use of the DC Streetcar than the No-Action Alternative while leaving sufficient room for further growth, a beneficial impact. This beneficial impact would be minor because greater traffic congestion on H Street (see **Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Traffic*) may create operational delays that would partially offset the benefits of increased ridership.

Table 5-47. Streetcar Volumes, All Alternatives

	All Action Alternatives				No-Action Alternative			
	AM Peak		PM Peak		AM Peak		PM Peak	
	WB	EB	WB	EB	WB	EB	WB	EB
Car Capacity (Passengers per Car)	157	157	157	157	157	157	157	157
Cars per Run	1	1	1	1	1	1	1	1
Frequency (Runs per Hour)	12	6	12	6	12	6	12	6
Peak Capacity Departing WUS	1,884	942	1,884	942	1,884	942	1,884	942
Prior Segment Ridership	617	334	238	588	475	274	159	378
V/C Arriving at WUS	65%	18%	25%	31%	50%	15%	17%	20%
Alightings at WUS	297	94	158	528	155	34	79	318
Through Volume	320	240	80	60	320	240	80	60
Boardings at WUS	628	157	76	332	284	71	43	195
Departing Volume	948	397	156	392	604	311	123	255
V/C Departing WUS	50%	42%	8%	42%	32%	33%	7%	27%

WB – westbound; EB - eastbound

Comparison to Existing Conditions

Because of the different operational conditions of the Streetcar in existing conditions, it is not possible to compare the impacts to existing conditions. Under existing conditions, the DC Streetcar terminates at WUS, continuing east along H Street/Benning Road NE to Oklahoma Avenue. This service travels every 12 minutes. In the No-Action Alternative and Action Alternatives, the DC Streetcar would continue east to the Benning Road Metrorail Station and west to Georgetown, making it a substantially different transportation element.

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative A would have a moderate adverse direct operational impact on intercity and tour/charter, and daily sightseeing bus operations because of the new 30-minute time limit for buses at WUS. Alternative A would have a

negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

In Alternative A and all action alternatives, intercity buses, tour/charter buses, and daily sightseeing buses,[62] would be accommodated in a new facility on the H Street level. Hop-on/hop-off sightseeing buses would be accommodated on G Street NE. Impacts to all these modes are assessed in this section.

In Alternative A, the new bus facility would be located in approximately the same location as the existing WUS parking garage. Buses would reach it via the new west intersection on H Street NE. Exit would be via a ramp east of that intersection, near where the existing ramp is located today. All intercity and tour/charter buses that serve WUS would use this facility. As in the No-Action Alternative, exiting buses could only turn right onto eastbound H Street NE. However, the west intersection would not be offset (as it would be in the No-Action Alternative), which would facilitate inbound bus movements.

In Alternative A and all Action Alternatives, the capacity of the bus facility would be optimized by using an “active management” approach. In this approach, buses could not stay at a slip for more than 30 minutes during the peak hours of operation. This quicker turnaround would allow the bus facility to process more buses with a smaller number of slips than would be the case in the No-Action Alternative and in existing operational conditions, where there are no limits on bus layovers.

In 2040, Alternative A and all Action Alternatives would generate an estimated 117 peak-hour intercity, tour/charter and daily sightseeing bus movements (**Table 5-48**). Relative to the No-Action Alternative, this would be an increase of 75 percent (22 trips, or 79 percent, in the AM peak and 28 trips, or 72 percent, in the PM peak.)

Table 5-48. Peak-hour Bus Trips, All Alternatives

	All Action Alternatives		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	25	34	14	20	11	14
Outs	25	33	14	19	10	14
Total	**50**	**67**	**28**	**39**	**21**	**28**

Bus demand would be lower in Alternative A and all Action Alternatives than in the No-Action Alternative due to the introduction of the lower-cost Metropolitan train service. However, the 30-minute stay policy would result in more trips in and out of the bus facility and may create additional delays for bus operators. Buses may need to lay over at other locations in

62 Daily sightseeing buses are coach-style buses that provide scheduled tours of Washington-area sites and currently depart from the existing WUS bus facility.

the District or the region as a result of the 30-minute policy. These locations have not been determined.

In Alternative A and all Action Alternatives, hop-on/hop-off sightseeing buses, which currently serve the front of WUS, would provide service via a curbside loading zone on the south side of G Street NE (See **Figure 5-4**). There would be seven slips at that location. Future sightseeing bus operations would need four of them. The additional slips would serve to accommodate any overflow from the bus facility during peak season as well as other vehicular pick-up and drop-off activity. While the 30-minute-stay policy would create a constraint on bus operations at the bus facility, the availability of overflow spaces on G Street NE would provide added flexibility.

Comparison to Existing Conditions

Relative to existing conditions, bus trips would increase by 29 trips (138 percent) in the AM peak and 39 trips (139 percent) in the PM peak. Of the additional trips, 19 percent would be due to the anticipated increase in demand and the rest to the implementation of the 30-minute stay limit.

Loading

Relative to the No-Action Alternative, Alternative A would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

In Alternative A and all Action Alternatives, use of the existing east and west loading docks would continue. A new loading dock (north dock) between 2nd Street and K Street NE with access from 2nd Street NE would be constructed. Relative to the No-Action Alternative, the demand for loading dock slips at WUS would increase an estimated 75 percent because of the greater amount of retail and the increase in multimodal operations. Between the existing loading docks and the new north dock, there would be sufficient capacity to accommodate the expected volume of vehicles and materials.

The east dock would continue to accommodate up to six vehicles per hour, while the west dock would accommodate only Package Express loading due to the potential reconfiguration of access from the Metrorail station to WUS. The new north loading dock would include 14 slips, with at least two of these slips designed to accommodate smaller vehicles.

The heaviest loading dock activity would continue to be in the midday hours, outside of both the AM and PM peaks. The AM peak would include 30 loading movements across all three docks and the PM peak would include eight loading movements across all three docks. The heaviest volumes would occur between 10:00 AM to 11:00 AM, with 40 total loading movements.

Construction of the north dock would introduce new truck activity along 2nd Street NE relative to the No-Action Alternative. Truck activity would be distributed throughout the day, with the highest volumes outside of the rush hour periods. It would not spill into adjacent residential streets due to existing truck restrictions on those streets. Trucks serving this dock would comply with District law, which prohibits backing up in the public right-of-way.

Comparison to Existing Conditions

The impacts of Alternative A on loading relative to existing conditions would be the same as relative to the No-Action Alternative. There would be no difference between the two baselines with regard to loading dock conditions.

Pedestrians

Relative to the No-Action Alternative, Alternative A would have a major beneficial direct operational impact on pedestrian circulation inside WUS. Additional access points to WUS would disperse pedestrian traffic and make access to WUS easier. Outside of WUS, Alternative A would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

As shown in **Table 5-49**, interior passenger volumes at WUS would increase in Alternative A and all Action Alternatives relative to the No-Action Alternative. In both the AM and PM peaks, volumes would be approximately 50 percent greater. The largest generator of internal pedestrian trips would be passengers transferring between commuter rail and Metrorail.

Table 5-49. Interior Pedestrian Volumes, All Alternatives

	Action Alternatives		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Total	71,734	92,356	47,703	61,416	35,867	46,178

By providing new concourse space and access points, Alternative A and all Action Alternatives, would facilitate the movement of passengers and visitors through and in and out of WUS, avoiding the congestion that would occur in the No-Action Alternative, where existing, already congested circulation space and entry points would have to accommodate a growing number of persons. For this reason, despite the increase in pedestrian volumes relative to the No-Action Alternative, Alternative A would result in a major beneficial impact on pedestrian conditions in WUS.

Outside WUS, pedestrian volumes would increase relative to No-Action Alternative volumes, by about 61 percent in the AM peak and 55 percent in the PM peak (**Table 5-50**).

Table 5-50. Exterior Pedestrian Volumes, All Alternatives

	Action Alternatives		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	5,566	10,339	3,753	6,587	3,419	6,736
Outs	12,372	6,427	7,370	4,232	4,927	3,654
Total	**17,938**	**16,766**	**11,123**	**10,819**	**8,346**	**10,390**

To assess the potential impacts of these increases on pedestrian circulation, two signalized pedestrian crossings at the First Street NE / Columbus Circle NE / Union Station Drive intersection were analyzed: the east-west crossing of First Street NE and the east-west crossing of Union Station Drive. The analysis compared the anticipated volumes to the cycle times of the traffic signal to calculate the maximum queue of pedestrians during each peak hour. **Table 5-51** presents the results.

Table 5-51. Pedestrian Analysis, All Alternatives

Intersection Name	Direction	Cycle Time (sec)	Action Alternatives Peak Hour Volumes (No-Action Alternative Peak Hour Volumes)		Cycles Per Peak Hour		Action Alternatives Maximum Queue in Peak Hour (No-Action Alternative Maximum Queue in Peak Hour)	
			AM	**PM**	**AM**	**PM**	**AM**	**PM**
First Street NE NB at Massachusetts Avenue NE	**EB**	110	767 (598)	1,941 (1,402)	33	33	26 (21)	68 (49)
Union Station Drive NE and Columbus Monument Drive NE (West Corner)	**NB**	110	613 (478)	221 (160)	33	33	22 (17)	8 (6)
First Street NE NB at Massachusetts Avenue NE	**WB**	110	543 (389)	590 (461)	33	33	20 (14)	21 (16)
Union Station Drive NE and Columbus Monument Drive NE (West Corner)	**SB**	110	376 (270)	513 (401)	33	33	13 (9)	18 (14)

In Alternative A, as in all Action Alternatives, projected queues at each crossing would be longer than they would be in the No-Action Alternative. However, queues would remain manageable, as they could remain contained within the available sidewalk space at these locations.

Anticipated increases in vehicular traffic near WUS, including pick-up and drop-off activities, along with increases in pedestrian volumes, may result in more conflicts between pedestrians and vehicles. Based on the projected number and distribution of new multimodal trips, the following locations would be most affected: G Street NE between North Capitol Street and First Street NE; First Street NE between G Street NE and K Street NE; H Street NE between the west intersection and east intersection; and 2nd Street NE between F Street NE and K Street NE.

Comparison to Existing Conditions

The impacts of Alternative A relative to existing conditions would be similar to those relative to the No-Action Alternative. The major beneficial impact that would result from the provision of more circulation space and access points would be somewhat greater because it would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative, which would incorporate some changes beneficial to pedestrians, such as those associated with the Concourse Modernization project. The increase in pedestrian volumes inside WUS would also be greater relative to existing conditions (about 115 percent in the AM and 61 percent in the PM peak).

Impacts on outside pedestrian circulation would be the same relative to existing conditions as relative to the No-Action Alternative since they are a function of a feature – sidewalk queuing space for pedestrians – that would be the same in both baselines.

Bicycle Activity

Relative to the No-Action Alternative, Alternative A would result in a minor beneficial direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be partially offset by increased conflicts with pedestrians and vehicles.

In Alternative A, as in all Action Alternatives, a total of 586 WUS-generated peak-hour bicycle trips would be generated, with 285 trips in the AM peak and 301 trips in the PM peak (**Table 5-52**). The Alternative A volumes would represent an increase of 78 AM trips (38 percent) and 60 PM trips (25 percent) over the No-Action Alternative.

Table 5-52. Peak-hour Bicycle Trips, All Alternatives

	All Action Alternatives		No-Action Alternative		Existing Conditions	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Ins	118	163	89	124	67	93
Outs	167	138	118	117	89	88
Total	285	301	207	241	156	181

Alternative A, like all Action Alternatives, would provide 104 Bikeshare spaces and 200 bicycle storage spaces. These new bicycle storage facilities would be adjacent to the H Street Concourse entrances at First and 2nd Streets NE. With the new bicycle facilities, Alternative A would fully accommodate the increased volumes in bicycle trips unlike the No-Action

Alternative, which would not accommodate any additional bicycle storage. Therefore, Alternative A would have a beneficial direct operational impact on bicycle activity relative to the No-Action Alternative.

However, greater vehicular, pedestrian, and bicycle volumes in Alternative A (and all Action Alternatives) would increase the risk of conflicts between bicycles and vehicles. Bicycle facility improvements planned by DDOT (on Louisiana Avenue NE and K Street NE, for instance) would improve safety. However, the volumes and new activities like pick-up and drop-off on First Street would create conflicts even with these additional safety measures. This would partially offset the beneficial impact from increased storage, resulting in a minor beneficial net impact.

Comparison to Existing Conditions

The impacts of Alternative A relative to existing conditions would be similar to those relative to the No-Action Alternative. Alternative A would generate 129 additional AM peak trips (83 percent increase) and 120 additional PM peak trips (66 percent increase) relative to existing conditions. The bicycle parking and storage facilities included in Alternative A and all Action Alternatives could accommodate up to 200 bicycles, more than enough to cover the anticipated increase, with room for further growth.

Based on the growth in peak-hour WUS-related bicycle trips, an additional 88 Bikeshare docks would be required to meet demand under Alternative A relative to existing conditions. Alternative A would fully accommodate this demand as it would provide 104 Bikeshare spaces. Like relative to the No-Action Alternative, greater vehicular, pedestrian, and bicycle volumes would increase the risk of conflict with bicycles.

City and Commuter Buses

Relative to the No-Action Alternative, Alternative A would have a minor adverse direct operational impact on city and commuter buses. Increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delays experienced by all city and commuter buses. There would also be a moderate adverse direct operational impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

Alternative A would increase usage of the city and commuter buses (including DC Circulator Metrobus, MTA, and LCT buses) that serve WUS, as shown in **Table 5-53.**

Table 5-53. Peak-hour City and Commuter Bus Ridership, All Alternatives

	Action Alternatives		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Capacity	7,837	7,471	7,837	7,471	7,837	7,471
Volume Prior to WUS	4,271	4,484	3,887	3,863	3,723	3,593
V/C Arriving	54%	60%	50%	52%	48%	48%
Alightings for WUS	860	1,475	476	854	394	719
Through Volume	3,411	3,009	3,411	3,009	3,329	2,874
Boardings from WUS	1,694	1,010	829	612	717	501
Total Volume	**5,105**	**4,019**	**4,240**	**3,621**	**4,046**	**3,375**
V/C Departing	65%	54%	54%	48%	52%	45%

Compared to the No-Action Alternative, there would be an additional 384 alighting WUS passengers (81 percent) and 865 boarding WUS passengers (104 percent) in the AM peak on city and commuter buses. There would be an additional 621 alighting passengers (73 percent) and 398 boarding passengers (65 percent) in the PM peak. Considered collectively, city and commuter buses would continue to operate under capacity.

The same individual Metrobus routes that would be over capacity in the No-Action Alternative would be over capacity in Alternative A (see **Table 5-54**). Because of the increase in ridership, the overcrowding would be worse but Alternative A would not cause more Metrobus or DC Circulator lines to run above capacity than the No-Action Alternative. As a result, Alternative A would only have a minor adverse direct operational impact on city and commuter buses.

The reconstruction of the bus facility in Alternative A and all Action Alternatives would require employee shuttles currently making use of the facility to relocate to another location. These shuttles serve USCIS and Gallaudet University. They operate with a short dwell time to pick up passengers and then proceed to their destination; they do not lay over at WUS. The relocation of the employee shuttles would be a moderate adverse impact on their operation because while they must be proximate to WUS, they do not need to be within the bus facility itself to continue fulfilling their purpose. No impact to traffic operations would occur because of this relocation.

Increases in vehicle delay and queue would likely affect bus reliability and speeds due to the overall degradation in traffic operations. **Table 5-55** shows which bus routes would pass through at least two intersections in the Local Study Area that would degrade to LOS F relative to the No-Action Alternative. These buses may experience slightly greater delays than in the No-Action Alternative.

Table 5-54. Bus Routes Over Capacity, All Alternatives

	Metrobus Route	Direction	Action Alternatives	No-Action Alternative	Existing Conditions
AM Peak	80	SB	Over Capacity	Over Capacity	
	D4	WB	Over Capacity	Over Capacity	
	D6	WB	Over Capacity	Over Capacity	
	P6	NB	Over Capacity	Over Capacity	
	P6	SB	Over Capacity	Over Capacity	
	X1	WB	Over Capacity	Over Capacity	
	X2	WB	Over Capacity	Over Capacity	Over Capacity
	X9	EB	Over Capacity	Over Capacity	Over Capacity
	X9	WB	Over Capacity	Over Capacity	Over Capacity
PM Peak	96	EB	Over Capacity	Over Capacity	
	D6	EB	Over Capacity	Over Capacity	
	P6	NB	Over Capacity	Over Capacity	
	X2	EB	Over Capacity	Over Capacity	Over Capacity
	X2	WB	Over Capacity	Over Capacity	Over Capacity
	X9	EB	Over Capacity	Over Capacity	Over Capacity
	X9	WB	Over Capacity	Over Capacity	Over Capacity

Table 5-55. Bus Routes Passing through LOS F Intersections, Alternative A

	Alternative A
AM Peak	D4, D8, X1, X2, X9, 80, 97 NM Circulator LCT MTA 220, MTA 230, MTA 240, MTA 250, MTA 260, MTA 735
PM Peak	X1, X2, X9, 80, 97 NM LCT MTA 220, MTA 230, MTA 240, MTA 250, MTA 260, MTA 735

Comparison to Existing Conditions

Compared to existing conditions, in Alternative A there would be an additional 466 alighting WUS passengers (118 percent) and 977 boarding WUS passengers (136 percent) in the AM peak on city and commuter buses. There would be an additional 756 alighting passengers (105 percent) and 509 boarding passengers (102 percent) in the PM peak. Considered collectively, city and commuter buses would continue to operate under capacity. Because of the increase in ridership, six Metrobuses in the AM peak and three Metrobuses in the PM peak would become over capacity (see **Table 5-54**). Impacts on employee shuttles would be the same relative to existing conditions and the No-Action Alternative because there is no difference between the two baselines in this regard. Compared to existing conditions, in Alternative A buses would see increases in vehicle delays or queues that would affect their reliability and speeds because of greater traffic. Four bus routes in the AM peak and 13 bus routes in the PM peak would pass through intersections degrading to LOS F relative to existing conditions

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative A would have a moderate adverse direct operational impact on parking at WUS because of a reduction in parking capacity. There would be a minor beneficial direct operational impact on rental car operations.

In Alternative A, all parking and rental car activity would be in a new above-ground parking facility located within the same general footprint as the existing WUS parking garage, with access via H Street NE (west intersection) and the new southwest road. The new parking facility would have reduced capacity, with space for approximately 700 fewer cars than the existing one, which would continue to be used in the No-Action Alternative. While this reduction in parking capacity would be an adverse impact, the new facility would meet the parking program for the Project. It would not fully meet the projected parking demand but it is anticipated that users not able to park would use different modes to reach the station.[63] In general, fewer passengers or visitors are expected to be driving to and parking at WUS.[64] Therefore, the adverse impact would be moderate. The impacts of the reduction in parking capacity on other modes of travel are incorporated in the impact analyses conducted for those modes.

WUS activity in Alternative A would generate more peak-hour parking trips than would be the case in the No-Action Alternative, as shown in **Table 5-56**. Though parking capacity in Alternative A would be less than in the No-Action Alternative, the increase in peak hour train volumes would increase peak hour parking trips. In the AM peak, the difference between Alternative A and the No-Action Alternative would be 88 trips (47 percent). In the PM peak, the difference would be 11 trips (4 percent). These trips were incorporated in the traffic impact analysis.

[63] Appendix A6, *Parking Program Memorandum*, provides more information on parking demand projection and the development of the parking program.

[64] The MWCOG Model estimates a 10% reduction in single-occupancy vehicle trips in the WUS area to 2040.

Table 5-56. Peak-Hour Parking Trips, Alternative A

	Alternative A		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	190	83	127	102	104	53
Outs	87	227	62	197	24	154
Total	**277**	**310**	**189**	**299**	**128**	**207**

Increased WUS activity would also generate more rental car trips relative to the No-Action Alternative, as shown in **Table 5-57**. In both the AM and PM peak hours, the number of car-rental trips would more than double relative to the No-Action Alternative (105 against 46 in the AM peak and 92 against 45 in the PM peak). As with parking, these trips were considered in the traffic impact analysis. This substantial change would be due to the large increase in intercity train volumes concentrated in the peak hours. As with parking, these trips were incorporated in the traffic impact analysis.

The new rental car facility in the new parking facility would be designed to accommodate the anticipated level of demand. In Alternative A and all Action Alternatives, the design of the new facility would address the capacity issues that would occur in the No-Action Alternative, resulting in a beneficial impact. This beneficial impact would be minor, being partially offset by the increase in operations.

Table 5-57. Peak-Hour Rental Car Trips, All Alternatives

	Alternative A		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	57	37	28	17	26	13
Outs	48	55	18	28	15	23
Total	**105**	**92**	**46**	**45**	**41**	**36**

Comparison to Existing Conditions

The impacts of Alternative A on parking and rental car activity would be the same relative to existing conditions as relative to the No-Action Alternative since the existing parking garage and rental car facility would be in use in both baselines. The reduction in parking capacity would be the same relative to existing conditions as relative to the No-Action Alternative.

Alternative A would generate proportionately more peak-hour parking trips relative to existing conditions than relative to the No-Action Alternative. In the AM peak, Alternative A would generate 149 parking trips (116 percent) more than in existing conditions. In the PM peak, the increase would be 103 parking trips (50 percent) above existing conditions. With regard to rental cars, in the AM peak, the number of trips would increase by 64 (156 percent). In the PM peak, trips would increase by 56 (156 percent).

For-hire Vehicles

Relative to the No-Action Alternative, Alternative A would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative A would also have a major adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The following four pick-up and drop-off locations would be provided in Alternative A (see **Figure 5-4**):

- **Front of WUS:** For-hire vehicles would have two means of access depending on trip purpose: from Columbus Circle (drop-off only) and, for taxis, from H Street NE, via the center intersection, center road, and east ramp (pick-up only). Egress from the front of WUS would continue to occur at the intersection of Massachusetts Avenue, E Street NE, and First Street NE. In Alternative A, a projected 40 percent of for-hire drop-off activity and 40 percent of for-hire pick-up activity would occur in front of WUS.

  Improvements to the traffic lanes in front of WUS would double the number of lanes for for-hire drop-off from two to four over the No-Action Alternative. This doubling of capacity would benefit for-hire vehicle operations. Taxi pick-up would continue to have dedicated lanes closest to the WUS entrance.

- **Adjacent to the north-south train hall on the deck level**: For-hire vehicles would access this location via the center intersection on H Street NE, with egress via either the east intersection to H Street NE or the east ramp to F Street NE. In Alternative A, a projected 35 percent of for-hire drop-off activity and 35 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on First Street NE**: This location would serve the new WUS entrance on First Street NE and consist of a curbside pick-up and drop-off area on the east side of the street, north of G Place NE. For-hire vehicles would reach it via northbound First Street NE. In Alternative A, a projected 20 percent of for-hire drop-off activity and 20 percent of for-hire pick-up activity would use this location.
- **New H Street Concourse entrance on 2nd Street NE**: This location would serve the new WUS entrance on 2nd Street NE. It would consist of space for curbside pick-up and drop-off on both sides of the street. These layby areas would be developed to accommodate expected volumes associated with a station entrance. The west side location would be reached via southbound 2nd Street NE. Vehicles would reach the east side location via northbound 2nd Street NE. In Alternative A, a projected 5 percent of for-hire drop-off activity and 5 percent of for-hire pick-up activity would use this location.

Table 5-58 shows the anticipated number of WUS-related for-hire trips in Alternative A.[65] Relative to the No-Action Alternative, Alternative A would generate an estimated 1,404 new peak-hour for-hire trips in the AM peak hour (268 percent increase) and 1,206 in the PM peak hour (140 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity. These trips were considered in the traffic impact analysis.

Table 5-58. Peak-hour For-hire Trips, Alternative A

	Alternative A		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	964	1,034	262	431	197	324
Outs	964	1,034	262	431	197	324
Total	**1,928**	**2,068**	**524**	**862**	**394**	**648**

As explained below (**Section 5.5.2.1,** *Direct Operational Impacts, Vehicular Traffic*), volumes associated with for-hire as well as private pick-up and drop-off activity on the deck level and in front of WUS could create queueing and congestion, resulting in a major adverse impact on for-hire vehicle operations at WUS.

Comparison to Existing Conditions

The beneficial impacts of Alternative A on for-hire vehicle activities would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative A would generate an estimated 1,534 new AM peak-hour for-hire trips (389 percent increase) and 1,420 new PM peak-hour for-hire trips (219 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative A would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for these activities. These locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips, but queuing may occur. Alternative A would also have a major adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

65 A single for-hire pick-up or drop-off trip creates both an in and an out trip as the vehicle arrives and then departs WUS. A single for-hire vehicle pick-up or drop-off is assumed to generate 1.5 trips to reflect the linking of trips in the WUS circulation network.

The same four locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be allowed to use the east ramp to access the front of WUS. The anticipated distribution of activity would be the same as for for-hire vehicles activity: 40 percent at front of WUS; 35 percent next to the train hall; 20 percent on First Street NE; and 5 percent on 2nd Street NE.

Table 5-59 shows the anticipated number of WUS-related peak-hour private pick-up and drop-off trips in Alternative A.[66] Relative to the No-Action Alternative, Alternative A would generate an estimated 812 additional AM peak-hour trips (93 percent) and 592 additional PM peak hour trips (63 percent). The principal source of increased peak-hour private pick-up/drop-off trips would be the increase in intercity rail activity. The impacts of these trips are considered in the traffic impact analysis.

Table 5-59. Peak-hour Private Pick-up and Drop-off Trips, Alternative A

	Alternative A		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	842	770	436	474	328	356
Outs	842	770	436	474	328	356
Total	**1,684**	**1,540**	**872**	**948**	**656**	**712**

As explained below (**Section 5.5.2.2,** *Direct Operational Impacts, Vehicular Traffic*), volumes associated with private pick-up and drop-off, as well as for-hire, activity on the deck level and in front of WUS could create queueing and congestion, resulting in a major adverse impact on private pick-up and drop-off operations at WUS.

Comparison to Existing Conditions

The beneficial impacts of Alternative A on private pick-up and drop-off activity would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative A would generate an estimated 1,028 additional private pick-up and drop-off trips in the AM peak hour (157 percent) and an estimated 828 additional private pick-up and drop-off trips in the PM peak hour (116 percent). The principal source of increased peak-hour private pick-up/drop-off trips would be the increase in intercity rail activity.

66 A single private pick-up or drop-off vehicle generates two trips: one in and one out as the vehicle arrives and then departs WUS.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative A would have major adverse direct operational impacts on traffic operations at several intersections near WUS due to increased traffic volumes. During at least one of the peak periods, out of 35 intersections in the Local Study Area, seven would degrade to LOS F; 16 would experience an increase in queue length of more than 150 feet; and 20 would experience an increase in average delay of more than 5 seconds.

Trips Generation and Circulation

WUS-related vehicular activity in Alternative A would be primarily distributed across four locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility, new pick-up/drop-off location, and parking facility accessed from H Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse); and
- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse).

Parking and rental car activity would converge onto H Street NE to reach the parking facility. Private and for-hire pick-up and drop-off activity would be spread across all four locations. **Table 5-60** shows the anticipated distribution of WUS-related vehicular trips by access point and type of trip in Alternative A. Approximately 70 percent of WUS-related traffic is expected to travel to and from points west of WUS, with 30 percent traveling to and from points east of WUS. Deck-level circulation patterns in Alternative A are represented in **Figure 5-5**. [67]

Table 5-60. Trip Distribution by WUS Access Point and Trip Type, Alternative A

	First Street	2nd Street	Front of WUS	H Street
For-hire Drop-Off	20%	5%	40%	35%
For-hire Pick-Up	20%	5%	40%	35%
Private Pick-up/Drop-off	20%	5%	40%	35%
Parking	0%	0%	0%	100%
Rental Car	0%	0%	0%	100%

[67] Figure 5-5 shows all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Figure 5-5. Deck Level Circulation (All Movements), Alternative A

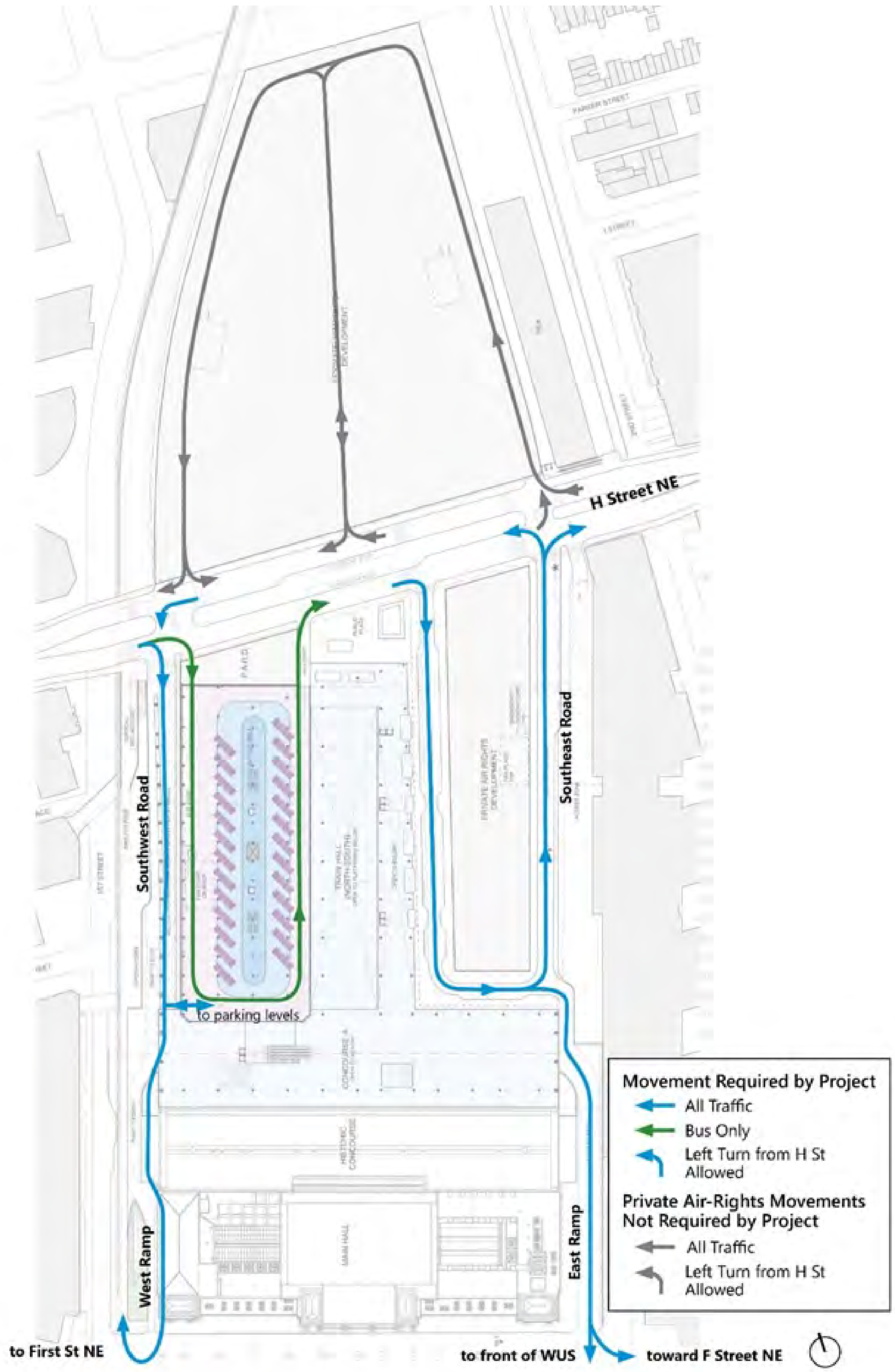


Table 5-61 and **Table 5-62** show AM and PM peak WUS-related traffic volumes in Alternative A, along with the corresponding information for the No-Action Alternative and existing conditions. Compared to the No-Action Alternative, Alternative A would generate 2,363 additional AM peak trips (145 percent increase) and 1,856 additional PM peak trips (86 percent increase). These volume increases would result in major adverse impacts to traffic operations at some study intersections, as described below (*Intersection Analysis*).

Table 5-61. AM Peak-hour Traffic Volumes, Alternative A

	Alternative A			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	277	190	87	189	127	62	128	104	24
Private Pick-Up/Drop-Off	1,684	842	842	872	436	436	656	328	328
For-hire Vehicles	1,928	964	964	524	262	262	394	197	197
Car Rental	105	57	48	46	28	18	41	26	15
Total Trips	**3,994**	**2,053**	**1,941**	**1,631**	**853**	**778**	**1,219**	**655**	**564**

Table 5-62. PM Peak-hour Traffic Volumes, Alternative A

	Alternative A			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	310	83	227	299	102	197	207	53	154
Private Pick-Up/Drop-Off	1,540	770	770	948	474	474	712	356	356
For-hire Vehicles	2,068	1,034	1,034	862	431	431	648	324	324
Car Rental	92	37	55	45	17	28	36	13	23
Total Trips	**4,010**	**1,924**	**2,086**	**2,154**	**1,024**	**1,130**	**1,603**	**746**	**857**

Comparison to Existing Conditions

Relative to existing conditions, the difference would be 2,775 additional AM peak trips (228 percent) and 2,407 additional PM peak trips (150 percent). These volume increases would result in major adverse impacts to traffic operations.

Curbside Analysis

The anticipated vehicular volumes associated with for-hire and private pick-up and drop-off activities on the deck level and on First and 2nd Streets NE may create conflicts and could lead to queues. In particular, queues may occur at the intersection of the deck-level pick-up and drop-off area and the southeast road/east ramp. As a result, conflicts could occur between for-hire vehicles heading down the east ramp and vehicles seeking to exit onto H Street NE. Queues may slow down vehicle movements in the pick-up and drop-off area and cause delays.

At deck level, queues at the first layby lane next to the train hall on the center road would be located less than 100 feet from H Street NE and could possibly "spill back" onto this street. In the AM peak, the estimated maximum queue length could reach 15 cars. In the PM peak, the estimated maximum queue length could reach 107 cars. This queue would have a major adverse impact on traffic operations. In these conditions, it is possible that WUS users may walk to nearby destinations to find a for-hire vehicle.

The front of WUS, First Street, and 2nd Street would also experience curbside activity. Queues at the front may spill back into travel lanes on Massachusetts Avenue. The pick-up and drop-off lanes on First and 2nd Streets would help accommodate the excess volumes. No queue would form at the First Street or 2nd Street pick-up and drop-off areas. On First Street, 236 pick-ups and drop-offs would occur in the AM peak and 206 would occur in the PM peak. On 2nd Street, 77 pick-ups and drop-offs would occur in the AM peak and 65 would occur in the PM peak.

Intersection Analysis

The impacts of Alternative A on traffic operations were assessed through Synchro modeling. Three indicators were used to assess impacts on traffic operations at each intersection:

- Degradation of intersection LOS to F from a better LOS due to vehicle trips generated by the Project;
- Increase in average vehicle delay of more than 5 seconds; and
- Increase in 95th-percentile queue lengths of more than 150 feet for any lane group at an intersection.[68]

In Alternative A, relative to the No-Action Alternative, seven intersections would degrade to LOS F in at least one peak hour (**Table 5-63**). The peak hour LOS of each intersection are shown in **Figure 5-6**.

Sixteen intersections out of 35 would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative (**Table 5-64**). Of those 16 intersections, eight would experience such a queue increase in both peak hours.

Finally, in Alternative A, 20 of the 35 study intersections would experience an increase in average delay of more than 5 seconds for at least one peak period relative to the No-Action

[68] These indicators align with those used by DDOT in identifying traffic operations impacts as included in *DDOT Guidelines for Comprehensive Transportation Review (CTR) Requirements*, available at https://nacto.org/docs/usdg/comprehensive_transportation_review_ddot.pdf.

Alternative. Fourteen of those 20 intersections would see such an increased delay in both peak hours (**Table 5-65**).

Table 5-66 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and Existing Conditions across the three indicators for traffic operations impacts in Alternative A.

Table 5-63. Intersections with Failing LOS, Alternative A

Int. No.	Intersection Name	Alternative A		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	**North Capitol Street / K Street**	F	**F**	F	E	F	D
2	**First Street / K Street**	F	**F**	F	E	F	E
5	**North Capitol Street / H Street**	F	F	F	F	C	C
6	**WUS West Intersection / H Street NE**	**F**	**F**	B	E	A	A
7	**WUS Bus Exit / H Street NE**	D	**F**	B	A	A	A
8	**WUS East Intersection / H Street NE**	F	C	F	B	B	A
9	**3rd Street / H Street NE**	F	D	F	C	E	C
13	**North Capitol Street / Massachusetts Avenue**	**F**	E	D	D	D	D
17	**First Street / E Street / Mass. Avenue NE**	**F**	C	E	B	D	B
20	**Louisiana Avenue / D Street NW**	F	**F**	F	E	F	F
21	**Louisiana Avenue / North Capitol Street**	F	F	F	F	F	D
32	**3rd Street / Massachusetts Avenue / H Street NW**	E	F	D	F	E	D

Figure 5-6. Intersection Peak Hour LOS, Alternative A

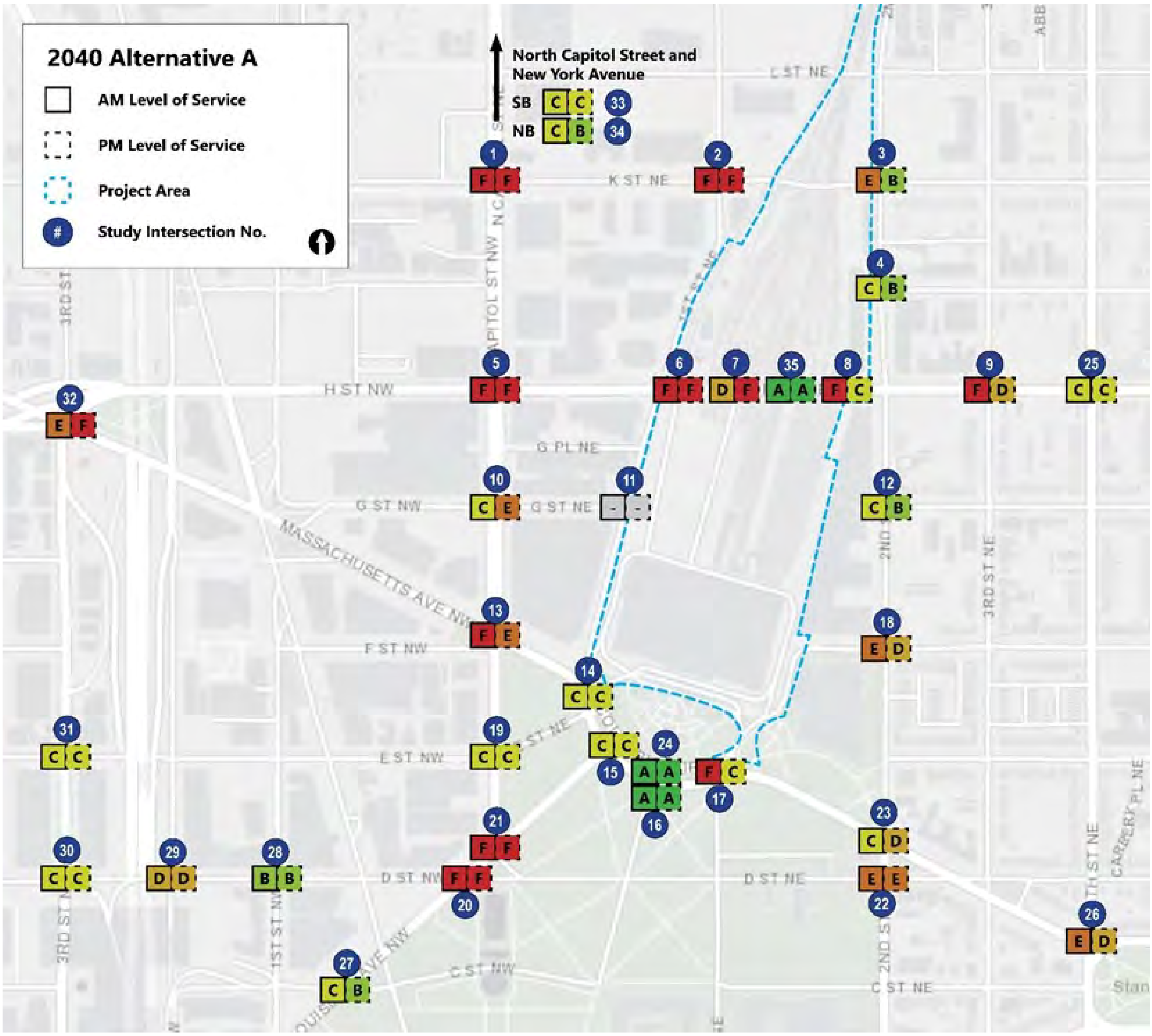


Table 5-64. Intersections with Queue Increase Greater than 150 Feet, Alternative A

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	**North Capitol Street / K Street**	3 / 11	5 / 10	5 / 10	5 / 10
2	**First Street / K Street NE**	1 / 7	2/ 6	1 / 7	3 / 7
3	**2nd Street / K Street NE**	0 / 6	0 / 6	2 / 6	1 / 6
5	**North Capitol Street / H Street**	2 / 10	4/ 10	6 / 9	6 / 6
6	**WUS West Intersection / H Street NE**	3 / 7	3 / 7	3 / 4	3 / 4
7	**WUS Bus Exit / H Street NE**	1 / 3	1/ 3	1 / 3	1 / 3
8	**WUS East Intersection / H Street NE**	1 / 8	0 / 8	-	-
9	**3rd Street / H Street NE**	1/ 8	0 / 8	4 / 8	2/ 8
10	**North Capitol Street / G Street**	4 / 7	3/ 6	3 / 7	3 / 6
13	**North Capitol Street / Massachusetts Avenue**	5 / 10	0 / 10	5 / 10	6 / 10
14	**Massachusetts Avenue / E Street / First Street NE**	0 / 9	0 / 9	1 / 9	0 / 9
15	**Louisiana Avenue / Massachusetts Avenue NE**	0 / 5	0 / 5	3 / 5	0 / 5
16	**Delaware Avenue / Massachusetts Avenue NE**	0 / 3	0 / 3	0 / 3	0 / 3
17	**First Street / Massachusetts Avenue NE**	0 / 7	0 / 7	3 / 7	1 / 7
19	**North Capitol Street / E Street**	3 / 10	0 / 10	2 / 10	2 / 10
20	**Louisiana Avenue / D Street NW**	1 / 7	2 / 7	2 / 7	2 / 7
21	**Louisiana Avenue / North Capitol Street**	1 / 6	0 / 6	1 / 6	3 / 6
22	**2nd Street / D Street NE**	1 / 4	0 / 4	1 / 4	1 / 4
23	**2nd Street / Massachusetts Avenue NE**	0 / 7	1 / 6	2 / 7	2 / 6
25	**4th Street / H Street NE**	0 / 6	0 / 6	2 / 6	0 / 6
26	**Massachusetts Avenue / C Street / 4th Street NE**	0 /5	0 /5	3 /5	2 /5
27	**Louisiana Avenue / C Street NW**	2 / 8	2 / 7	3 / 8	1 / 7
29	**2nd Street / D Street NW**	0 / 4	0 / 4	2 / 5	2 / 5
30	**3rd Street / I-395 On-ramp / D Street NW**	0 / 10	0 / 10	1 / 10	1 / 10
31	**3rd Street / E Street NW**	1 / 11	0 / 10	4 / 11	2 / 10
32	**3rd Street / Massachusetts Avenue/ H St NW**	0 / 6	0 / 6	0 / 6	3 / 6
33	**North Capitol Street (SB Ramp) / New York Avenue**	0 / 6	0 / 6	3 / 6	2 / 6
34	**North Capitol Street (NB Ramp) / New York Avenue**	0 / 6	0 / 6	2 / 6	0 / 6

Table 5-65. Intersections with Delay Increase > 5 seconds, Alternative A

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	144.0	177.5	191.0	213.0
2	First Street / K Street NE	<5	193.5	73.6	211.9
3	2nd Street / K Street NE	21.4	5.0	32.7	6.0
4	2nd Street / I Street NE	< 5	< 5	5.4	< 5
5	North Capitol Street / H Street	57.2	84.4	218.4	350.0
6	WUS West Intersection / H Street NE	78.1	104.6	88.6	153.9
7	WUS Bus Exit / H Street NE	39.3	81.7	51.2	83.2
8	WUS East Intersection / H Street NE	66.8	6.9	227.6	20.6
9	3rd Street / H Street NE	84.2	12.4	128.9	19.6
10	North Capitol Street / G Street	22.2	50.6	20.9	53.9
13	North Capitol Street / Massachusetts Avenue	47.5	13.1	51.4	23.1
15	Louisiana Avenue / Massachusetts Avenue NE	< 5	< 5	8.9	< 5
17	First Street / Massachusetts Avenue NE	55.0	< 5	77.1	5.1
18	2nd Street / F Street NE	22.5	10.5	26.9	12.4
19	North Capitol Street / E Street	6.5	< 5	9.8	< 5
20	Louisiana Avenue / D Street NW	86.0	21.8	< 5	< 5
21	Louisiana Avenue / North Capitol Street	102.6	73.1	280.4	234.5
22	2nd Street / D Street NE	24.1	20.7	20.0	< 5
23	2nd Street / Massachusetts Avenue	< 5	5.0	< 5	8.8
25	4th Street / H Street NE	< 5	< 5	7.8	10.6
26	Massachusetts Avenue / C Street / 4th St NE	30.2	5.4	41.5	6.7
27	Louisiana Avenue / C Street NW	15.5	< 5	21.6	8.7
29	2nd Street / D Street NW	10.1	< 5	< 5	< 5
31	3rd Street / E Street NW	< 5	< 5	5.5	10.9
32	3rd Street / Massachusetts Avenue/ H Street NW	38.7	6.6	24.6	39.2
33	North Capitol Street (SB Ramp) / New York Ave	< 5	< 5	< 5	5.9
35	WUS Central Intersection / H Street NE	< 5	< 5	-	-

Table 5-66. MOE Summary Table, Alternative A

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing Conditions		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	X	X	X	X	X	X
7	WUS Bus Exit / H Street NE	X	X	X	X	X	X
8	WUS East Intersection / H Street NE	A	X	X	X	n/a	X
9	3rd Street / H Street NE	A	X	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	X	X	X	X	X	X
14	Massachusetts Avenue/ E Street / First Street NE	A	A	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	A	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	X	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	X	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	A	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	A	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	X	A	X	A
30	3rd Street / I-395 On-ramp / D Street NW	A	A	A	A	X	A
31	3rd Street / E Street NW	A	X	A	A	X	X
32	3rd Street / Massachusetts Avenue/ H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	X
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	A	A	A	n/a	n/a	n/a

"A" indicates that the degradation in traffic operations, if any, is within an acceptable range. "X" indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative A:

- Eleven intersections would degrade to LOS F in at least one peak period.
- Twenty-six intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 21 projected to do so in both peak hours.
- Twenty-four intersections would experience delay increases of more than 5 seconds, with 18 projected to do so in both peak hours.

5.5.2.2 Indirect Operational Impacts

Alternative A would have minor adverse indirect operational impacts on traffic because of the trips generated by the potential Federal air-rights development.

In Alternative A, approximately 323,720 square feet of air rights above the new parking facility would be potentially available for development, separately from the Project. This is referred to as the "Federal air-rights development." For the purposes of the traffic analysis, it is assumed that in Alternative A, this space, entirely located on top of a multistory parking facility and bus facility and with no opportunity for direct street access, would be used for additional parking and would operate at near capacity. **Table 5-67** shows the trips the Federal air-rights development would generate under this assumption.

Table 5-67. Federal Air-rights Development Trip Generation, Alternative A

	AM Peak			PM Peak		
	Total Trips	**Inbound**	**Outbound**	**Total Trips**	**Inbound**	**Outbound**
Parking	180	90	90	180	90	90

The potential Federal air-rights development would increase the total number of trips generated by Alternative A by approximately 5 percent. These trips were incorporated in the traffic impact analysis presented above.

5.5.2.3 Construction Impacts

Construction of Alternative A would take place over approximately 11 years and 5 months. Work would be conducted in four phases moving from the east side to the west side of the Project Area. Between Phases 1 and 2, there would a 12-month period (Intermediate Phase) when only column removal work in the First Street Tunnel would take place. The intensity and location of construction activities would vary with the phase. The following sections characterize the potential impacts of the construction of Alternative A on the various transportation modes at and near WUS. The discussion focuses on Phase 4 of construction. Phase 4 would have the greatest impacts on transportation because of the demolition of the parking garage and bus facility that would occur during this phase and because of the concentration of construction activities on the west side of WUS, adjacent to Metrorail's Red Line. In Alternative A, Phase 4 would begin approximately 8 years and 4 months after the start of construction and last for approximately 3 years and 1 month.

During each of the four phases, a similar sequence of activities would take place, as described in **Section 3.5.1**, *Construction Phasing and Sequence* of the DEIS. A set of tracks would be taken out of service. Temporary tracks and connections would be constructed as needed to help maintain operations and potentially support the operation of work trains. Cut-off and support walls would be installed, as needed, to support excavation and keep groundwater out. Following excavation, drilled shafts would be constructed to provide deep foundations for the slabs supporting the new tracks and the columns supporting the deck on which the Project elements would stand. As construction moves to the next phase, the deck-level Project elements would be constructed.

Estimated phases durations in Alternative A are shown in **Table 5-68**. The table also shows the estimated duration of excavation activities in each phase. As explained further in the relevant sections, periods of excavation would be when some impacts are most intense or noticeable.

Table 5-68. Construction and Excavation Duration, Alternative A

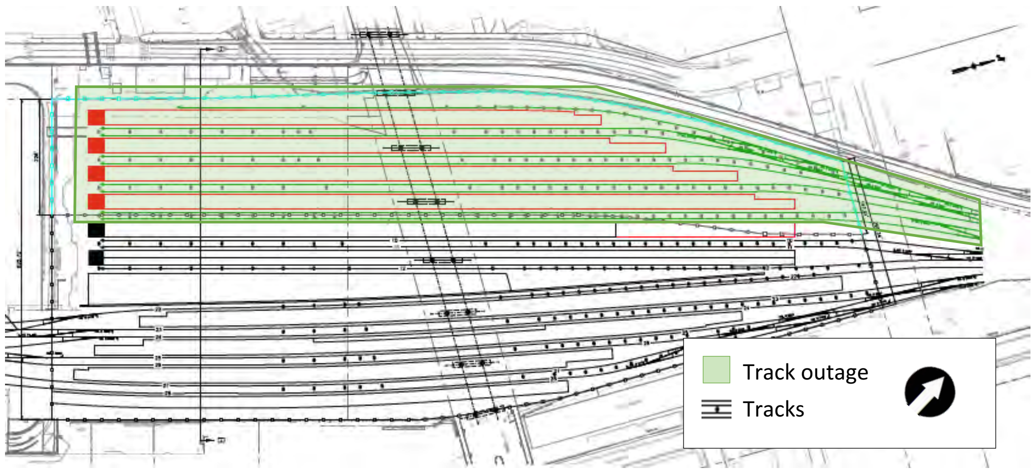
Phase	Overall Duration	Duration of Excavation
Phase 1	2 years, 5 months	5 months
Intermediate Phase	*12 months*	*None*
Phase 2	2 years, 5 months	9 months
Phase 3	2 years,	8 months
Phase 4	2 years, 6 months	1 year, 5 months
Total Project Completion	11 years, 5 months	3 years, 3 months

Commuter and Intercity Railroads

Construction of Alternative A would cause a moderate adverse impact to Intercity and Commuter rail operations. Limited train delays and cancellations may occur during the entire construction period.

Each phase of construction would involve taking a set of tracks out of service, thus reducing the number of tracks and platforms available for train service. As an illustration, **Figure 5-7** illustrates anticipated outages during Phase 4.

Figure 5-7. Track Outages in Construction Phase 4



The provision of temporary tracks and connections would largely make up for this temporary loss. A construction-period operating plan designed to maximize use of the available infrastructure through a flexible approach to train signaling would be put in place. However, railroad operations would be affected, as certain trips would have to be canceled or rescheduled. Anticipated schedule impacts by service by construction phase are shown in **Table 5-69**. These impacts would be the same in all Action Alternatives.

Table 5-69. All Day Train Cancellations and Alterations during Construction, All Action Alternatives

Service	Construction			
	Phase 1 & Intermediate Phase	Phase 2	Phase 3	Phase 4
Amtrak Trains Altered (out of 144 Daily)	0	2	0	1
MARC Canceled (out of 106 Daily)	0	4	0	4
VRE Canceled (out of 34 Daily)	2	2	0	0

Not all services would be affected at the same time and none would be affected during the entire construction period. Impacts on VRE operations would occur only in the first two phases of construction while impacts on Amtrak and MARC service would occur only in Phases 2 and 4. There would be no impacts on any service during Phase 3. Amtrak, MARC, and VRE operations during the entire construction period would meet the levels defined in the 2025 operating plan developed for the Project. This operating plan is consistent with short- to medium-term operator plans (see **Appendix B**, *Washington Union Station Terminal Infrastructure EIS Report*, Section 7.2.3).

In all phases, anticipated service cancellations would represent at most approximately 3 percent of the overall service levels at WUS. While moderate and manageable, this would reduce flexibility and increase delays. Phase 4 of construction would see an average delay to train operations[69] of 6 minutes and 12 seconds. Phase 2 would see larger delays and greater disruptions to train operations. During this phase, a total of 8 trains would be canceled daily. The average train delay would be 18 minutes and 36 seconds. These delays and cancellations would cause disruptions for passengers, most notably VRE passengers, as 6 percent of VRE trains would be canceled.

WMATA Metrorail

Construction of Alternative A would have moderate adverse impacts on WMATA Metrorail Red Line operations due to intermittent stoppages or single-tracking events.

Metrorail's Red Line runs along the western side of the Project Area. Therefore, it would be most affected during Phase 4 of construction period, which is when the First Street Concourse and the First Street entrance to the H Street Concourse would be constructed. Additionally, in Phase 4, the existing parking garage would be demolished and a new Track 37 would be constructed near the NoMA-Gallaudet station.

These construction activities may require schedule adjustments for safety purpose. Intermittent stoppages or single-tracking may occur on weeknights or weekends. Such impacts would occur throughout Phase 4 (see **Table 5-68** above for the duration of Phase 4 in Alternative A) and their exact frequency or duration are not known at this stage of planning. No extended shutdowns or periods of single-tracking are anticipated by the constructability analysis conducted for the Project. This constraint is reflected in the construction scheduling.

During the same period, the unavailability of parking between the demolition of the existing garage and the completion of the new parking facility (See *Vehicular Parking and Rental Cars* below) would likely generate up to 350 additional daily Metrorail trips when the station is open. This would not cause noticeable overcrowding as those trips would be distributed over the entire day.

DC Streetcar

Construction of Alternative A would have moderate adverse impacts on DC Streetcar operations due to temporary disruptions to direct access between the WUS Streetcar station and WUS.

DC Streetcar operations would be affected during Project construction if the H Street Bridge were to be closed for safety reasons. Such closures are not likely and if they did occur, they would be rare and of limited duration. Construction of the Project elements and demolition

[69] This is the average delay that a scheduled train would experience due to the construction. This metric does not include canceled trains.

of the existing parking garage may result in a loss of direct access between the WUS Streetcar station and WUS, including the Metrorail Station, during certain times. Such adverse impacts would be moderate because of their limited duration.

Intercity, Tour/Charter, and Sightseeing Buses

Construction of Alternative A would have major adverse impacts on bus operations and bus passenger accommodations.

Impacts on intercity, tour/charter, and daily sightseeing bus operations would be concentrated in Phase 4 of construction, which would last for approximately 3 years and 1 month and begin approximately 8 years and 4 months after the start of construction. During Phase 3, the relocation of the facility within the existing structure would create some disruptions but operations would be able to continue. During Phase 4, however, the entire existing bus facility and parking garage would be demolished to construct the new structure.

During Phase 4, without an adequately-sized interim bus facility or loading zones near WUS, intercity, tour/charter, and sightseeing bus service at WUS would be severely disrupted. Adverse impacts would be major. At this stage of planning, no location for an interim bus facility or suitable loading zones have been identified. Buses serving WUS would have to operate within the surrounding street grid. As explained in **Section 3.1.6.1**, *Bus Program Size*, a bus program of at least 25 slips would be needed to adequately accommodate future bus service, reduced from 47 slips through the implementation of an active management approach. Because street accommodations may not lend themselves to the type of active management required by the reduced program, it can be estimated that on-street space equivalent to 25 to 47 bus slips would be needed to accommodate bus activity at WUS.

Based on a bus length of 45 feet and adding 25 percent to account for separation and maneuvering room, it would take approximately from 1,400 to 2,600 feet of linear curbside to provide the equivalent of 25 to 47 slips. For purposes of illustration, this would amount to the entire length of First Street NE from the front of WUS to at least I Street NE and as far as north of L Street NE. Alternatively, along Massachusetts Avenue, it would take the portion of the avenue from the southwest corner of WUS to at least New Jersey Avenue NW and up to H Street NW.

Even though the needed space could be divided among several streets, the street grid around WUS would not be able to support this level of bus activity without major disruptions to vehicular traffic, on-street parking, and pedestrians and bicycle movements. The District, or the adjacent property owners such as the Architect of the Capitol (to the south of WUS), are unlikely to authorize bus companies to operate in these conditions. Additionally, even if authorized, on-street operations would cause a severe deterioration in passenger experience, with longer walking distances to and from WUS; unsheltered boarding or alighting areas; and lack of basic amenities for waiting passengers such as restrooms or benches. As a result, it is likely that some or most bus service would be displaced away from WUS, reducing multimodal connectivity at the station for several years.

Loading

Construction of Alternative A would have a major adverse impact on loading operations and facilities.

The east loading facility, which is accessed from H Street NE, would remain open for operation during the majority of the Alternative A construction period. However, the west loading dock would be closed in Phase 4 when construction activities would occur nearby. The new loading dock at 2nd and K Streets NE would not be operational until the end of the construction period because of the need to use the area for material laydown and storage.

Because of these constraints, large truck loading on-site would be limited. Small trucks would have to be used instead. A facility to transfer and screen large loads to smaller trucks would be needed. At this stage of planning, the location of this temporary facility has not been determined.

Pedestrians

Construction of Alternative A would have moderate adverse impacts on pedestrian traffic.

Throughout the construction period, circulation within WUS would be affected as tracks and platforms are replaced; sections of the station are closed to allow for column removal in the First Street Tunnel; and new concourses and access points are built. The intensity of the impacts would vary with the phase but would be greatest during Phases 1 and 2, when the column removal work is ongoing, and during Phase 4, because of interior construction activities on the west side of the site. Access to the Metrorail station from within WUS may also be affected.

Externally, throughout the construction period, street and sidewalk segments around WUS would be subject to temporary closures. The affected areas would include the front of the historic station building during the upgrade of the pick-up and drop-off lanes; and First Street NE, G Street, NE, and 2nd Street NE, as multimodal facilities are constructed there. Construction traffic (up to 120 trucks a day during periods of excavation; see **Table 5-68** above for durations)[70] may also make pedestrian movements more challenging and generate conflicts along truck routes, especially 2nd Street NE.

Bicycles

Construction of Alternative A would have a major adverse impact on bicycle circulation during the reconstruction of the First Street Cycle Track.

During Phase 4 of construction, portions of First Street NE would be rebuilt. This would involve reconstructing the existing First Street cycle track to safely accommodate new pick-up and drop-off areas on First Street. While this work is being performed, it would not be

[70] See **Section 5.7**, *Avoidance, Minimization, and Mitigation Evaluation* for proposed mitigation of this truck traffic.

possible to maintain a bicycle accommodation along the First Street corridor. It is expected that bicyclists would be rerouted to the 2nd Street shared-use path portion of the Metropolitan Branch Trail. How long disruption of the cycle track would last is not known at this time but it would likely be less than the full duration of Phase 4. Temporary road closures around WUS would also disrupt bicycle circulation, as described above for pedestrians.

City and Commuter Buses

Construction of Alternative A would have negligible adverse impacts on city and commuter bus operations as there would only be intermittent disruptions. Construction would have a moderate adverse impact on employee shuttles operating out of the WUS bus facility for the duration of Phase 4.

Construction activities would not significantly affect commuter bus activities. Most commuter bus service in the area serves North Capitol Street and the Columbus Circle area, where the larger transportation network would absorb the construction truck traffic and where there would be no direct access to the site. City bus operations could be disrupted if H Street NE were to be closed for safety reasons. Specific information on the frequency and duration of these possible closures is not available at this time but long-term disruptions to H Street NE are not anticipated.

Employees shuttle operations out of the existing bus facility would have to stop in Phase 4, when the facility would be demolished. These shuttle would need to look for a new pick-up and drop-off location. As explained in **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses*, this would become a permanent condition since the shuttles could not be accommodated in the new facility. For the reasons explained in that section, this would be a moderate adverse impact.

Vehicular Parking and Rental Cars

Construction of Alternative A would have a major adverse impact on parking in the period between the demolition of the existing parking garage and the completion of the new one in Phase 4 of construction.

Major impacts to parking and rental car operations would occur in Phase 4 of construction, when demolition of the existing parking garage would occur. There would be a partial loss of parking capacity during Phase 3, as partial demolition of the garage would begin but it is only during Phase 4, which would last for approximately 3 years and 1 month and begin approximately 8 years and 4 months after the start of construction that parking would be entirely unavailable at WUS. During that time, the Project's parking program of 1,600 spaces would not be met. This program covers Union Station Redevelopment Corporation (USRC)'s obligation, under current lease agreements, to provide 600 parking spaces to serve retail activities at WUS as well as 900 additional spaces. It also provides for 75 spaces for rental cars. [71]

To meet the program, interim parking would have to be provided starting in Phase 3. At the current stage of planning, no potential location or locations have been identified. Without an adequately-sized interim parking location, parking, including rental car parking, would be unavailable at WUS during Phase 4 until the new parking facility is completed, resulting in a major adverse impact on parking.

The loss of parking capacity would likely lead WUS visitors or passengers to use alternative modes of transportation, including Metrorail, for-hire vehicles, and private pick-ups and drop-offs. Based on projected mode distribution, this shift would generate an estimated 581 daily Metrorail trips, 431 daily for-hire trips, and 431 daily private pick-up and drop-off trips.[72] Given the overall daily volumes of these modes, the added trips would be manageable.

WUS-bound drivers may also seek parking in commercial parking facilities nearby or on the streets around the station. While the above estimate is based on a reasonable assumption that the reduction in parking capacity would lead to increases in Metrorail, for-hire, and private pick-up and drop-off trips, it is possible that a number of WUS-users would still drive to the station, including users from areas not well served by transit, who may have a limited set of options. If these drivers represented 50 percent of the demand, then the demand in the commercial market for parking would be approximately 530 daily spaces. Street parking near WUS is in very limited supply, as most streets within a quarter mile of the station are residential parking permit areas,[73] two-hour parking areas, or monitored parking areas on Architect of the Capitol property. Therefore, no WUS passengers or visitors are likely to be able to use street parking for long-term parking. There may be some demand for local on-street parking from WUS retail patrons. During Phase 4, the lack of parking at WUS may make the station unusable by anyone who would lack other options to reach it.

For-hire Vehicles

Construction of Alternative A would have a major adverse impact on for-hire vehicle operations because of extended queueing.

Passenger pick-up and drop-off in front of the historic station building by for-hire vehicles would remain available during most of the construction period, although some disruption

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71 **Appendix A6**, *Parking Program Memorandum*, provides more information on parking demand projection and the development of the parking program.

72 Because of the anticipated disruption in Metrorail service during Phase 4, however, fewer people may use Metrorail as an alternative mode of travel than modeled.

73 District Department of Transportation. 2018. RPP/ANC Map. Accessed from https://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/RPP_blocks_ANC.pdf. Accessed on September 4, 2018.

would occur when the taxi and private pick-up and drop-off lanes (used by TNC vehicles) would be improved to enhance traffic flow and promote pedestrian safety. The existing loop road along the back of the station building would be unavailable during the entire period of construction. Therefore, the east ramp currently used by taxis to reach the front of the station would not be accessible until the new southeast road and reconstructed east ramp are completed during Phase 2. Taxis would have to queue along the west ramp as they do today when the east ramp is not available. During Phase 4, the west ramp would be closed for repurposing and taxis would have to queue along the new southeast road on the deck level and the east ramp (both available after completion of Phases 1 and 2). The east ramp would be used for the entirety of Phase 4. The loss of parking likely would result in an uptick in for-hire operations (see *Vehicular Parking and Rental Cars* above), which would contribute to the adverse impact on these operations during Phase 4.

Private Pick-up and Drop-off

Construction of Alternative A would have a moderate adverse impact on private pick-up and drop-off operations.

Private pick-up and drop-off would remain available in front of WUS during the construction period. The reconstruction of the traffic lanes to enhance traffic flow and promote pedestrian safety would require the temporary closure of parts of the pick-up and drop-off area, although some spaces would remain available at all times. Therefore, this adverse impact would be moderate. As noted above, the loss of parking likely would result in an uptick in private pick-up and drop-off operations (see *Vehicular Parking and Rental Cars* above), which would contribute to the adverse impact on these operations during Phase 4.

Vehicular Traffic

Construction of Alternative A would have a major adverse impact on vehicular traffic operations because of roadway closures and construction vehicle traffic.

In Alternative A as in all Action Alternatives, construction activities at WUS would generate traffic to and from the site throughout the day during the entire construction period, although the volume and nature of this traffic would vary depending on the phase and type of activities being conducted. It would be minimal during the Intermediate Phase, when only column-removal work would be performed. It would be greatest during excavations activities, when up to 120 trucks per 20-hour day could be traveling to and from the site. This is a maximum, conservative estimate that assumes that no work trains would be used to haul spoils away. Use of two work trains a day would eliminate most of this truck traffic. Additionally, while each construction phase (excluding the Intermediate Phase) would include a period of excavation and associated truck traffic, that period would be substantially shorter than the phase itself, as shown in **Table 5-68** above. The longest period of excavation (approximately 1 year and 5 months) would occur during Phase 4, on the west side of the Project Area. During that time, most truck traffic would travel on First Street NE to connect to designated District truck routes along the North Capitol Street and New York Avenue corridors. Phase 1, on the east side of the Project Area, would have the shortest excavation period (approximately 5 months). During that period, trucks would likely travel along portions of 2nd Street NE before connecting to a designated truck route. No trucks would circulate along residential streets or any other street not designated as a truck route by the District.

As WUS would remain operational throughout the construction period, construction traffic would add to the traffic generated by users of the station. By the time of Phase 4, WUS would generate similar levels of vehicular traffic to what it is expected to do in the No-Action Alternative. Although construction traffic would add to total traffic volumes on major WUS access routes, it would be spread out across the entire day, reducing its impact on local traffic operations.

At different times during the construction period, temporary roadway closures would be required, especially along First Street NE (between Columbus Circle and K Street) and 2nd Street NE (between Massachusetts Avenue and K Street), to accommodate construction traffic in and out of the construction site. Road closures would generally last from 5 to 6 minutes on average and no more than 20 minutes. During those times, traffic may temporarily move to other streets such as G Street, H Street, K Street, 4th Street NE, and North Capitol Street.

5.5.3 Alternative B

The following sections describe the direct, indirect, operational and construction impacts of Alternative B. **Figure 5-8** illustrates the transportation elements of Alternative B.

5.5.3.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative B would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

<u>Intercity Railroad Service</u>

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Intercity Railroad Service.*

<u>MARC</u>

Impacts would be the same as those of Alternative A and the other Action Alternatives. They are described in **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, MARC*.

Figure 5-8. Key Transportation Element Locations, Alternative B

VRE

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, VRE*.

Private Train Cars

Relative to the No-Action Alternative, Alternative B would have no direct operational impact on private train car operations.

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Private Train Cars*.

WMATA Metrorail

Relative to the No-Action Alternative, Alternative B would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would aggravate train overcapacity and station circulation issues.

Increased train service and ridership in Alternative B, as well as the reduction in parking capacity and the provision of new retail uses, would generate increased demand on Metrorail at WUS. Modeled AM peak and PM peak activity is shown in **Table 5-70** and **Table 5-71**.

Table 5-70. AM Peak WUS-related Metrorail Activity, Alternative B

	Alternative B		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[74]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,402	1,631	5,202	1,010	2,802	528
WUS Alightings	5,123	3,478	4,128	2,803	923	3,644
Through Ridership[75]	9,141	1,241	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,543	2,8721	14,725	2,457	10,378	1,955
V/C Departing WUS	102%	17%	86%	14%	69%	13%
Excess Passengers	400	0	0	0	0	0

74 Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

75 "Through ridership" refers to riders who neither board nor alight at WUS but ride the Red Line train through the WUS Metrorail Station.

Table 5-71. PM Peak WUS-related Metrorail Activity, Alternative B

	Alternative B		No-Action Alternative		Existing Conditions	
	Shady Grove	**Glenmont**	**Shady Grove**	**Glenmont**	**Shady Grove**	**Glenmont**
Passengers Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS	20%	115%	20%	107%	19%	72%
WUS Boardings	3,263	4,670	2,559	3,661	3,265	918
WUS Alightings	1,560	8,276	1,154	6,126	582	3,090
Through Ridership	1,640	9,883	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,903	14,533	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Passengers	0	2,421	0	1,110	0	0

In Alternative B, 2040 volumes would exceed capacity in the Shady Grove direction departing from WUS during the AM peak and in the Glenmont direction arriving at WUS during the PM peak.

In the AM peak, Alternative B would cause the V/C ratio leaving WUS toward Shady Grove to reach 102 percent, against 86 percent in the No-Action Alternative. As a result, Alternative B would increase the excess demand by approximately 400 passengers. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate in the Red Line core. [76]

In the PM peak, capacity exceedance toward Glenmont (115 percent arriving at WUS) would be greater in Alternative B than in the No-Action Alternative (107 percent). Alternative B would aggravate the level of crowding and generate an additional demand of 1,311 seats, for a total excess demand of 2,421.

In the PM peak departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative B would cause no additional exceedance of this threshold relative to the No-Action Alternative.

The increase in Metrorail ridership at WUS would also affect passenger circulation as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail.*

<u>Comparison to Existing Conditions</u>

Relative to existing conditions, Alternative B would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

[76] That is, between WUS and Dupont Circle.

In the AM peak, Alternative B would cause the V/C ratio leaving WUS toward Shady Grove to reach 102 percent, against 69 percent in existing conditions. Alternative B would increase the overall demand in the AM peak in the Shady Grove direction by an estimated 7,165 passengers. In the PM peak, the V/C ratio toward Glenmont arriving at WUS would be 115 percent, against 72 percent under existing conditions. Alternative B would increase overall demand in this direction by approximately 8,211 passengers.

The increase in Metrorail ridership at WUS would also affect passenger circulation relative to existing conditions as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail, Comparison to Existing Conditions.*

DC Streetcar

Relative to the No-Action Alternative, Alternative B would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Alternative B would generate the same level of additional Streetcar ridership as Alternative A, presented in **Section 5.5.2.1**, *Direct Operational Impacts, DC Streetcar.*

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative B would have a moderate adverse direct operational impact on intercity, tour/charter, and daily sightseeing bus operations because of the new 30-minute time limit for buses at WUS. Alternative B would have a negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

In Alternative B, the bus facility would be located at approximately the same location as the existing facility. It would be accessed via the west intersection on H Street NE. Exit would be via a ramp east of the intersection, close to the existing ramp. All intercity, tour/charter, and daily sightseeing buses that serve WUS would use this facility.

The anticipated increases in bus ridership and impacts of the 30-minute time limit required because of the reduction in the number of slips relative to the existing facility would be the same as those of Alternative A. These impacts are described in **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*.

Loading

Relative to the No-Action Alternative, Alternative B would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

The impacts of Alternative B on loading would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Loading.*

Pedestrians

Relative to the No-Action Alternative, Alternative B would have a major beneficial direct operational impact on pedestrian circulation inside WUS. Additional access points to WUS would disperse pedestrian traffic and make access to WUS easier. Outside of WUS, Alternative B would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

The adverse and beneficial impacts of Alternative B on pedestrian movements would be generally the same as those of Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians.* Because of the location and layout of the new parking facility, however, walking distances may increase relative to No-Action Alternative conditions for some visitors if they park near the northern end of the facility and want to get to the front of WUS. This would affect only a relatively small number of people. Most passengers would have access to the concourses and platforms at the level of H Street NE and would not have to walk to the front of the station.

Bicycle Activity

Relative to the No-Action Alternative, Alternative B would result in a minor adverse direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be offset by increased conflicts with pedestrians and vehicles on both First Street and K Street NE.

Alternative B would have the same impacts on bicycle activity as Alternative A, described in **Section 5.5.2.1**, *Direct Operational Impacts, Bicycle Activity.* Additionally, the entrance to the below ground parking facility on K Street NE would create conflicts with proposed K Street bicycle facilities. This adverse impact on K Street, combined with the other adverse impacts described for Alternative A, which would also occur in Alternative B, would offset the benefits from additional storage. On balance, net impacts would be adverse but minor.

City and Commuter Buses

Relative to the No-Action Alternative, Alternative B would have a minor adverse direct operational impact on city and commuter buses. Increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delays experienced by all buses. There would also be a moderate adverse direct operational impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

The impacts of Alternative B on city and commuter bus ridership would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses.*

As in Alternative A and the other Action Alternatives, increases in vehicle delays and queues due to greater traffic volumes would likely affect bus reliability and speeds due to the overall degradation of traffic operations. In Alternative B, out of the 13 Metrobus routes that serve the Local Study Area, four in the AM peak and four in the PM peak would pass through at least two intersections that would degrade to LOS F relative to the No-Action Alternative, a potential source of delays. One DC Circulator routes and seven commuter bus routes (out of nine) would be similarly affected but in the PM peak only. Conditions would be similar to those in the No-Action Alternative, though delays may be slightly greater.

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative B would have a minor adverse direct operational impact on parking at WUS because of a reduction in parking capacity. Alternative B would have a minor beneficial direct operational impact on rental car operations.

In Alternative B, all parking and rental car activity would be in a below-ground facility located beneath the railroad tracks south of K Street NE. The below-ground parking facility would be accessed via a new signalized intersection on K Street NE between First Street and 2nd Street NE. While this would change the routes WUS-bound drivers would take to travel to or from the parking facility and affect the local street network, the change in location by itself would not adversely affect parking or car rental activities.

The new parking facility would offer space for approximately 450 fewer cars than the existing one. The reduction in parking capacity would be an adverse impact but the new parking facility would exceed the parking program for the Project. It still would not fully meet the projected parking demand but it is anticipated that users not able to park would use different modes to reach the station.[77] By 2040, fewer passengers or visitors are anticipated to drive and park at WUS. [78] The impacts of the reduction in parking capacity on other modes of travel were considered in the impact analyses conducted for those modes.

WUS activity in Alternative B would generate more peak-hour parking trips than would be the case under the No-Action Alternative, as shown in **Table 5-72**. Though parking capacity in Alternative B would be less than in the No-Action Alternative, the increase in peak hour train volumes would increase peak hour parking trips. Relative to the No-Action Alternative, Alternative B would generate an estimated 188 additional peak-hour trips (39 percent

[77] **Appendix A6**, *Parking Program Memorandum*, provides more information on parking demand projections and the development of the parking program.

[78] The MWCOG Model estimates a 10% reduction in single-occupancy vehicle trips in the WUS area to 2040.

increase): 132 in the AM peak hour (70 percent increase) and 56 in the PM peak hour (20 percent increase). These trips were considered in the traffic impact analysis.

Table 5-72. Peak-hour Parking Trips, Alternative B

	Alternative B		No-Action Alternative		Existing Conditions	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Ins	211	104	127	102	104	53
Outs	110	251	62	197	24	154
Total	**321**	**355**	**189**	**299**	**128**	**207**

Alternative B would generate the same number of additional rental car trips relative to the No-Action Alternative as Alternative A. These trips are shown in **Table 5-57**. As in Alternative A and the other Action Alternatives, the design of the new rental car facility would address the capacity issues that would occur in the No-Action Alternative, resulting in a beneficial impact. This beneficial impact would be minor, being partially offset by the increase in operations.

Comparison to Existing Conditions

The impacts of Alternative B on parking and rental car activity would be the same relative to existing conditions as relative to the No-Action Alternative since the existing parking garage and rental car facility would be in use in both baselines. The reduction in parking capacity would be the same relative to existing conditions as relative to the No-Action Alternative.

Alternative B would generate proportionately more peak-hour parking trips relative to existing conditions than relative to the No-Action Alternative. In the AM peak, the difference between Alternative B and existing conditions would be 193 trips (151 percent increase). In the PM peak, the difference would be 148 trips (72 percent increase).

With regard to rental cars, as in Alternative A, in the AM peak, the number of trips would increase by 64 (156 percent). In the PM peak, trips would increase by 56 (156 percent).

For-hire Vehicles

Relative to the No-Action Alternative, Alternative B would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative B would also have a major adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The following five pick-up and drop-off locations would be provided (see **Figure 5-7**). The first four of these pick-up and drop-off locations would also be present in Alternative A:

- **Front of WUS:** See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative B, a projected 40 percent of for-hire drop-off activity and 30 percent of for-hire pick-up activity is anticipated to occur in front of WUS.
- **Adjacent to the north-south train hall on the deck level:** See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative B, a projected 35 percent of for-hire drop-off activity and 25 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on First Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative B, 20 percent of for-hire drop-off activity and 20 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on 2nd Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative B, an anticipated 5 percent of for-hire drop-off activity and 5 percent of for-hire pick-up activity would occur at this location.
- **New below-ground parking facility:** For-hire vehicles serving the below-ground parking facility would access it via a new intersection on K Street NE, between First Street and 2nd Street NE. In Alternative B, a projected 20 percent of for-hire pick-up activity would occur in the underground parking facility; no for-hire drop-off activity would be permitted in the facility.

Table 5-73 shows the number of anticipated peak-hour WUS-related for-hire trips in Alternative B. [79] Relative to the No-Action Alternative, Alternative B would generate an estimated 1,412 new for-hire trips (270 percent increase) in the AM peak hour and an estimated 1,212 new for-hire trips in the PM peak hour (141 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity. The impacts of these trips were considered in the traffic impact analysis.

Table 5-73. Peak-hour For-hire Trips, Alternative B

	Alternative B		**No-Action Alternative**		**Existing Conditions**	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	968	1,037	262	431	197	324
Outs	968	1,037	262	431	197	324
Total	**1,936**	**2,074**	**524**	**862**	**394**	**648**

79 A single for-hire pick-up or drop-off trip creates both an in and an out trip as the vehicle arrives and then departs WUS. A single for-hire vehicle pick-up or drop-off is assumed to generate 1.5 trips to reflect the linking of trips in the WUS circulation network.

Impacts from queuing and congestion would be as described for Alternative A in **Section 5.5.2.1,** *Direct Operational Impacts, For-hire Vehicles*. Curbside analysis for Alternative B is presented in **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis.*

Comparison to Existing Conditions

The impacts of Alternative B on for-hire vehicle activities would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative B would generate an estimated 1,542 new for-hire trips in the AM peak hour (391 percent increase) and 1,426 new for-hire trips in the PM peak hour (220 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative B would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for these activities. These locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips, but queuing may occur. Alternative B would also have a major adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

The same locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be allowed to use the east ramp to the front of WUS. The anticipated distribution of trips would be the same as for for-hire vehicles trips.

Table 5-74 shows the anticipated number of WUS-related peak-hour private pick-up and drop-off trips in Alternative B. [80] Relative to the No-Action Alternative, Alternative B would generate estimated 824 additional trips in the AM peak hour (94 percent increase) and 598 in the PM peak hour (63 percent increase). The principal source of increased peak-hour private pick-up/drop-off trips would be the increase in intercity rail activity. The impacts of these trips were considered in the traffic impact analysis.

Table 5-74. Peak-hour Private Pick-up and Drop-off Trips, Alternative B

	Alternative B		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	848	773	436	474	328	356
Outs	848	773	436	474	328	356
Total	**1,696**	**1,546**	**872**	**948**	**656**	**712**

80 A single private pick-up or drop-off vehicle generates two trips: one in and one out as the vehicle arrives and then departs WUS.

Impacts from queuing and congestion would be as described for Alternative A in **Section 5.5.2.1,** *Direct Operational Impacts, Private Pick-up and Drop-off*. Curbside analysis is described in **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis.*

<u>**Comparison to Existing Conditions**</u>

As in Alternative A, the beneficial impacts of Alternative B on private pick-up and drop-off activity would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative B would generate an estimated 1,040 additional trips in the AM peak hour (158 percent increase) and 834 in the PM peak hour (117 percent increase). The principal source of increased peak-hour private pick-up/drop-off trips is the increase in intercity rail activity.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative B would have major adverse direct operational impacts on traffic operations at several intersections near WUS because of increased traffic volumes and changes in traffic patterns due to the new parking facility location. During at least one of the peak periods, out of 36 intersections in the Local Study Area, four would degrade to LOS F; 15 would experience an increase in queue length of more than 150 feet; and 21 would experience an increase in average delay of more than 5 seconds.

<u>**Trip Generation and Circulation**</u>

WUS-related vehicular activity in Alternative B would be primarily distributed across five locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility and new pick-up/drop-off location accessed from H Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse);
- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse); and
- The new below-ground parking facility accessed from K Street NE.

All parking and rental car activity would be in the below-ground parking facility. Relative to the No-Action Alternative, this would redirect all parking facility and rental car traffic from H Street NE or the east ramp to K Street NE. Private and for-hire pick-up and drop-off activity would be spread across all five locations. Approximately 70 percent of WUS-related traffic is expected to travel to and from points west of WUS, with 30 percent traveling to and from points east of WUS. Anticipated circulation patterns on the deck level in Alternative B are represented in **Figure 5-9**. [81]

Table 5-75 shows the anticipated distribution of WUS-related vehicular trips by access point and type of trip in Alternative B.

Table 5-76 and **Table 5-77** show AM and PM peak WUS-related traffic volumes in Alternative B, respectively, along with the corresponding information for the No-Action Alternative and existing conditions.

Table 5-75. Trip Distribution by WUS Access Point and Trip Type, Alternative B

	First Street	2nd Street	Front of WUS	K Street	H Street
For-hire Drop-Off	20%	5%	40%	0%	35%
For-hire Pick-Up	20%	5%	30%	20%	25%
Private Car Drop-off/Pick-up	20%	5%	40%	0%	35%
Parking	0%	0%	0%	100%	0%
Rental Car	0%	0%	0%	100%	0%

Table 5-76. AM Peak-hour Traffic Volumes, Alternative B

	Alternative B			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	321	211	110	189	127	62	128	104	24
Private Pick-Up/Drop-Off	1,696	848	848	872	436	436	656	328	328
For-hire Vehicles	1,936	968	968	524	262	262	394	197	197
Car Rental	105	57	48	46	28	18	41	26	15
Total Trips	**4,058**	**2,084**	**1,974**	**1,631**	**853**	**778**	**1,219**	**655**	**564**

[81] Figure 5-9 shows all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Figure 5-9. Deck Level Circulation (All Movements), Alternative B

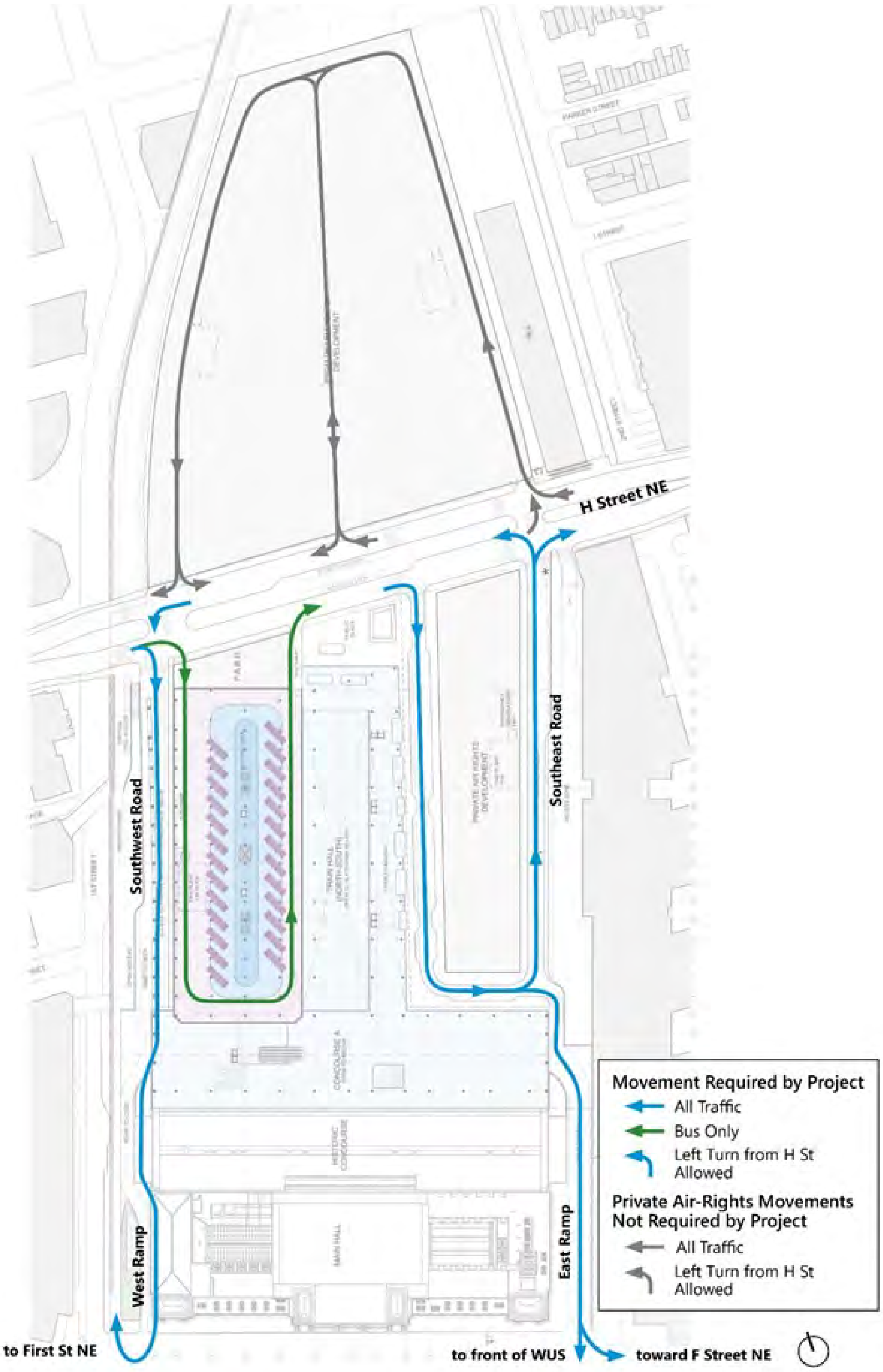


Table 5-77. PM Peak-hour Traffic Volumes, Alternative B

	Alternative B			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	355	104	251	299	102	197	207	53	154
Private Pick-Up/Drop-Off	1,546	773	773	948	474	474	712	356	356
For-hire Vehicles	2,074	1,037	1,037	862	431	431	648	324	324
Car Rental	92	37	55	45	17	28	36	13	23
Total Trips	**4,067**	**1,951**	**2,116**	**2,154**	**1,024**	**1,130**	**1,603**	**746**	**857**

Compared to the No-Action Alternative, Alternative B would generate 2,427 additional AM peak trips (149 percent) and 1,913 additional PM peak trips (89 percent increase). These volume increases would result in major adverse impacts to traffic operations. An operational analysis of the local traffic network is presented below under *Intersection Analysis.*

Comparison to Existing Conditions

Relative to existing conditions, Alternative B would generate 2,839 additional AM peak trips (233 percent increase) and 2,464 additional PM peak trips (154 percent increase).

Curbside Analysis

The anticipated volumes associated with for-hire and private pick-up and drop-off activity would potentially create conflicts and queueing. At deck level, queues at the first layby lane next to the train hall on the center road would be located less than 100 feet from H Street NE and could possibly "spill back" onto this street. In the PM peak, the estimated maximum queue length could reach 103 cars. This queue would have a major adverse impact on traffic operations. In these conditions, it is possible that WUS users may walk to nearby destinations to find a for-hire vehicle.

The front of WUS, First Street, and 2nd Street would also experience curbside activity. Queues at the front may spill back into travel lanes on Massachusetts Avenue. The pick-up and drop-off lanes on First and 2nd Streets would help accommodate the excess volumes. No queue would form at the First Street or 2nd Street pick-up and drop-off areas. On First Street, 257 pick-ups and drop-offs would occur in the AM peak and 225 would occur in the PM peak. On 2nd Street, 78 pick-ups and drop-offs would occur in the AM peak and 67 would occur in the PM peak. An estimated 93 pick-ups and drop-offs in the AM peak and 82 pick-ups and drop-offs in the PM peak would use the below-ground facility accessed from K Street NE.

Intersection Analysis

As with all Action Alternatives, three indicators were used to assess impacts on traffic operations in Alternative B relative to the No-Action Alternative: degradation of intersection LOS to F due to vehicle trips generated by the alternative; increase in average vehicle delay at an intersection by more than 5 seconds; and increase in 95th-percentile queue lengths of more than 150 feet for any lane group in an intersection.

Table 5-78 shows the intersections that would operate at LOS F in Alternative B. The peak hour LOS of each intersection are shown in **Figure 5-10** below. In Alternative B, out of 36 intersections in the Local Study Area, four would degrade to LOS F during at least one peak hour relative to the No-Action Alternative.

Table 5-79 shows a list of intersections with unacceptable queue increases. Fifteen intersections out of 36 study intersections would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Eight would experience such a queue increase in both peak hours.

Table 5-80 shows study intersections with projected delay increases exceeding 5 seconds compared to the No-Action Alternative. In Alternative B, 21 of the 36 study intersections would experience an increased delay relative to the No-Action Alternative of more than 5 seconds in at least one peak period. Sixteen would see such a delay increase in both peak hours.

Table 5-81 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and Existing Conditions across the three indicators for traffic operations impacts in Alternative B.

Table 5-78. Intersections with Failing LOS, Alternative B

Int. No.	Intersection Name	Alternative B		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	**North Capitol Street / K Street**	F	**F**	F	E	F	D
2	**First Street / K Street**	F	**F**	F	E	F	E
5	**North Capitol Street / H Street**	F	F	F	F	C	C
6	**WUS West Intersection / H Street NE**	E	**F**	B	E	A	A
8	**WUS East Intersection / H Street NE**	F	B	F	B	A	A
9	**3rd Street / H Street NE**	F	D	F	C	E	C
17	**First Street / Mass. Avenue NE (WUS Entrance)**	**F**	C	E	B	D	B
20	**Louisiana Avenue / D Street NW**	F	E	F	E	F	F
21	**Louisiana Avenue / North Capitol Street**	F	F	F	F	F	D
32	**3rd Street / Massachusetts Avenue/ H Street NW**	E	F	D	F	E	D

Figure 5-10. Intersection Peak Hour LOS, Alternative B

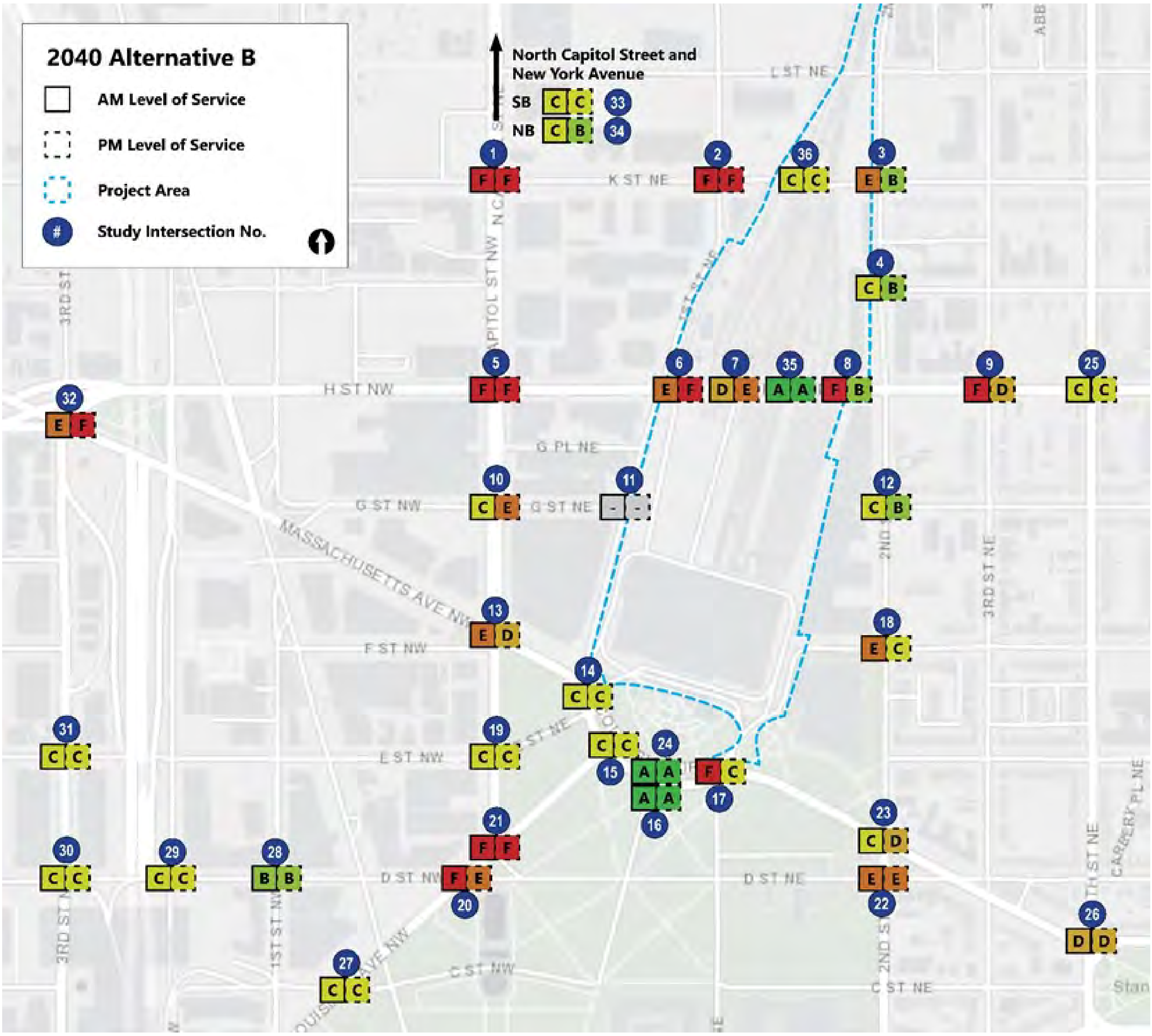


Table 5-79. Intersections with Queue Increase > 150 Feet, Alternative B

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	North Capitol Street / K Street	3 / 11	5 / 9	7 / 10	7 / 9
2	First Street / K Street NE	1 / 7	3 / 6	2 / 7	4 / 7
3	2nd Street / K Street NE	0 / 6	0 / 6	2 / 6	1 / 6
5	North Capitol Street / H Street	4 / 10	2 / 10	9 / 9	6 / 6
6	WUS West Intersection / H Street NE	3 / 7	3 / 7	3 / 4	3 / 4
7	WUS Bus Exit / H Street NE	1 / 3	1 / 3	1 / 4	1 / 4
8	WUS East Intersection / H Street NE	1 / 8	0 / 8	-	-
9	3rd Street / H Street NE	2 / 8	0 / 8	3 / 8	2 / 8
10	North Capitol Street / G Street	3 / 7	2 / 6	2 / 7	2 / 6
13	North Capitol Street / Massachusetts Avenue	3 / 9	0 / 9	6 / 10	4 / 10
14	Massachusetts Avenue / E Street / First Street NE	0 / 9	0 / 9	1 / 10	0 / 10
15	Louisiana Avenue / Massachusetts Avenue NE	0 / 5	0 / 5	3 / 5	0 / 5
17	First Street / Massachusetts Avenue NE	0 / 7	0 / 7	3 / 7	1 / 7
19	North Capitol Street / E Street	1 / 10	0 / 10	2 / 10	2 / 10
20	Louisiana Avenue / D Street NW	1 / 7	2 / 7	2 / 7	2 / 7
21	Louisiana Avenue / North Capitol Street	0 / 6	0 / 6	1 / 6	2 / 6
22	2nd Street / D Street NE	1 / 4	0 / 4	1 / 4	1 / 4
23	2nd Street / Massachusetts Avenue NE	0 / 7	1 / 6	2 / 7	2 / 6
25	4th Street / H Street NE	0 / 6	0 / 6	2 / 6	0 / 6
26	Massachusetts Avenue / C Street / 4th Street NE	0 /5	0 /5	3 /5	2 /5
27	Louisiana Avenue / C Street NW	2 / 8	4 / 7	3 / 8	3 / 7
29	2nd Street / D Street NW	0 / 4	0 / 4	1 / 4	0 / 4
30	3rd Street / I-395 On-ramp / D Street NW	0 / 10	0 / 10	1 / 10	1 / 10
31	3rd Street / E Street NW	1 / 11	0 / 10	0 / 11	2 / 10
32	3rd Street / Massachusetts Avenue/ H St NW	0 / 6	0 / 6	0 / 6	3 / 6
33	North Capitol Street (SB Ramp) / New York Avenue	0 / 6	0 / 6	3 / 6	2 / 6
34	North Capitol Street (NB Ramp) / New York Avenue	0 / 6	0 / 6	2 / 6	0 / 6

Table 5-80. Intersections with Delay Increase >5 seconds, Alternative B

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	168.0	240.3	215.0	275.8
2	First Street / K Street NE	65.0	278.9	136.8	297.3
3	2nd Street / K Street NE	34.2	5.1	45.5	6.1
4	2nd Street / I Street NE	< 5	< 5	5.1	< 5
5	North Capitol Street / H Street	122.5	129.2	23.7	394.8
6	WUS West Intersection / H Street NE	61.5	61.8	72.0	111.1
7	WUS Bus Exit / H Street NE	32.4	69.6	44.3	71.1
8	WUS East Intersection / H Street NE	62.1	5.9	222.9	19.6
9	3rd Street / H Street NE	127.8	< 5	172.5	10.7
10	North Capitol Street / G Street	14.0	42.9	12.7	46.2
13	North Capitol Street / Massachusetts Avenue	32.8	5.3	36.7	15.3
15	Louisiana Avenue / Massachusetts Avenue NE	< 5	< 5	10.5	< 5
17	First Street / Massachusetts Avenue NE	56.0	< 5	78.1	5.1
18	2nd Street / F Street NE	20.9	9.3	25.3	11.2
19	North Capitol Street / E Street	5.9	< 5	9.2	< 5
20	Louisiana Avenue / D Street NW	92.4	13.4	< 5	< 5
21	Louisiana Avenue / North Capitol Street	57.4	23.2	235.2	184.6
22	2nd Street / D Street NE	27.0	20.0	22.9	< 5
23	2nd Street / Massachusetts Avenue	6.9	< 5	6.4	8.8
25	4th Street / H Street NE	< 5	< 5	5.7	9.8
26	Massachusetts Avenue / C Street / 4th St NE	11.0	5.6	22.3	6.9
27	Louisiana Avenue / C Street NW	14.7	8.0	20.8	12.1
31	3rd Street / E Street NW	< 5	10.8	5.5	10.8
32	3rd Street / Massachusetts Avenue/ H Street NW	22.3	8.4	8.2	41.0

Table 5-81. MOE Summary Table, Alternative B

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	X	X	X	X	X	X

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
7	WUS Bus Exit / H Street NE	A	X	X	A	X	X
8	WUS East Intersection / H Street NE	A	X	X	X	-	X
9	3rd Street / H Street NE	A	X	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	A	X	X	A	X	X
14	Massachusetts Avenue/ E Street / First Street NE	A	A	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	A	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	A	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	A	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	A	A	X	A
30	3rd Street / I-395 On-ramp / D Street NW	A	A	A	A	X	A
31	3rd Street / E Street NW	A	X	X	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	A
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	A	A	A	n/a	n/a	n/a
36	K Street NE / WUS Underground Parking Facility	n/a	n/a	n/a	n/a	n/a	n/a

“A” indicates that the degradation in traffic operations, if any, is within an acceptable range. “X” indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative B:

- Nine intersections would degrade to LOS F in at least one peak period.
- Twenty-six intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 19 projected to do so in both peak hours.
- Twenty-three intersections would experience delay increases of more than 5 seconds, with 19 projected to do so in both peak hours.

5.5.3.2 Indirect Operational Impacts

Alternative B would have moderate adverse indirect operational impacts on multimodal transportation because of the trips generated by the potential Federal air-rights development.

In Alternative B, 917,420 square feet of Federal air rights above the bus facility would be potentially available for development separately from the Project. For the purposes of the transportation analysis, it was conservatively assumed that this space would be developed as office space. Of the likely uses, it is the use that would generate the most peak-hour vehicular trips. [82] **Table 5-82** shows the multimodal trips that the Federal air-rights development would generate under this assumption. The vehicular trips were considered in the traffic impact analysis.

The Federal air-rights development would add trips to local transportation modes, an adverse impact. The number of trips it would generate would be typical of an office space development of its size, however, and represent a small increment over those directly generated by Alternative B. Therefore, this adverse indirect impact would be moderate.

Table 5-82. Federal Air-rights Development Trip Generation, Alternative B

	AM Peak			PM Peak		
	Total Trips	**Inbound**	**Outbound**	**Total Trips**	**Inbound**	**Outbound**
Parking	287	252	24	282	48	234
Private Pick-Up/Drop-Off	0	0	0	0	0	0
For-hire	20	18	2	20	3	17
Car Rental	0	0	0	0	0	0
Amtrak Express	10	9	1	11	2	9
Amtrak Corridor	0	0	0	0	0	0

[82] Based on coordination with DDOT and the private air-rights developer in 2016-2017, this analysis assumes 4 employees per 1,000 square feet of office space. Current DDOT CTR guidelines assume 2.5 employees per 1,000 square feet. Therefore, the present analysis further provides a conservative projection of office-related transportation demand.

	AM Peak			PM Peak		
	Total Trips	**Inbound**	**Outbound**	**Total Trips**	**Inbound**	**Outbound**
MARC	133	125	8	141	22	119
VRE	76	71	5	81	13	68
Metrorail	284	267	17	304	48	256
Streetcar	29	27	2	31	5	26
City/Commuter Bus	56	53	3	61	10	51
Pedestrian	95	89	6	101	16	85
Bicycle	95	89	6	101	16	85

5.5.3.3 Construction Impacts

Construction of Alternative B would take place over approximately 13 years and 4 months. As in all Action Alternatives, and as explained for Alternative A in **Section 5.5.2.3**, *Construction Impacts*, work would be conducted in four east-to-west phases with the greatest impacts on transportation occurring in Phase 4. Phase durations and the duration of excavation activities in each phase for Alternative B are shown in **Table 5-83**.

Table 5-83. Construction and Excavation Duration, Alternative B

Phase	Overall Duration	Duration of Excavation
Phase 1	2 years, 5 months	5 months
Intermediate Phase	*12 months*	*None*
Phase 2	3 years	11 months
Phase 3	3 years	13 months
Phase 4	4 years, 11 months	2 years, 7 months
Total Project Completion	14 years, 4 months	5 years, 1 month

Except for the difference in duration, the construction impacts of Alternative B on most transportation modes would be as described for Alternative A in **Section 5.5.2.3**, *Construction Impacts*. In particular, adverse impacts on intercity bus operations and parking would be the same but last longer because of the longer duration of Phase 4 in Alternative B. This is because Alternative B would involve the construction of two levels of below-ground parking on the west side of the Project Area as well as that of a new intersection in the K Street NE underpass to provide access to the parking. This would require more excavation during Phase 4 than in Alternative A. It would also cause impacts to K Street NE that would not occur under Alternative A. The following sections focus on those additional impacts. Impacts on the modes not addressed below are those described in **Section 5.5.2.3**, *Construction Impacts*.

City and Commuter Buses

The construction of Alternative B would have minor adverse impacts on city and commuter bus operations during periods of lane closure on K Street NE.

In addition to the impacts described in **Section 5.5.2.3**, *Construction Impacts, City and Commuter Buses*, construction of the new intersection in the K Street NE underpass would require the closure of one or both of the existing eastbound lanes for an extended period. In general, it is anticipated that at least two lanes of traffic would remain available at all times, at least during the daytime, allowing for traffic movement in both directions. Metrobus Line D4 travels along K Street at that location, as do several MTA commuter bus lines (220, 240, and 260). The closure of one or two of the four existing lanes may cause delays and inconvenience passengers, but it is not likely that buses would have to be rerouted during construction. This adverse impact would be minor.

Vehicular Traffic

Construction of Alternative B would have major adverse impact on vehicular traffic operations because of roadway closures and construction vehicle traffic.

The impacts of constructing Alternative B on vehicular traffic would be the same as those of Alternative A (**Section 5.5.2.3**, *Construction Impacts*, *Vehicular Traffic*) though they would occur over a longer period. Additionally, the construction of the intersection providing access to the new below-ground parking facility would require lane closures under the K Street overpass. As noted above, it is anticipated that one lane of traffic in each direction would remain in operation at all times during the day. However, delays and back-up may occur, and some traffic may seek alternative routes, such as L Street.

As in the other Action Alternatives, construction of Alternative B would generate truck traffic to and from the Project Area during the entire construction period. The greatest amount of traffic would occur during excavation activities, with up to 120 trucks per day. As explained for Alternative A, this is a maximum, conservative estimate that assumes that no work trains would be used to haul spoils away. Construction trucks have the potential to result in major adverse impacts on local traffic operations during at least part of the construction period. Alternative B (along with Alternative E) would involve deep excavation to accommodate two levels of below-ground parking and it would generate a large amount of spoil material. Excavation for the parking facility would occur mostly in Phase 4 and in Alternative B, excavation-related heavy truck traffic would occur for approximately 2 years and 7 months. Because work in Phase 4 would be on the west side of the Project Area, First Street NE would be the local street most affected. As in all Action Alternatives, use of work train to remove the spoils could reduce or eliminate excavation-related truck traffic.

5.5.4 Alternative C

The following sections describe the direct and indirect, operational and construction impacts of Alternative C. Alternative C has two options. The East Option would place the bus facility and above-ground parking facility along the east side of the Project Area north of H Street NE. The West Option would place those structures along the west side of the Project Area, also north of H Street. The key transportation elements of each option are illustrated in **Figure 5-11** and **Figure 5-12**, respectively. Unless otherwise specified, the impacts described in the following sections would occur regardless of the option.

5.5.4.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative C (either option) would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

Intercity Railroad Service

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Intercity Railroad Service*.

MARC

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, MARC*.

VRE

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1***, Direct Operational Impacts, Commuter and Intercity Railroads, VR*E.

Private Train Cars

Relative to the No-Action Alternative, Alternative C (either option) would have no direct operational impact on private train car operations.

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Private Train Cars*.

Figure 5-11. Key Transportation Element Locations, Alternative C East Option

WASHINGTON UNION STATION
STATION EXPANSION

Figure 5-12. Key Transportation Element Locations, Alternative C West Option

WMATA Metrorail

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would aggravate train overcapacity and station circulation issues.

Increased train service and ridership in Alternative C, as well as the reduction in parking capacity and the new retail uses included in the alternative, would generate increased demand on Metrorail at WUS. Modeled AM peak and PM peak activity is shown in **Table 5-84** and **Table 5-85.** respectively.

Table 5-84. AM Peak Metrorail Activity, Alternative C

	Alternative C		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[83]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,365	1,623	5,202	1,010	2,802	528
WUS Alightings	5,042	3,423	4,128	2,803	923	3,644
Through Ridership	9,222	1,296	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,587	2,929	14,725	2,457	10,378	1,955
V/C Departing WUS	103%	17%	86%	14%	69%	13%
Excess Passengers	444	0	0	0	0	0

83 Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

Table 5-85. PM Peak Metrorail Activity, Alternative C

	Alternative C		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
V/C Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS[84]	20%	115%	20%	107%	19%	72%
WUS Boardings	3,201	4,580	2,559	3,661	3,265	918
WUS Alightings	1,550	8,221	1,154	6,126	582	3,090
Through Ridership	1,650	9,938	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,851	14,518	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Passengers	0	2,421	0	1,110	0	0

In 2040, Alternative C volumes would exceed capacity in the Shady Grove direction departing WUS during the AM peak and in the Glenmont direction arriving at WUS during the PM peak.

In the AM peak, Alternative C would cause the V/C ratio leaving WUS toward Shady Grove to exceed capacity (at 103 percent), compared to 86 percent in the No-Action Alternative. As a result, Alternative C would create a new excess demand of around 444 passengers. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate within the Red Line core. [85]

In the PM peak, capacity exceedance toward Glenmont (115 percent arriving) would be greater in Alternative C than in the No-Action Alternative (107 percent). Alternative C would aggravate the level of crowding, generating an additional excess demand of approximately 1,311 passengers, for a total excess demand of 2,421.

In the PM peak, departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative C would cause no additional exceedance of this threshold relative to the No-Action Alternative.

The increase in Metrorail ridership at WUS would also affect passenger circulation as described in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail*.

[84] Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

[85] The Red Line core, as defined by WMATA, consists of the line segment between Dupont Circle and WUS.

Comparison to Existing Conditions

Relative to existing conditions, Alternative C would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

In the AM peak, Alternative C would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 69 percent under existing conditions. Alternative C would increase the overall AM peak demand in the Shady Grove direction by 7,209 passengers.

In the PM peak, the V/C ratio toward Glenmont arriving at WUS in Alternative C would be 115 percent, against 72 percent under existing conditions. Alternative C would increase overall demand in this direction by 8,211 passengers.

The increase in Metrorail ridership at WUS would also affect passenger circulation relative to existing conditions as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail, Comparison to Existing Conditions.*

DC Streetcar

Relative to the No-Action Alternative, Alternative C (either option) would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Alternative C would generate the same level of additional Streetcar ridership as Alternative A, presented in **Section 5.5.2.1**, *Direct Operational Impacts, DC Streetcar.*

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate adverse direct operational impact on intercity, tour/charter, and daily sightseeing bus operations because of the new 30-minute time limit for buses at WUS and greater distance between the Metrorail Station and the bus facility. Alternative C (either option) would have a negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

Alternative C would provide two locations for bus operations: a main bus facility to the north of H Street NE and a bus drop-off and pick-up area to the south of H Street NE, adjacent to the train hall. Buses would reach this area from H Street NE via the west intersection. They would exit back to H Street via the east intersection.

The main facility's location and capacity would vary with the option. In the East Option, the facility would be to the northeast of H Street and feature 17 slips. Bus access would be via the east intersection. In the West Option, the facility would be to the northwest of H Street and would have 19 slips. Bus access would be via the west intersection.

The anticipated increases in bus ridership and the impacts of the 30-minute time limit required because of the reduction in the number of slips would be the same as in Alternative

A. These impacts are described in **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*.

There would be greater flexibility in bus movements in Alternative C than in the No-Action Alternative. In the West Option, unlike in the No-Action Alternative, buses exiting the facility could turn either left or right onto H Street NE. In the East Option, buses exiting the facility could not turn left (eastward) onto H Street but this movement would be available to buses coming from the bus pick-up and drop-off area.

Because of the location of the main facility, the distance bus passengers would have to walk to reach the front of WUS and the Metrorail station would increase relative to No-Action Alternative conditions; passengers connecting to Metrorail would walk approximately an additional 1,100 feet with the East Option and an additional 250 feet with the West Option. The East Option would also offer fewer bus slips than the West Option. Thus, although the impacts of both options would be comparable, the West Option would present some benefits over the East Option.

<u>Comparison to Existing Conditions</u>

The bus facility location would be the same in the No-Action Alternative as under existing conditions. Therefore, impacts pertaining to walking distances would be the same regardless of the baseline. Relative to existing conditions, in Alternative C as in all Action Alternatives, bus trips would increase by 29 trips (138 percent) in the AM peak and 39 trips (139 percent) in the PM peak. Of the additional trips, 19 percent would be due to the anticipated increase in demand and the rest to the implementation of the 30-minute stay limit.

Loading

Relative to the No-Action Alternative, Alternative C (either option) would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

The impacts of Alternative C on loading would be the same as those of Alternative A and the other Action Alternatives. See **Section 5.5.2.1**, *Direct Operational Impacts, Loading.*

Pedestrians

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate beneficial direct operational impact on pedestrian circulation inside WUS. Additional access points would disperse pedestrian traffic and make access to WUS easier; however, some passengers would have to walk longer distances. Outside of WUS, Alternative C (either option) would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

Alternative C would have the same adverse impacts on pedestrian movements outside WUS and the same beneficial impacts on pedestrian movements within WUS as Alternative A, which are described in **Section 5.5.2.1,** *Direct Operational Impacts, Pedestrians*. On balance, however, increased walking distances between WUS elements, as explained below, would partially offset the benefits from increased circulation space and additional access points, making this impact moderate.

Because of the location of the new main bus facility, walking distances for those passengers transferring between an intercity bus and Metrorail or the front of WUS would increase, as noted above. This would also be the case for visitors or passengers parking in the new above-ground facility. Bus passengers and above-ground parking users would have to walk outside to reach the nearest entry point to the H Street Concourse. Drivers who would park near the northern end of the below-ground parking facility would be farther away from the front of WUS than in the No-Action Alternative.

Not all bus passengers would have to walk greater distances, however, as some buses would also use the bus drop-off and pick-up area adjacent to the train hall, which would bring riders closer to the front of WUS and the Metrorail station. Which buses would use the pick-up and drop-off area would vary depending on destination, schedule, and conditions at the main bus facility.

<u>Comparison to Existing Conditions</u>

The impacts of Alternative C relative to existing conditions would be as described for Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians, comparison to Existing Conditions*.

Bicycle Activity

Relative to the No-Action Alternative, Alternative C (either option) would result in a minor adverse direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be offset by increased conflicts with pedestrians and vehicles on both First Street and K Street NE.

The impacts of Alternative C would be the same as those of Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, Bicycle Activity.*

City and Commuter Buses

Relative to the No-Action Alternative, Alternative C (either option) would have a minor adverse direct operational impact on city and commuter buses. Increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delay experienced by all buses. There would also be a moderate adverse direct operational

impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

The impacts of Alternative C on ridership would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses.*

The impacts of Alternative C on bus operations would be the same as those of Alternative B (see **Section 5.5.3.1**, *Direct Operational Impacts, City and Commuter Buses*).

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate adverse direct operational impact on parking at WUS because of a reduction in parking capacity. Alternative C would have a minor beneficial direct operational impact on rental car operations.

Alternative C would split parking between a new above-ground parking facility (to the northeast or northwest of H Street according to the option) and a new below-ground parking facility beneath the railroad tracks south of K Street NE. Vehicular access to the below-ground facility would be through a new intersection in the K Street NE underpass, like in Alternative B (see **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*). All rental car activity would be concentrated in the below-ground parking facility. Under either option, the above-ground facility is expected to accommodate an estimated 46 percent of all parking trips, with the below-ground one accommodating the other 54 percent.

While this would change the routes WUS users would take to travel to park at the station and affect the local network, the change in location by itself would not adversely affect parking or car rental activities. Altogether, the new parking facilities would accommodate approximately 800 fewer cars than the existing garage under the East Option and approximately 840 fewer cars under the West Option. This would be an adverse impact. This adverse impact would be moderate because the new parking facilities would meet the parking program for the Project and while they would not meet the projected parking demand, it is anticipated that users not able to park would use different modes to reach the station.[86] By 2040, fewer passengers or visitors are anticipated to drive and park at WUS.[87] The impacts of the reduction in parking capacity on other modes of travel are taken into account in the impact analyses conducted for those modes.

WUS activity in Alternative C would generate more overall peak-hour parking trips than in the No Action Alternative in the AM peak and fewer in the PM peak, as shown in **Table 5-86**. In

[86] Appendix A6, *Parking Program Memorandum*, provides more information on parking demand projections and the development of the parking program.

[87] The MWCOG Model estimates a 10% reduction in single-occupancy vehicle trips in the WUS area to 2040.

the AM peak, the difference between Alternative C and the No-Action Alternative would be 68 additional trips (14 percent increase). In the PM peak, the difference would be 5 fewer trips (2 percent decrease). The parking trips were incorporated in the traffic impact study.

Table 5-86. Peak-hour Parking Trips, Alternative C

	Alternative C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	183	76	127	102	104	53
Outs	79	218	62	197	24	154
Total	**262**	**294**	**189**	**299**	**128**	**207**

Increased WUS activity in Alternative C would generate the same number of rental car trips as in Alternative A. These trips are shown in **Table 5-57**. As in the other Action Alternatives, the design of the new rental car facility would address the capacity issues that would occur in the No-Action Alternative, resulting in a beneficial impact. This beneficial impact would be minor, being partially offset by the increase in operations.

<u>**Comparison to Existing Conditions**</u>

The impacts of Alternative C on parking and rental car activity would be the same relative to existing conditions as relative to the No-Action Alternative since the existing parking garage and rental car facility would be in use in both baselines. The reduction in parking capacity would be the same relative to existing conditions as relative to the No-Action Alternative.

Alternative C would generate proportionately more peak-hour parking trips relative to existing conditions than relative to the No-Action Alternative. In the AM peak, the difference between Alternative C and existing conditions would be 134 trips (105 percent). In the PM peak, the difference would be 87 trips (42 percent).

With regard to rental cars, in the AM peak, the number of trips would increase by 64 (156 percent). In the PM peak, trips would increase by 56 (156 percent).

For-hire Vehicles

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative C (either option) would also have a moderate adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The following five pick-up and drop-off locations would be provided in Alternative C:

- **Front of WUS:** See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative C, a projected 40 percent of for-hire drop-off activity and 30 percent of for-hire pick-up activity is anticipated to occur in front of WUS.
- **Adjacent to the east-west train hall on the deck level:** For-hire vehicles would access this location via the west intersection on H Street NE and southwest road, potentially after staging in the first level of the above-ground parking facility. Egress would be either via the southeast road and east intersection to H Street NE or via the east ramp to F Street NE or the front of WUS. A projected 35 percent of for-hire drop-off activity and 25 percent of for-hire pick-up activity is projected to occur at this location.
- **New H Street Concourse entrance on First Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative C, 20 percent of for-hire drop-off activity and 20 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on 2nd Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. An anticipated 5 percent of for-hire drop-off activity and 5 percent of for-hire pick-up activity would occur at this location.
- **New below-ground parking facility:** See **Section 5.5.3.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. A projected 20 percent of for-hire pick-up activity would occur in the underground facility; no for-hire drop-off activity would be permitted in the facility.

Table 5-87 shows the number of anticipated peak-hour WUS-related for-hire trips in Alternative C. [88] Relative to the No-Action Alternative, Alternative C would generate an estimated 1,400 additional trips in the AM peak hour (267 percent increase) and 1,202 additional trips in the PM peak hour (140 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity. The impacts of these trips are considered in the *Intersection Analysis* below.

Table 5-87. Peak-hour For-hire Trips, Alternative C

	Alternative C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	962	1,032	262	431	197	324
Outs	962	1,032	262	431	197	324
Total	**1,924**	**2,064**	**524**	**862**	**394**	**648**

[88] A single for-hire pick-up or drop-off trip creates both an in and an out trip as the vehicle arrives and then departs WUS. A single for-hire vehicle pick-up or drop-off is assumed to generate 1.5 trips to reflect the linking of trips in the WUS circulation network.

As explained in **Section 5.5.4.1,** *Direct Operational Impacts, Vehicular Traffic*, volumes associated with for-hire as well as private pick-up and drop-off activity in front of WUS could create queueing and congestion, resulting in a moderate adverse impact on for-hire vehicle operations at WUS.

Comparison to Existing Conditions

The beneficial impacts of Alternative C on for-hire vehicle activities would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative C would generate an estimated 1,530 additional trips in the AM peak hour (388 percent increase) and 1,416 trips in the PM peak hour (219 percent increase). The principal source of increased peak-hour for-hire trips would be the increase in intercity rail activity.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for these activities. These locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips, but queuing may occur. Alternative C would also have a moderate adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

The same locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be allowed to use the east ramp to the front of WUS. The anticipated distribution of trips would be the same as for for-hire vehicles trips.

Table 5-88 shows the anticipated number of WUS-related peak-hour private pick-up and drop-off trips in Alternative C. [89]

Table 5-88. Private Pick-up and Drop-off Trips, Alternative C

	Alternative C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	847	774	436	474	328	356
Outs	847	774	436	474	328	356
Total	**1,694**	**1,548**	**872**	**948**	**656**	**712**

Relative to the No-Action Alternative, Alternative C would generate an estimated 822 additional trips in the AM peak hour (94 percent increase) and 600 in the PM peak hour (63 percent increase). The principal source of increased peak-hour private pick-up/drop-off trips

[89] A single private pick-up or drop-off vehicle generates two trips: one in and one out as the vehicle arrives and then departs WUS.

would be the increase in intercity rail activity. The impacts of these trips are considered in *Intersection Analysis* below.

As explained below (**Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic*), volumes associated with private pick-up and drop-off as well as for-hire activity in front of WUS could create queueing and congestion, resulting in a moderate adverse impact on private pick-up and drop-off operations at WUS.

<u>Comparison to Existing Conditions</u>

The beneficial impacts of Alternative C on private pick-up and drop-off activity would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in trips would be proportionately greater. Relative to existing conditions, Alternative C would generate an estimated 1,038 additional trips in the AM peak hour (158 percent increase) and 836 in the PM peak hour (117 percent increase). The principal source of increased peak-hour private pick-up/drop-off trips is the increase in intercity rail activity.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative C would have major adverse direct operational impacts on traffic operations at several intersections near WUS because of increased traffic volumes and changes in traffic patterns due to the new parking facility location.

- **In Alternative C, East Option, during at least one of the peak periods, out of 36 intersections in the Local Study Area, five would degrade to LOS F; 19 would experience an increase in queue length of more than 150 feet; and 21 would experience an increase in average delay of more than 5 seconds.**
- **In Alternative C, West Option, during at least one of the peak periods, out of 36 intersections in the Local Study Area, four would degrade to LOS F; 15 would experience an increase in queue length of more than 150 feet; and 20 would experience an increase in average delay of more than 5 seconds.**

<u>Trip Generation and Circulation</u>

WUS-related vehicular activity in Alternative C would be primarily distributed across five locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility, new above-ground parking facility, and new pick-up/drop-off location accessed from H Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse);

- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse); and
- The new below-ground parking facility accessed from K Street NE.

Table 5-89 shows the anticipated distribution of WUS-related vehicular trips by access point and type of trip in Alternative C.

Table 5-89. Trip Distribution by WUS Access Point and Trip Type, Alternative C

	First Street	2nd Street	Front of WUS	K Street	H Street
For-hire Drop-Off	20%	5%	40%	0%	35%
For-Hire Pick-Up	20%	5%	30%	20%	25%
Private Drop-off/Pick-up	20%	5%	40%	0%	35%
Parking	0%	0%	0%	54%	46%
Rental Car	0%	0%	0%	100%	0%

Alternative C would split parking activity between the above-ground parking facility, accessed from H Street NE (54 percent of all parking-generated traffic) and the below-ground parking facility, accessed from K Street NE (46 percent of parking-generated traffic). This would distribute parking -generated traffic approximately equally between the two streets. All rental car activity would be in the below-ground parking. Private and for-hire pick-up and drop-off activity would be spread across all five locations.

Approximately 70 percent of WUS-related traffic is expected to travel to and from points west of WUS and 30 percent to and from points east. Deck-level circulation patterns in Alternative C are represented in **Figure 5-13** for the East Option and **Figure 5-14** for the West Option. [90]

Table 5-90 and **Table 5-91** show AM and PM peak WUS-related traffic volumes in Alternative C, along with the corresponding information for the No-Action Alternative and existing conditions. Compared to the No-Action Alternative, Alternative C would generate 2,354 additional AM peak trips (144 percent increase) and 1,844 additional PM peak trips (86 percent increase). These volume increases would result in major adverse impacts to traffic operations at some study intersections. An operational analysis of the local traffic network is presented below under *Intersection Analysis.*

[90] The figures show all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Table 5-90. AM Peak-hour Traffic Volumes, Alternative C

	Alternative C			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	262	183	79	189	127	62	128	104	24
Private Pick-Up/Drop-Off	1,694	847	847	872	436	436	656	328	328
For hire Vehicles	1,924	962	962	524	262	262	394	197	197
Car Rental	105	57	48	46	28	18	41	26	15
Total Trips	3,985	2,049	1,936	**1,631**	**853**	**778**	**1,219**	**655**	**564**

Table 5-91. PM Peak-hour Traffic Volumes, Alternative C

	Alternative C			No-Action Alternative			Existing Conditions		
	Total Trips	**In**	**Out**	**Total Trips**	**In**	**Out**	**Total Trips**	**In**	**Out**
Parking	294	76	218	299	102	197	207	53	154
Private Pick-Up/Drop-Off	1,548	774	774	948	474	474	712	356	356
For-Hire Vehicles	2,064	1,032	1,032	862	431	431	648	324	324
Car Rental	92	37	55	45	17	28	36	13	23
Total Trips	3,998	1,919	2,079	**2,154**	**1,024**	**1,130**	**1,603**	**746**	**857**

Comparison to Existing Conditions

Relative to existing conditions, Alternative C would generate 2,766 additional AM peak trips (227 percent increase) and 2,395 additional PM peak trips (149 percent increase).

Curbside Analysis

The anticipated for-hire and private pick-up and drop-off activity at the front of WUS would create conflicts and queueing. At deck level, queueing analysis indicates that the approximately 550 feet of curbside space adjacent to the east-west train hall would accommodate for-hire vehicles and private pick-up and drop-off without spill-back onto H Street NE.

No queue would form at the First Street or 2nd Street pick-up and drop-off areas. On First Street NE, there would be 253 pick-ups and drop-offs in the AM peak and 223 in the PM peak. On 2nd Street NE, there would be 77 pick-up and drop-offs in the AM peak and 67 in the PM peak. In the below-ground facility accessed from K Street, 95 pick-up and drop-offs would occur in the AM peak and 82 would occur in the PM peak.

Figure 5-13. Deck Level Circulation (All Movements), Alternative C, East Option

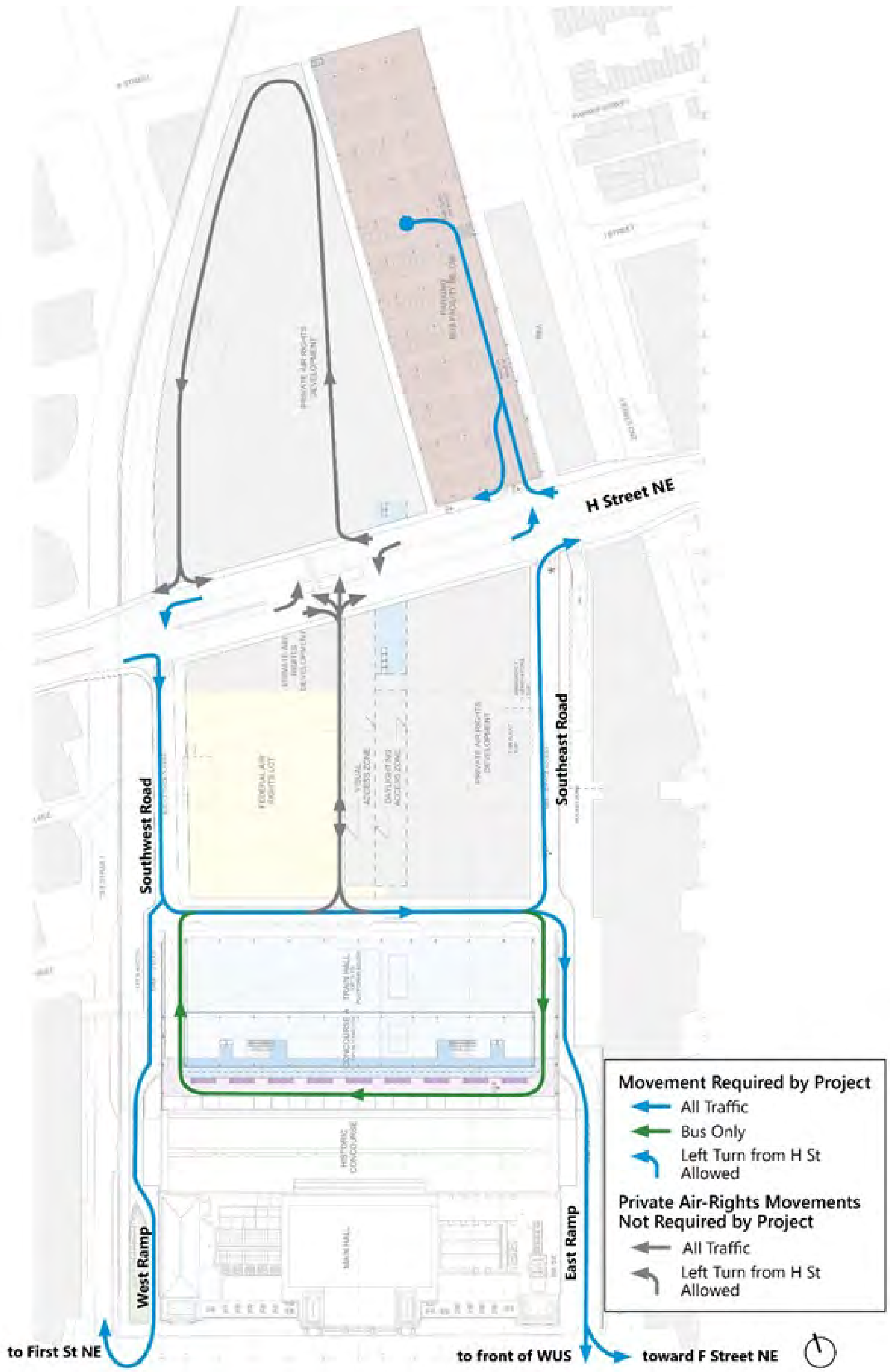
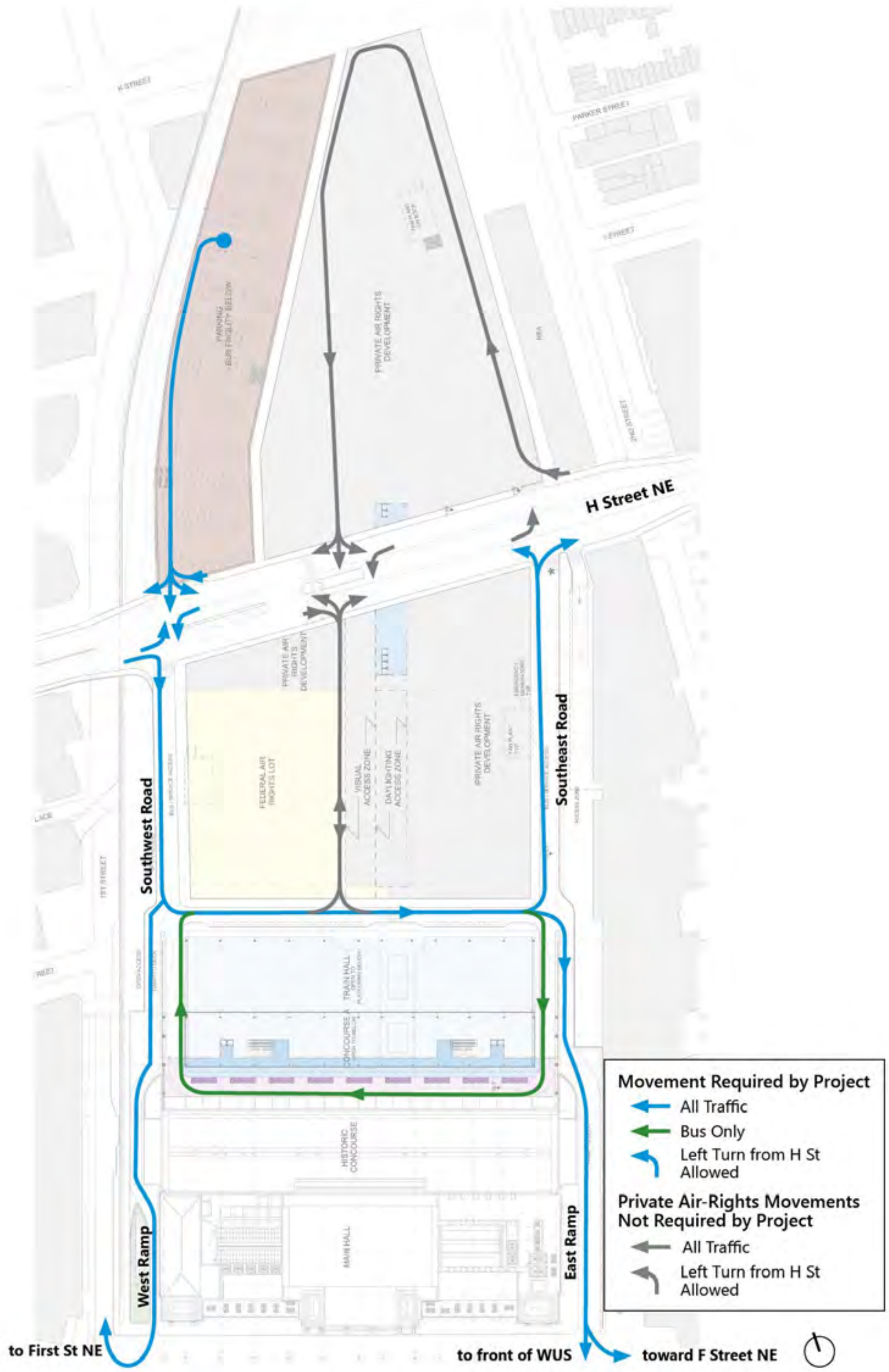


Figure 5-14. Deck Level Circulation (All Movements), Alternative C, West Option



Intersection Analysis

As with all Action Alternatives, three indicators were used to assess impacts on traffic operations in Alternative C relative to the No-Action Alternative: degradation of intersection LOS to F due to vehicle trips generated by the alternative; increase in average vehicle delay at an intersection by more than 5 seconds; and increase in 95th-percentile queue lengths of more than 150 feet for any lane group in an intersection.

Alternative C, East Option

Table 5-92 shows intersections projected to degrade to LOS F. The peak-hour LOS of each study intersection are shown in **Figure 5-15**. In Alternative C with the East Option, five intersections would degrade to LOS F during at least one peak hour relative to the No-Action Alternative.

Table 5-93 shows intersections with unacceptable queue increases in Alternative C, East Option. Nineteen intersections out of 36 would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Twelve of those would experience such a queue increase in both peak hours.

Table 5-94 shows study intersections with projected delay increases exceeding 5 seconds compared to the No-Action Alternative. In Alternative C East Option, 21 of the 36 study intersections would experience delay increases of more than 5 seconds in at least one peak period relative to the No-Action Alternative. Seventeen of them would see such a delay increase in both peak hours.

Table 5-95 provides a snapshot of each study intersection's performance across the three indicators relative to both the No-Action Alternative and existing conditions for traffic operations impacts in Alternative C with the East Option.

Table 5-92. Intersections with Failing LOS, Alternative C East Option

Int. No.	Intersection Name	Alternative C East Option		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	**North Capitol Street / K Street**	F	**F**	F	E	F	D
2	**First Street / K Street**	F	**F**	F	E	F	E
5	**North Capitol Street / H Street**	F	F	F	F	C	C
8	**WUS East Intersection / H Street NE**	F	C	F	B	B	A
9	**3rd Street / H Street NE**	F	**F**	F	C	E	C
17	**First Street / E Street / Mass. Avenue NE**	**F**	C	E	B	D	B
20	**Louisiana Avenue / D Street NW**	F	**F**	F	E	F	F
21	**Louisiana Avenue / North Capitol Street**	F	F	F	F	F	D
32	**3rd Street / Massachusetts Avenue/ H Street NW**	D	E	D	F	E	D

Figure 5-15. Intersection Peak Hour LOS, Alternative C East Option

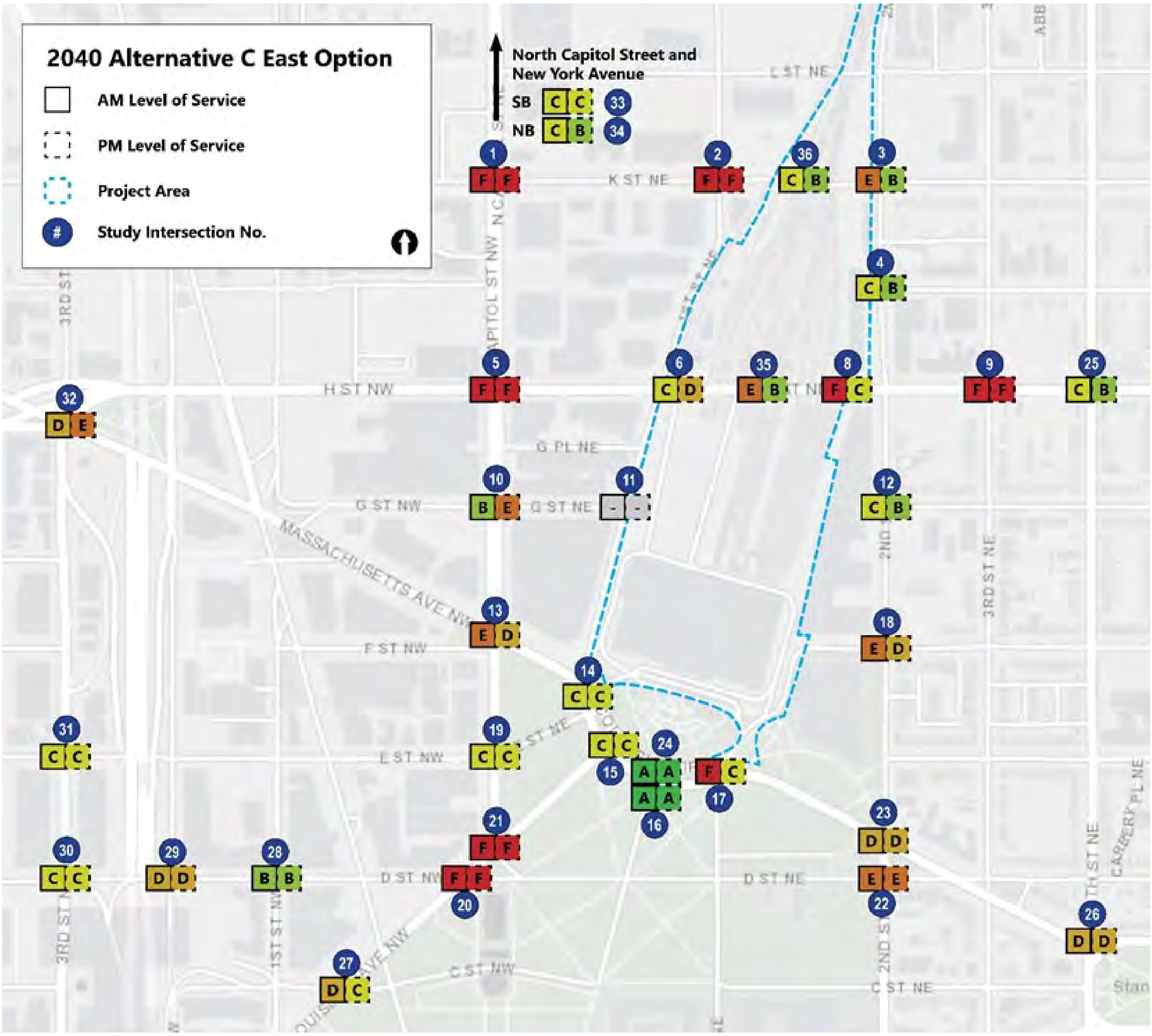


Table 5-93. Intersections with Queue Increase > 150 Feet, Alternative C East Option

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	**North Capitol Street / K Street**	2 / 11	1 / 9	6 / 10	4 / 9
2	**First Street / K Street NE**	1 / 7	3 / 6	1 / 7	4 / 7
3	**2nd Street / K Street NE**	1 / 6	0 / 6	3 / 6	1 / 6
5	**North Capitol Street / H Street**	4 / 10	2 / 10	9 / 9	7 / 7
6	**WUS West Intersection / H Street NE**	0 / 7	1 / 7	2 / 4	2 / 4
8	**WUS East Intersection / H Street NE**	1 / 6	1 / 6	-	-
9	**3rd Street / H Street NE**	1 / 8	2 / 8	3 / 8	2 / 8
10	**North Capitol Street / G Street**	3 / 7	2 / 6	2 / 7	2 / 6
13	**North Capitol Street / Massachusetts Avenue**	3 / 9	0 / 9	6 / 10	4 / 10
14	**Massachusetts Avenue / E Street / First Street NE**	0 / 9	0 / 9	1 / 10	0 / 10
15	**Louisiana Avenue / Massachusetts Avenue NE**	0 / 5	0 / 5	3 / 5	0 / 5
17	**First Street / Massachusetts Avenue NE**	2 / 7	0 / 7	3 / 7	1 / 7
19	**North Capitol Street / E Street**	1 / 10	0 / 10	2 / 10	2 / 10
20	**Louisiana Avenue / D Street NW**	1 / 7	3 / 7	3 / 7	3 / 7
21	**Louisiana Avenue / North Capitol Street**	0 / 6	0 / 6	1 / 6	3 / 6
22	**2nd Street / D Street NE**	1 / 4	2 / 4	2 / 4	2 / 4
23	**2nd Street / Massachusetts Avenue NE**	2 / 7	1 / 6	2 / 7	2 / 6
25	**4th Street / H Street NE**	0 / 6	0 / 6	2 / 6	0 / 6
26	**Massachusetts Avenue / C Street / 4th Street NE**	0 /5	0 /5	1 /5	1 /5
27	**Louisiana Avenue / C Street NW**	2 / 8	4 / 7	3 / 7	3 / 7
29	**2nd Street / D Street NW**	1 / 4	0 / 4	1 / 4	1 / 4
30	**3rd Street / I-395 On-ramp / D Street NW**	0 / 10	0 / 10	0 / 10	1 / 10
31	**3rd Street / E Street NW**	0 / 11	0 / 10	2 / 11	2 / 10
32	**3rd Street / Massachusetts Avenue/ H St NW**	4 / 6	3 / 6	4 / 6	4 / 6
33	**North Capitol Street (SB Ramp) / New York Avenue**	2 / 6	0 / 6	2 / 6	0 / 6
34	**North Capitol Street (NB Ramp) / New York Avenue**	3 / 6	2 / 6	4 / 6	3 / 6

Table 5-94. Intersections with Delay Increase > 5 seconds, Alternative C East Option

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	155.3	196.1	202.3	231.6
2	First Street / K Street NE	44.2	231.8	116.0	250.2
3	2nd Street / K Street NE	31.4	5.2	42.7	6.2
4	2nd Street / I Street NE	< 5	< 5	5.4	< 5
5	North Capitol Street / H Street	92.3	86.3	253.5	351.9
6	WUS West Intersection / H Street NE	15.0	< 5	25.5	39.9
8	WUS East Intersection / H Street NE	8.4	9.1	169.2	22.8
9	3rd Street / H Street NE	59.1	79.0	103.8	86.2
10	North Capitol Street / G Street	13.5	45.2	12.2	48.5
13	North Capitol Street / Massachusetts Avenue	28.2	7.0	32.1	17.0
15	Louisiana Avenue / Massachusetts Avenue NE	< 5	< 5	9.2	< 5
17	First Street / Massachusetts Avenue NE	68.6	5.9	90.7	6.7
18	2nd Street / F Street NE	22.1	10.1	26.5	12.0
19	North Capitol Street / E Street	8.4	< 5	11.7	< 5
20	Louisiana Avenue / D Street NW	171.8	99.7	< 5	< 5
21	Louisiana Avenue / North Capitol Street	171.3	192.4	349.1	353.8
22	2nd Street / D Street NE	24.4	38.4	20.3	< 5
23	2nd Street / Massachusetts Avenue	11.0	11.0	10.5	13.8
25	4th Street / H Street NE	< 5	< 5	7.6	< 5
26	Massachusetts Avenue / C Street / 4th St NE	5.9	< 5	17.2	< 5
27	Louisiana Avenue / C Street NW	16.8	7.8	22.9	11.9
29	2nd Street / D Street NW	15.0	13.0	< 5	11.7
31	3rd Street / E Street NW	< 5	< 5	< 5	7.5
32	3rd Street / Massachusetts Avenue/ H Street NW	9.6	< 5	< 5	28.2
35	WUS Central Intersection / H Street NE	44.7	16.7	-	-

Table 5-95. MOE Summary Table, Alternative C East Option

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	X	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
6	WUS West Intersection / H Street NE	A	X	X	A	X	X
7	WUS Bus Exit / H Street NE	n/a	n/a	n/a	n/a	n/a	n/a
8	WUS East Intersection / H Street NE	A	X	X	X	A	X
9	3rd Street / H Street NE	X	X	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	A	X	X	A	X	X
14	Massachusetts Avenue / E Street / First Street NE	A	A	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	X	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	X	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	A	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	X	X	A	X	X
30	3rd Street / I-395 On-ramp / D Street NW	A	A	A	A	X	A
31	3rd Street / E Street NW	A	A	A	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	X	X	A	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	X	A	A	X	A
34	North Capitol Street (NB Ramp) / New York Avenue	A	X	A	A	X	A
35	WUS Central Intersection / H Street NE	A	A	X	n/a	n/a	n/a
36	K Street NE / WUS Underground Parking Facility	n/a	n/a	n/a	n/a	n/a	n/a

"A" indicates that the degradation in traffic operations, if any, is within an acceptable range. "X" indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative C with the East Option:

- Seven intersections would degrade to LOS F in at least one peak period.
- Twenty-five intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 20 projected to do so in both peak hours.
- Twenty-three intersections would experience increased delays of more than 5 seconds, with 14 projected to do so in both peak hours.

Alternative C, West Option

Table 5-96 shows intersections projected to degrade to LOS F from a better LOS in Alternative C with the West Option. The peak hour LOS of each study intersection are shown in **Figure 5-16**. In Alternative C with the West Option, four intersections would degrade to LOS F during at least one peak hour relative to the No-Action Alternative.

Table 5-96. Intersections with Failing LOS, Alternative C West Option

Int. No.	Intersection Name	Alternative C West Option		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	North Capitol Street / K Street	F	**F**	F	E	F	D
2	First Street / K Street	F	**F**	F	E	F	E
5	North Capitol Street / H Street	F	F	F	F	C	C
6	WUS West Intersection / H Street NE	**F**	**F**	B	E	A	A
8	WUS East Intersection / H Street NE	F	B	F	B	B	A
9	3rd Street / H Street NE	F	D	F	C	E	C
17	First Street / E Street / Mass. Avenue NE	**F**	C	E	B	D	B
20	Louisiana Avenue / D Street NW	F	E	F	E	F	F
21	Louisiana Avenue / North Capitol Street	F	F	F	F	F	D
32	3rd Street / Massachusetts Avenue/ H Street NW	E	F	D	F	E	D

Figure 5-16. Intersection Peak Hour LOS, Alternative C, West Option

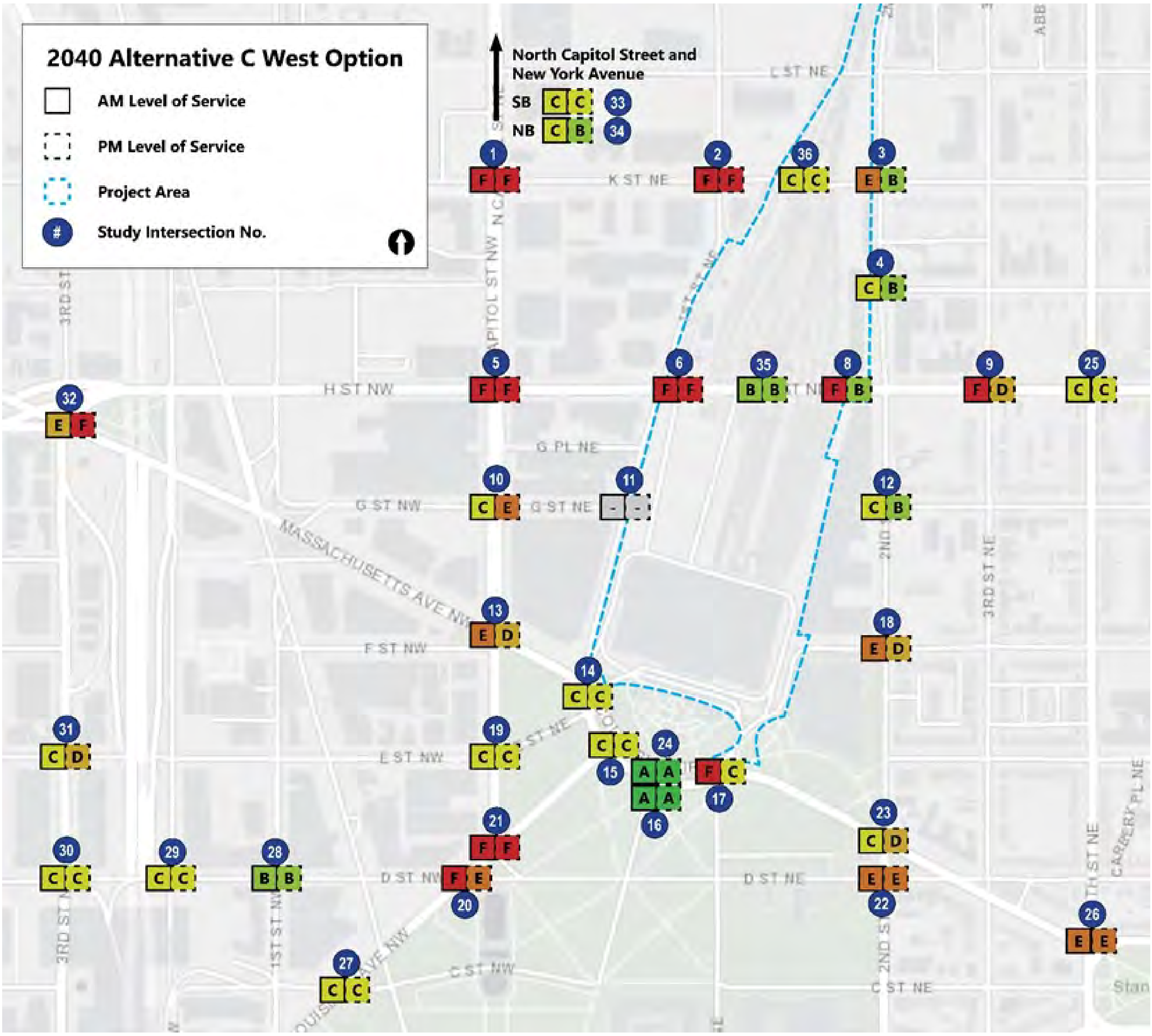


Table 5-97 shows intersections with unacceptable queue increases in Alternative C, West Option. Fifteen out of 36 intersections would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Seven of these would experience such a queue increase in both peak hours.

Table 5-98 shows intersections with projected delay increases exceeding 5 seconds in Alternative C with the West Option. Relative to the No-Action Alternative, 20 of the 36 intersections would experience an increased average delay of more than 5 seconds in at least one peak period relative. Fifteen of these would see such a delay increase in both peak hours.

Table 5-99 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and existing conditions across the three indicators for traffic operations impacts in Alternative C with the West Option.

Table 5-97. Intersections with Queue Increase > 150 Feet, Alternative C West Option

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	**North Capitol Street / K Street**	2 / 11	5 / 10	5 / 10	5 / 10
2	**First Street / K Street NE**	1 / 5	3 / 5	1 / 6	4 / 6
3	**2nd Street / K Street NE**	0 / 6	0 / 6	2 / 6	1 / 6
5	**North Capitol Street / H Street**	4 / 10	2 / 9	9 / 9	6 / 6
6	**WUS West Intersection / H Street NE**	4 / 6	4 / 6	4 / 4	4 / 4
8	**WUS East Intersection / H Street NE**	0 / 7	0 / 7	1 / 2	1 / 2
9	**3rd Street / H Street NE**	0 / 8	0 / 8	4 / 7	2 / 7
10	**North Capitol Street / G Street**	3 / 7	2 / 6	2 / 6	2 / 6
13	**North Capitol Street / Massachusetts Avenue**	3 / 10	0 / 10	5 / 10	4 / 10
14	**Massachusetts Avenue / E Street / First Street NE**	0 / 9	0 / 9	1 / 9	0 / 9
15	**Louisiana Avenue / Massachusetts Avenue NE**	0 / 5	0 / 5	3 / 5	0 / 5
17	**First Street / Massachusetts Avenue NE**	0 / 7	0 / 7	3 / 7	1 / 7
19	**North Capitol Street / E Street**	1 / 10	0 / 10	2 / 10	2 / 10
20	**Louisiana Avenue / D Street NW**	1 / 8	2 / 8	2 / 9	2 / 9
21	**Louisiana Avenue / North Capitol Street**	0 / 7	0 / 7	1 / 5	2 / 5
22	**2nd Street / D Street NE**	1 / 4	0 / 4	1 / 4	1 / 4
23	**2nd Street / Massachusetts Avenue NE**	0 / 7	1 / 6	2 / 7	2 / 6
25	**4th Street / H Street NE**	0 / 6	0 / 6	2 / 6	0 / 6
26	**Massachusetts Avenue / C Street / 4th Street NE**	0 / 5	2 / 5	3 / 5	2 / 5
27	**Louisiana Avenue / C Street NW**	2 / 11	4 / 11	3 / 11	3 / 10
29	**2nd Street / D Street NW**	0 / 4	0 / 4	2 / 5	0 / 5
30	**3rd Street / I-395 On-ramp / D Street NW**	1 / 10	0 / 10	1 / 11	1 / 11

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
31	3rd Street / E Street NW	1 / 11	0 / 11	2 / 11	2 / 10
32	3rd Street / Massachusetts Avenue/ H St NW	0 / 6	0 / 6	0 / 6	3 / 6
33	North Capitol Street (SB Ramp) / New York Avenue	0 / 6	0 / 6	3 / 6	2 / 6
34	North Capitol Street (NB Ramp) / New York Avenue	0 / 6	0 / 6	2 / 6	0 / 6
35	WUS Central Intersection / H Street NE	1 / 6	0 / 6	-	-

Table 5-98. Intersections with Delay Increase > 5 seconds, Alternative C West Option

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	150.0	206.5	197.0	242.0
2	First Street / K Street NE	39.0	212.9	110.8	231.3
3	2nd Street / K Street NE	35.6	5.7	46.9	6.7
4	2nd Street / I Street NE	< 5	< 5	5.4	< 5
5	North Capitol Street / H Street	128.7	175.3	289.9	440.9
6	WUS West Intersection / H Street NE	74.8	85.1	85.3	134.4
8	WUS East Intersection / H Street NE	72.7	6.1	233.5	19.8
9	3rd Street / H Street NE	64.5	< 5	109.2	11.6
10	North Capitol Street / G Street	14.1	46.7	12.8	50.0
13	North Capitol Street / Massachusetts Avenue	27.7	< 5	31.6	13.2
15	Louisiana Avenue / Massachusetts Avenue NE	< 5	< 5	9.0	< 5
17	First Street / Massachusetts Avenue NE	56.5	< 5	78.6	5.3
18	2nd Street / F Street NE	22.3	10.1	26.7	12.0
19	North Capitol Street / E Street	7.3	< 5	10.6	< 5
20	Louisiana Avenue / D Street NW	89.0	14.7	< 5	< 5
21	Louisiana Avenue / North Capitol Street	70.5	20.2	248.3	181.6
22	2nd Street / D Street NE	24.1	20.4	20.0	< 5
23	2nd Street / Massachusetts Avenue	6.7	5.1	6.2	8.9
25	4th Street / H Street NE	< 5	< 5	7.9	13.5
26	Massachusetts Avenue / C Street / 4th St NE	16.3	11.3	27.6	12.6
27	Louisiana Avenue / C Street NW	9.5	6.7	15.6	10.8
31	3rd Street / E Street NW	< 5	5.1	5.9	11.9
32	3rd Street / Massachusetts Avenue/ H Street NW	25.3	21.2	11.2	53.8

Table 5-99. MOE Summary Table, Alternative C West Option

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	X	X	X	X	X	X
7	WUS Bus Exit / H Street NE	n/a	n/a	n/a	n/a	n/a	n/a
8	WUS East Intersection / H Street NE	A	A	X	X	X	X
9	3rd Street / H Street NE	A	A	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	A	X	X	A	X	X
14	Massachusetts Avenue / E Street / First Street NE	A	A	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	A	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	A	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	X	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	A	A	X	A
30	3rd Street / I-395 On-ramp / D Street NW	A	X	A	A	X	A
31	3rd Street / E Street NW	A	X	X	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	A
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	A	X	A	n/a	n/a	n/a
36	K Street NE / WUS Underground Parking Facility	n/a	n/a	n/a	n/a	n/a	n/a

“A” indicates that the degradation in traffic operations, if any, is within an acceptable range. “X” indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative C with the West Option:

- Nine intersections would degrade to LOS F in at least one peak period.
- Twenty-six intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 20 projected to do so in both peak hours.
- Twenty-two intersections would experience increased delays of more than 5 seconds, with 18 projected to do so in both peak hours.

5.5.4.2 Indirect Operational Impacts

Alternative C (either option) would have moderate adverse indirect operational impacts on multimodal transportation because of the trips generated by the potential Federal air-rights development.

In Alternative C, around 952,600 square feet of Federal air rights within the footprint of the existing parking garage and bus facility would be potentially available for development separately from the Project. For the purposes of the transportation analysis, it was conservatively assumed that this space would be developed as office space. This is a conservative assumption because it is the use that would generate the most peak-hour vehicular trips.

Table 5-100 shows the multimodal trips that the Federal air-rights development would generate under this assumption. The vehicular trips were incorporated in the traffic analysis.

Table 5-100. Federal Air-rights Development Trip Generation, Alternative C

	AM Peak			PM Peak		
	Total Trips	**Inbound**	**Outbound**	**Total Trips**	**Inbound**	**Outbound**
Parking	296	260	36	292	50	141
Private Pick-Up/Drop-Off	0	0	0	0	0	0
For-hire	22	19	3	21	4	17
Car Rental	0	0	0	0	0	0
Amtrak Express	10	9	1	11	2	9
Amtrak Corridor	0	0	0	0	0	0
MARC	137	128	9	147	23	124
VRE	79	74	5	84	13	71
Metrorail	295	276	19	316	50	266
Streetcar	29	27	2	32	5	27
City/Commuter Bus	59	55	4	63	10	53
Pedestrian	98	92	6	105	17	88
Bicycle	98	92	6	195	17	88

The Federal air-rights development would add trips to local transportation modes, an adverse impact. The number of additional trips would be typical of an office space development of its size, however, and represent a small increment over those directly generated by Alternative C. Therefore, this adverse impact would be moderate.

5.5.4.3 Construction Impacts

Construction of Alternative C (either option) would take place over approximately 12 years and 3 months. As in the other Action Alternatives, and as explained for Alternative A in **Section 5.5.2.3**, *Construction Impacts*, work would be conducted in four east-to-west phases with the greatest impacts on transportation occurring in Phase 4. Phase durations and the duration of excavation activities in each phase for Alternative B are shown in **Table 5-101**.

Table 5-101. Construction and Excavation Duration, Alternative C (Either Option)

Phase	Overall Duration	Duration of Excavation
Phase 1	2 years, 5 months	5 months
Intermediate Phase	*12 months*	*None*
Phase 2	2 years, 4 months	10 months
Phase 3	2 years, 6 months	11 months
Phase 4	4 years	2 years
Total Project Completion	12 years, 3 months	4 years, 2 months

Except for the difference in duration, the construction impacts of Alternative C on all transportation modes considered other than intercity, tour/charter, and sightseeing buses; city and commuter buses; vehicular parking and rental cars; and vehicular traffic would be as described for Alternative A in **Section 5.5.2.3**, *Construction Impacts*. Construction impacts on city and commuter buses would be as described for Alternative B in **Section 5.5.3.3**, *Construction Impacts*. The following sections focus on those Alternative C impacts that would meaningfully differ from those of Alternative A or Alternative B. Refer to **Section 5.5.2.3** or **5.5.3.3** for impacts on the transportation modes not addressed below.

Intercity, Tour/Charter, and Sightseeing Buses

Construction of Alternative C with the East Option would have minor adverse impacts on bus operations and bus passenger accommodations. Construction of Alternative C with the West Option would have major adverse impacts on bus operations and bus passenger accommodations.

In Alternative C with the East Option, the existing bus facility would remain in operation until its demolition during Phase 4 of construction, which would last approximately 4 years and begin approximately 8 years and 3 months after the start of construction. The new facility, located to the north of H Street NE on the eastern side of the Project Area, would be complete by the time the existing one is demolished. Bus operations could move to the new location with minimal disruption. The bus pick-up and drop-off area near the train hall would not be available until the end of Phase 4, although it is anticipated that implementation of an enhanced active management approach would allow the main facility to operate adequately in the interim. The potential reduction in flexibility and the greater active management challenges would be a minor adverse impact.

With the West Option, neither of the bus facilities would be available when the existing one is demolished. Therefore, impacts would be as described for Alternative A in **Section 5.5.2.3**, *Construction Impacts, Intercity, Tour/Charter, and Sightseeing Buses*, except for the difference in duration.

Vehicular Parking and Rental Cars

Construction of Alternative C (either option) would have a major adverse direct impact on parking between the demolition of the existing parking garage and the completion of the below-ground parking in Phase 4 of construction.

East Option

The existing parking garage would remain in operation until its demolition in Phase 4 of construction, which would last for approximately 4 years and begin approximately 8 years and 3 months after the start of construction. By that time, the new above-ground parking facility on the eastern side of the Project Area would be complete. This parking facility would provide about 750 spaces. The below-ground parking facility would not be available until the end of Phase 4. Until the completion of the below-ground facility, there would be a shortage of parking at WUS relative to the parking program of 1,600 spaces. The program would not be fully met, including USRC's obligation, under current lease agreements, to provide 600 parking spaces to serve retail activities at WUS as well as 900 additional spaces. [91]

To fully meet the parking program, interim parking would have to be provided. At the current stage of planning, no potential location or locations have been identified. Without an adequately-sized interim parking location, during phase 4, there would be a shortage of around 850 parking spaces at WUS relative to the program.

The reduction in parking capacity would likely lead WUS visitors or passengers to use alternative modes of transportation, including Metrorail, for-hire vehicle, and private pick-ups and drop-offs. Based on projected distribution, this shift would generate approximately 433 daily Metrorail trips, 195 daily for-hire trips, and 195 daily private pick-up and drop-off

[91] Appendix A6, *Parking Program Memorandum*, provides more information on parking demand projection and the development of the parking program.

trips.[92] Given the overall daily volumes of these modes, the added trips would be manageable.

As explained for Alternative A (**Section 5.5.2.3**, *Construction Impacts, Vehicular Parking and Rental Cars*), it is possible that some WUS-users would still drive to the station, including users from areas not well served by transit, who may have a limited set of options. These users may seek parking in commercial garages. No significant use of local streets for WUS-related long-term parking is likely because of parking restrictions.

West Option

With the West Option, neither the above-ground nor the below-ground parking facility would be available when the existing garage is demolished. Therefore, impacts would be as described for Alternative A: See **Section 5.5.2.3**, *Construction Impacts, Vehicular Parking and Rental Cars* except for the duration (four years in Alternative C).

Vehicular Traffic

Construction of Alternative C (either option) would have major adverse impact on vehicular traffic operations because of roadway closures and construction vehicle traffic.

In addition to the impacts described in **Section 5.5.2.3**, *Construction Impacts, Vehicular Traffic* for Alternative A, the construction of the new intersection providing access to the below-ground parking facility in Alternative C would require lane closures under the K Street overpass. As noted in **Section 5.5.3.3**, *Construction Impacts, Vehicular Traffic* for Alternative B, one lane of traffic in each direction would remain in operation at least during the day. However, delays and back-up may occur, and some traffic may seek alternative routes, such as L Street.

As in the other Action Alternatives, construction of Alternative C would generate truck traffic to and from the Project Area during the entire construction period. The greatest amount of traffic would occur during excavation activities, with up to 120 trucks per day. As explained for Alternative A, this is a maximum, conservative estimate that assumes that no work trains would be used to haul spoils away. As in all Action Alternatives, construction trucks have the potential to result in major adverse impacts on local traffic operations. With one-level of below-ground parking on the west side of the Project Area, Alternative C would require substantial excavation and generate a commensurate amount of spoil. Excavation for the below-ground parking facility would occur in Phase 4. In Alternative C, excavation-related truck traffic would occur for approximately 2 years. Because work in Phase 4 would be on the west side of the Project Area, First Street NE would be the local street most affected. As in all

92 Because of the anticipated disruption in Metrorail service during Phase 4, however, fewer people may use Metrorail as an alternative mode of travel than modeled.

Action Alternatives, use of work train to remove the spoils could reduce or eliminate excavation-related truck traffic.

5.5.5 Alternative D

The following sections describe the direct and indirect, operational and construction impacts of Alternative D. The key transportation elements of Alternative D are illustrated in **Figure 5-17**.

5.5.5.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative D would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

Intercity Railroad Service

The impacts of Alternative D would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Intercity Railroad Service*.

MARC

The impacts of Alternative D would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, MARC*.

VRE

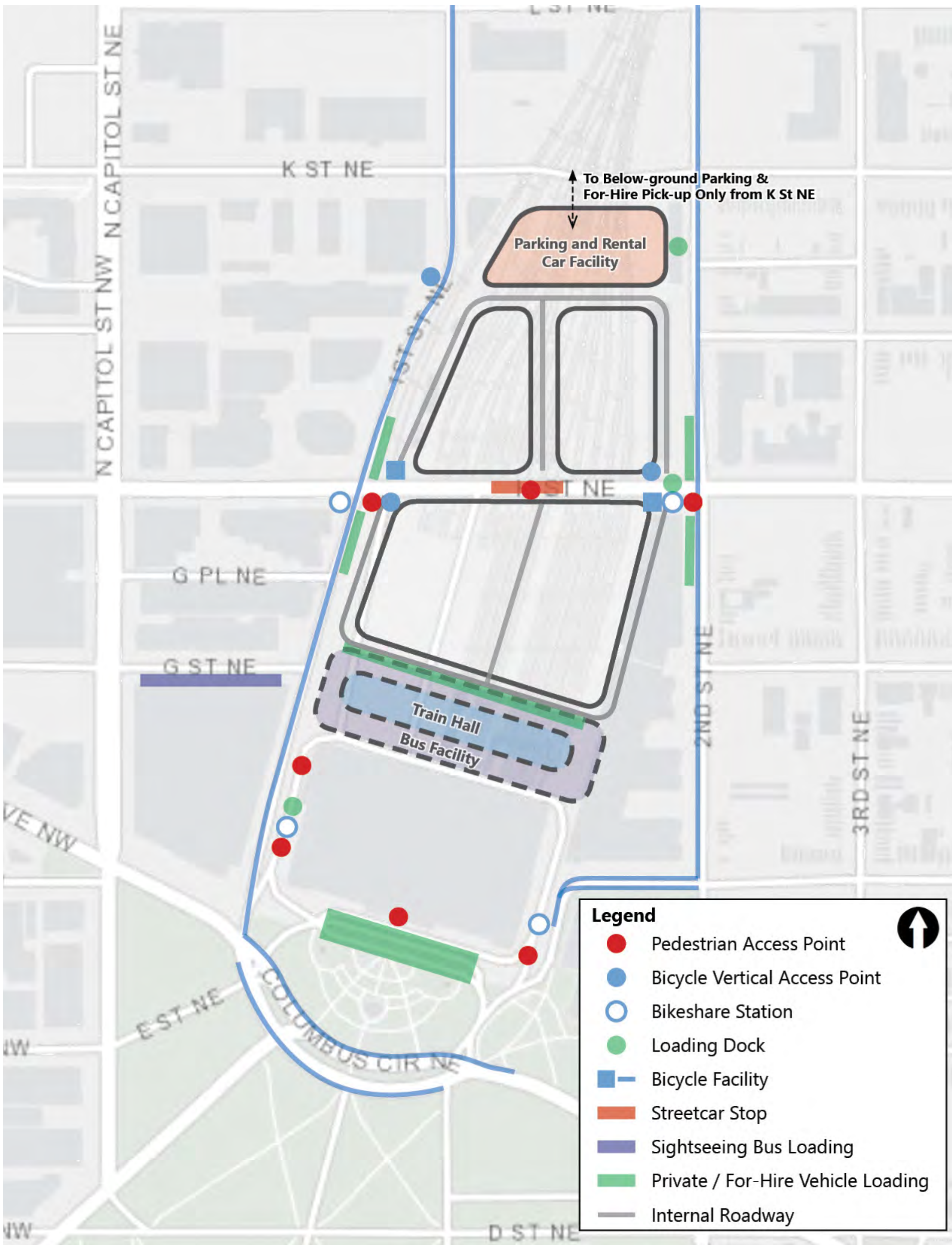
The impacts of Alternative D would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, VRE*.

Private Train Cars

Relative to the No-Action Alternative, Alternative D would have no direct operational impact on train operations.

The impacts of Alternative D would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Private Train Cars.*

Figure 5-17. Key Transportation Element Locations, Alternative D



WMATA Metrorail

Relative to the No-Action Alternative, Alternative D would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would cause or aggravate train overcapacity and station circulation issues.

Increased train service and ridership at WUS in Alternative D as well as the reduction in parking capacity and the new retail uses included in the alternative would generate increased demand on Metrorail. Modeled AM peak and PM peak activity is shown in **Table 5-102** and **Table 5-103**.

Table 5-102. AM Peak Metrorail Activity, Alternative D

	Alternative D		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[93]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,377	1,626	5,202	1,010	2,802	528
WUS Alightings	5,050	3,428	4,128	2,803	923	3,644
Through Ridership	9,214	1,291	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,591	2,917	14,725	2,457	10,378	1,955
V/C Departing WUS	103%	17%	86%	14%	69%	13%
Excess Passengers	448	0	0	0	0	0

93 Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

Table 5-103. PM Peak Metrorail Activity, Alternative D

	Alternative D		No-Action		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
V/C Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS[94]	21%	115%	20%	107%	19%	72%
WUS Boardings	3,209	4,591	2,559	3,661	3,265	918
WUS Alightings	1,553	8,239	1,154	6,126	582	3,090
Through Ridership	1,647	9,920	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,856	14,511	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Passengers	0	2,421	0	1,110	0	0

In 2040, Alternative D volumes would exceed capacity in the Shady Grove direction departing WUS during the AM peak. During the PM peak, capacity would be exceeded arriving at WUS in the Glenmont direction.

In the AM peak, Alternative D would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 86 percent in the No-Action Alternative. As a result, Alternative D would create an excess demand of 448 passengers. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate within the Red Line core. [95]

In the PM peak, capacity exceedance toward Glenmont (115 percent) would be greater in Alternative D than in the No-Action Alternative (107 percent). Alternative D would aggravate the level of crowding, generating an additional excess demand of approximately 1,311 passengers, for a total excess demand of 2,421.

In the PM peak, departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative D would cause no additional exceedance of this threshold relative to the No-Action Alternative.

The increase in Metrorail ridership at WUS would also affect passenger circulation as described in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail*.

94 Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

95 The Red Line core, as defined by WMATA, consists of the line segment between Dupont Circle and WUS.

Comparison to Existing Conditions

Relative to existing conditions, Alternative D would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

In the AM peak, Alternative D would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 69 percent in existing conditions. Alternative D would increase the overall demand in the AM peak in the Shady Grove direction by an estimated 7,213 passengers.

In the PM peak, the V/C ratio arriving at WUS toward Glenmont would be 115 percent, against 72 percent under existing conditions. Alternative D would increase overall demand in this direction by around 8,211 passengers.

The increase in Metrorail ridership at WUS would also affect passenger circulation relative to existing conditions as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail, Comparison to Existing Conditions.*

DC Streetcar

Relative to the No-Action Alternative, Alternative D would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Alternative D would generate the same level of additional Streetcar ridership as Alternative A, presented in **Section 5.5.2.1**, *Direct Operational Impacts, DC Streetcar.*

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative D would have a moderate adverse direct operational impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Alternative D would have a negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

In Alternative D, the bus facility would be located just north of the historic station building, looping around the new train hall. Access would be from H Street NE via the west intersection and egress back to H Street NE would be via the east intersection. All intercity, tour/charter, and daily sightseeing buses serving WUS would use this facility.

The anticipated increase in bus ridership and impacts of the 30-minute time limit required because of the reduction in the number of slips relative to the existing facility (which would continue in use in the No-Action Alternative) would be the same as those of Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. There would be greater flexibility in bus movements in Alternative D than in the No-

Action Alternative because buses exiting the facility could turn either left or right onto H Street NE.

Loading

Relative to the No-Action Alternative, Alternative D would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

The impacts of Alternative D on loading would be the same as those of Alternative A and the other Action Alternatives. See **Section 5.5.2.1**, *Direct Operational Impacts, Loading.*

Pedestrians

Relative to the No-Action Alternative, Alternative D would have a moderate beneficial direct operational impact on pedestrian circulation inside WUS. Additional access points would disperse pedestrian traffic and make access to WUS easier; however, some passengers would have to walk longer distances. Outside of WUS, Alternative D would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

The impacts of Alternative D on pedestrian movements would be generally the same as those of Alternative A (See **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians*). Because of the location of the new above- and below-ground parking facilities, however, beneficial impacts would be moderate because longer walking distances would partially offset the benefits from increased circulation spaces and additional access points. Users of the above-ground parking facility would have to walk outside from the facility to H Street NE to reach the nearest entry point to the H Street Concourse.

<u>**Comparison to Existing Conditions**</u>

The impacts of Alternative D relative to existing conditions would be as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians, comparison to Existing Conditions*.

Bicycle Activity

Relative to the No-Action Alternative, Alternative D would result in a minor adverse direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be offset by increased conflicts with pedestrians and vehicles on both First Street and K Street NE.

The impacts of Alternative D would be the same as those of Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, Bicycle Activity.*

City and Commuter Buses

Relative to the No-Action Alternative, Alternative D would have a minor adverse direct operational impact on city and commuter buses. Increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delay experienced by all buses. There would also be a moderate adverse direct operational impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

The impacts of Alternative D on ridership would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses.* The impacts of Alternative D on city and commuter bus operations would be the same as those of Alternative B (see **Section 5.5.3.1**, *Direct Operational Impacts, City and Commuter Buses*).

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative D would have a moderate adverse direct operational impact on parking at WUS because of a reduction in parking capacity. Alternative D would have a minor beneficial direct operational impact on rental car operations.

Alternative D would split parking between a new above-ground parking facility (south of K Street NE) and a new below-ground parking facility beneath the railroad tracks. Vehicular access to the above-ground facility would be via H Street NE. Inbound vehicles would use the east intersection and outbound ones the west intersection. Vehicular access to the below-ground facility would be through a new intersection in the K Street NE underpass, like in Alternatives B and C (see **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*).

Relative to the No-Action Alternative, this would change the routes WUS parking users would take to travel to or from the station and affect the local network. However, the change in location by itself would not adversely affect parking or car rental activities. The new parking facilities would offer space for approximately 800 fewer cars than the existing one. This would be an adverse impact. This adverse impact would be moderate because the new facilities would meet the parking program for the Project and while they would not meet the projected parking demand, it is anticipated that users not able to park would use different modes to reach the station.[96] Fewer passengers or visitors are anticipated to drive and park at WUS by 2040. [97] The impacts of the reduction in parking capacity on other modes of travel were taken into account in the impact analyses conducted for those modes.

[96] Appendix A6, *Parking Program Memorandum*, provides more information on parking demand projections and the development of the parking program.

[97] The MWCOG Model estimates a 10% reduction in single-occupancy vehicle trips in the WUS area to 2040.

The number of spaces provided in Alternative D would be the same as in Alternative C with the East Option (see **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*) and the number of parking-generated vehicular trips would be the same as in that alternative. However, the trips to the above-ground parking facility would be distributed differently. In Alternative D, parking access would be distributed between two intersections on H Street as opposed to a single intersection (east or west depending on the option) in Alternative C. These trips are shown in **Table 5-104** and were incorporated in the traffic impact analysis.

Table 5-104. Peak-hour Parking Trips, Alternative D

	Alternative D		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	183	76	127	102	104	53
Outs	79	218	62	197	24	154
Total	**262**	**294**	**189**	**299**	**128**	**207**

Increased WUS activity in Alternative D would generate the same number of rental car trips as in Alternative A, explained in **Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*. These trips are shown in **Table 5-57**. As in the other Action Alternatives, the design of the new rental car facility would address the capacity issues that would occur in the No-Action Alternative, resulting in a beneficial impact. This beneficial impact would be minor, being partially offset by the increase in operations.

<u>**Comparison to Existing Conditions**</u>

The impacts of Alternative D relative to existing conditions would be the same as those of Alternative C: See **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars, comparison to Existing Conditions*.

For-hire Vehicles

Relative to the No-Action Alternative, Alternative D would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative D would also have a moderate adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The same five pick-up and drop-off locations would be provided in Alternative D as in Alternative C. The distribution of for-hire trips among those locations would also be the same: See **Section 5.5.4.1**, *Direct Operational Impacts, For-hire Vehicles*. The anticipated number of peak-hour for-hire trips in Alternative D would be the same as in Alternative C: See **Table 5-87**. These trips were incorporated in the traffic impact analysis. Impacts from queuing and congestion would be as described for Alternative C in **Section 5.5.4.1,** *Direct*

Operational Impacts, For-Hire Vehicles and **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis.*

Comparison to Existing Conditions

The impacts of Alternative D relative to existing conditions would be as described for Alternative C: See **Section 5.5.4.1**, *Direct Operational Impacts, For-hire Vehicles, comparison to Existing Conditions*.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative D would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for these activities. These locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips but queuing may occur. Alternative D would also have a moderate adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

The same locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be allowed to use the east ramp to get to the front of WUS. The anticipated distribution of trips would be the same as for for-hire vehicles trips.

The anticipated number of peak-hour private pickup and drop-off trips in Alternative D would be the same as in Alternative C: See **Table 5-88**. Impacts from queuing and congestion would be as described for Alternative C in **Section 5.5.2.2**, *Direct Operational Impacts, Private Pick-up and Drop-off* and **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis*.

Comparison to Existing Conditions

The impacts of Alternative D relative to existing conditions would be as described for Alternative C: See **Section 5.5.4.1**, *Direct Operational Impacts, Private Pick-up and Drop-off, comparison to Existing Conditions*.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative D would have major adverse direct operational impacts on traffic operations at several intersections near WUS because of increased traffic volumes and changes in traffic patterns due to the new parking facility location. During at least one of the peak periods, out of 36 intersections in the Local Study Area, four would degrade to LOS F; 14 would experience an increase in queue length of more than 150 feet; and 20 would experience an increase in average delay of more than 5 seconds.

Trip Generation and Circulation

WUS-related vehicular activity in Alternative D would be primarily distributed across five locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility, new above-ground parking facility, and new pick-up/drop-off location accessed from H Street NE;
- The new below-ground parking facility accessed from K Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse); and
- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse).

The anticipated distribution of WUS-related vehicular trips by access point and type of trip in Alternative D would be the same as in Alternative C, shown in **Table 5-89**. Alternative D would also generate the same number of WUS-related trips as Alternative C. These are shown in **Tables 5-90** (AM peak) and **5-91** (PM peak) above. Approximately 70 percent of WUS-related traffic would travel to and from points west of WUS and 30 percent going to points east. Deck-level circulation in Alternative D is represented in **Figure 5-18**. [98] Volume increases would result in major adverse impacts to traffic operations. An operational analysis of the local traffic network is presented below under *Intersection Analysis.*

Curbside Analysis

The anticipated impacts of for-hire and private pick-up and drop-off activity on curbside activity would be the same as those described for Alternative C (see **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis*).

Intersection Analysis

As with all of the Action Alternatives, three indicators were used to assess the cumulative impacts on traffic operations in Alternative D based on comparison to the No-Action Alternative: degradation of intersection LOS to F due to vehicle trips generated by the Project; an increase in average vehicle delay at an intersection by more than 5 seconds; and an increase in 95^{th}-percentile queue lengths of more than 150 feet for any lane group in an intersection.

[98] Figure 5-18 shows all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Figure 5-18. Deck Level Circulation (All Movements), Alternative D

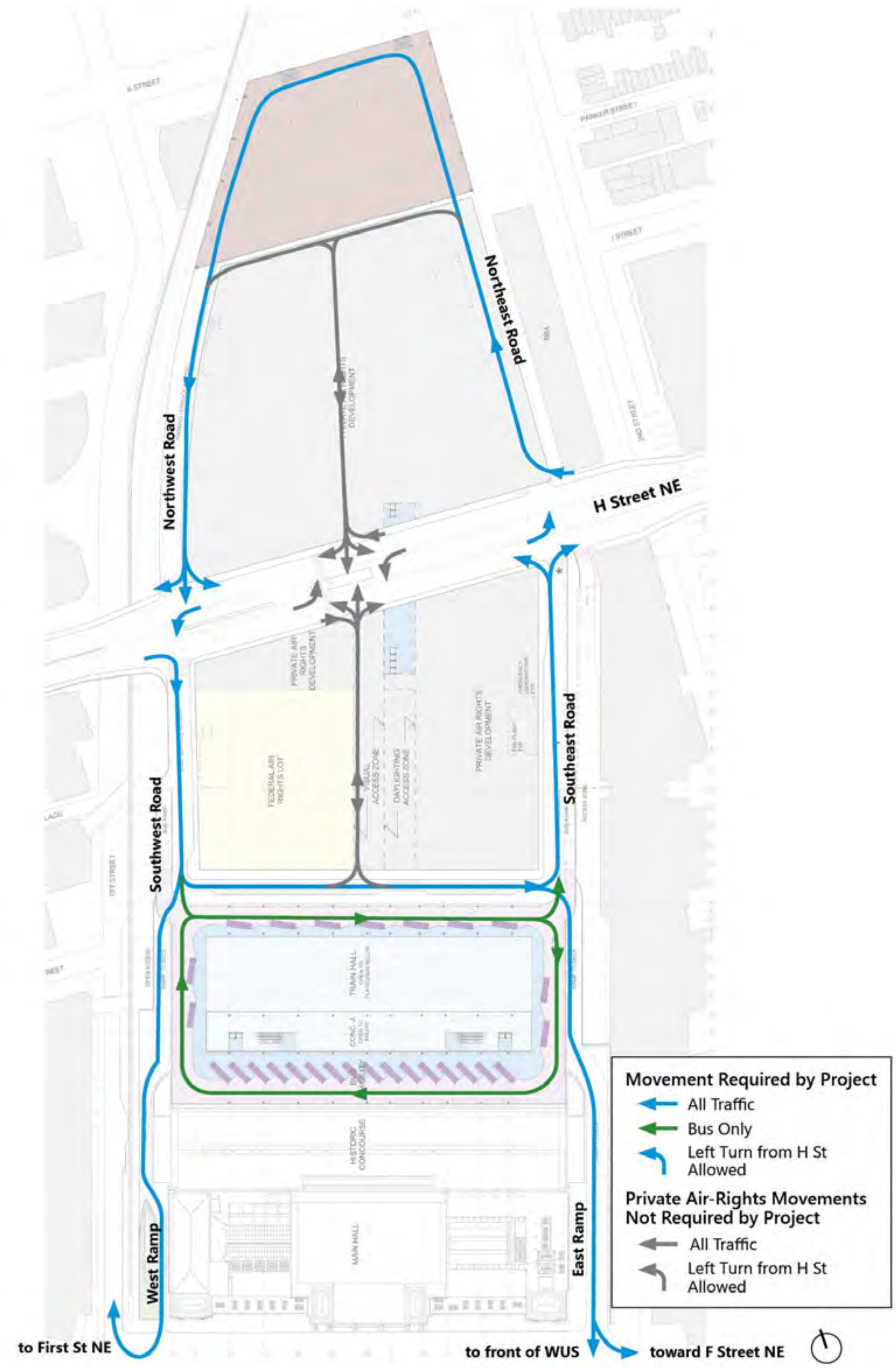


Table 5-105 shows the intersections projected to degrade to LOS F in Alternative D. The peak-hour LOS of the study intersections are shown in **Figure 5-19** below. In Alternative D, four intersections would degrade to LOS F from a better LOS during at least one peak hour relative to the No-Action Alternative.

Table 5-106 shows intersections with unacceptable queue increases in Alternative D. Fourteen intersections would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Seven of these would experience such a queue increase in both peak hours.

Table 5-107 shows intersections with projected delay increases exceeding 5 seconds compared to the No-Action Alternative. In Alternative D, 20 of the 36 study intersections would experience an increased delay of more than 5 seconds in at least one peak period relative to the No-Action Alternative. Fourteen would see such a delay increase in both peak hours.

Table 5-108 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and Existing Conditions across the three indicators for traffic operations impacts in Alternative D.

Table 5-105. Intersections with Failing LOS, Alternative D

Int. No.	Intersection Name	Alternative D		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	North Capitol Street / K Street	F	**F**	F	E	F	D
2	First Street / K Street	F	**F**	F	E	F	E
5	North Capitol Street / H Street	F	F	F	F	C	C
8	WUS East Intersection / H Street NE	F	B	F	B	B	A
9	3rd Street / H Street NE	F	C	F	C	E	C
17	First Street / E Street / Mass. Avenue NE	**F**	C	E	B	D	B
20	Louisiana Avenue / D Street NW	F	E	F	E	F	F
21	Louisiana Avenue / North Capitol Street	F	F	F	F	F	D
32	3rd Street / Massachusetts Avenue/ H St NW	E	F	D	F	E	D
35	WUS Central Intersection / H Street NE	**F**	C	B	B	-	-

Figure 5-19. Intersection Peak Hour LOS in Alternative D

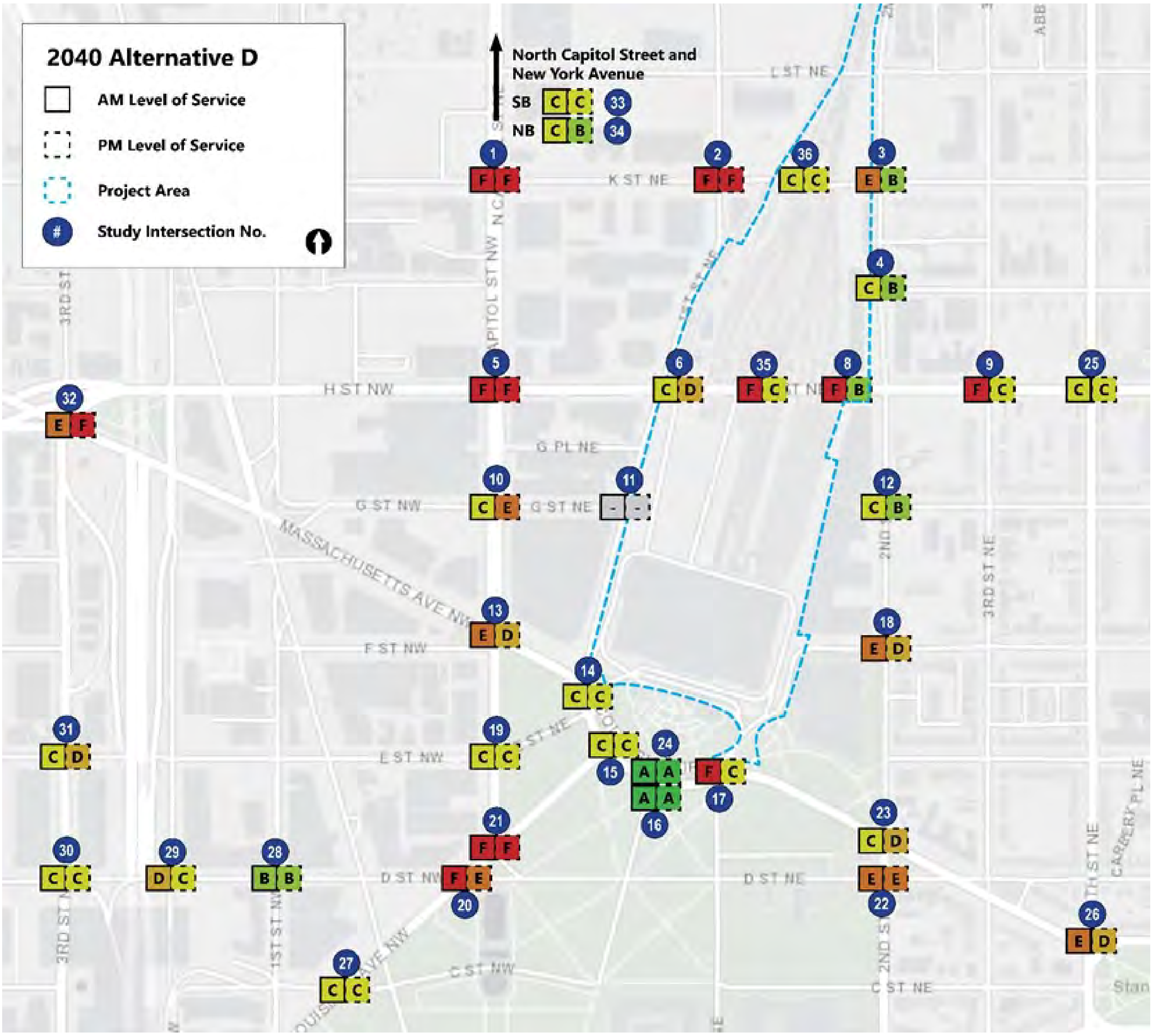


Table 5-106. Intersections with Queue Increase > 150 Feet, Alternative D

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	North Capitol Street / K Street	2 / 11	5 / 10	6 / 10	4 / 10
2	First Street / K Street NE	1 / 5	3 / 5	1 / 6	4 / 6
3	2nd Street / K Street NE	0 / 6	0 / 6	2 / 6	1 / 6
5	North Capitol Street / H Street	4 / 10	2 / 9	9 / 9	6 / 6
6	WUS West Intersection / H Street NE	0 / 5	2 / 5	2 / 3	3 / 3
8	WUS East Intersection / H Street NE	0 / 7	0 / 7	1 / 2	1 / 2
9	3rd Street / H Street NE	0 / 8	0 / 8	3 / 7	2 / 7
10	North Capitol Street / G Street	3 / 7	2 / 6	2 / 6	2 / 6
13	North Capitol Street / Massachusetts Avenue	3 / 10	0 / 10	6 / 10	5 / 10
14	Massachusetts Avenue / E Street / First Street NE	0 / 9	0 / 9	1 / 9	0 / 9
15	Louisiana Avenue / Massachusetts Avenue NE	0 / 5	0 / 5	3 / 5	0 / 5
17	First Street / Massachusetts Avenue NE	0 / 7	0 / 7	3 / 7	1 / 7
19	North Capitol Street / E Street	1 / 10	0 / 10	0 / 10	2 / 10
20	Louisiana Avenue / D Street NW	1 / 8	2 / 8	2 / 9	2 / 9
21	Louisiana Avenue / North Capitol Street	0 / 6	0 / 6	1 / 5	2 / 5
22	2nd Street / D Street NE	1 / 4	0 / 4	1 / 4	1 / 4
23	2nd Street / Massachusetts Avenue NE	0 / 7	1 / 6	2 / 7	2 / 6
25	4th Street / H Street NE	0 / 6	0 / 6	2 / 6	0 / 6
26	Massachusetts Avenue / C Street / 4th Street NE	0 / 5	1 / 5	3 / 5	2 / 5
27	Louisiana Avenue / C Street NW	2 / 11	4 / 11	3 / 11	3 / 10
29	2nd Street / D Street NW	0 / 4	0 / 4	2 / 5	0 / 5
30	3rd Street / I-395 On-ramp / D Street NW	0 / 10	0 / 10	1 / 11	1 / 11
31	3rd Street / E Street NW	1 / 11	0 / 10	4 / 11	2 / 10
32	3rd Street / Massachusetts Avenue/ H St NW	0 / 6	0 / 6	0 / 6	3 / 6
33	North Capitol Street (SB Ramp) / New York Avenue	0 / 6	0 / 6	3 / 6	2 / 6
34	North Capitol Street (NB Ramp) / New York Avenue	0 / 6	0 / 6	2 / 6	0 / 6
35	WUS Central Intersection / H Street NE	2 / 8	2 / 8	-	-

Table 5-107. Intersections with Delay Increase > 5 seconds, Alternative D

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	147.1	203.3	194.1	238.8
2	First Street / K Street NE	32.7	205.7	104.5	224.1
3	2nd Street / K Street NE	33.6	5.6	44.9	6.6
4	2nd Street / I Street NE	< 5	< 5	5.4	< 5
5	North Capitol Street / H Street	123.5	155.2	284.7	420.8
6	WUS West Intersection / H Street NE	9.5	< 5	20.0	27.7
8	WUS East Intersection / H Street NE	< 5	< 5	117.6	15.8
9	3rd Street / H Street NE	46.7	< 5	91.4	9.9
10	North Capitol Street / G Street	14.0	45.3	12.7	48.6
13	North Capitol Street / Massachusetts Avenue	28.2	< 5	32.1	13.5
15	Louisiana Avenue / Massachusetts Avenue NE	< 5	< 5	9.9	< 5
17	First Street / Massachusetts Avenue NE	56.2	< 5	78.3	5.2
18	2nd Street / F Street NE	22.1	10.1	26.5	12.0
19	North Capitol Street / E Street	6.2	< 5	9.5	< 5
20	Louisiana Avenue / D Street NW	87.2	13.8	< 5	< 5
21	Louisiana Avenue / North Capitol Street	68.5	18.7	246.3	180.1
22	2nd Street / D Street NE	23.8	20.4	19.7	< 5
23	2nd Street / Massachusetts Avenue	6.7	5.2	6.2	9.0
25	4th Street / H Street NE	< 5	< 5	8.0	11.2
26	Massachusetts Avenue / C Street / 4th St NE	15.3	10.2	26.6	11.5
27	Louisiana Avenue / C Street NW	8.2	6.6	14.3	10.7
31	3rd Street / E Street NW	< 5	5.1	5.8	11.9
32	3rd Street / Massachusetts Avenue/ H Street NW	22.9	15.7	8.8	48.3
35	WUS Central Intersection / H Street NE	99.1	7.8	-	-

Table 5-108. MOE Summary Table, Alternative D

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	A	X	X	A	X	X

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
7	WUS Bus Exit / H Street NE	n/a	n/a	n/a	n/a	n/a	n/a
8	WUS East Intersection / H Street NE	A	A	A	X	X	X
9	3rd Street / H Street NE	A	A	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Ave	A	X	X	A	X	X
14	Massachusetts Avenue / E Street / First Street NE	A	A	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	A	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	A	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	X	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	A	A	X	A
30	3rd Street / I-395 On-ramp / D Street NW	A	A	A	A	X	A
31	3rd Street / E Street NW	A	X	X	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	A
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	X	X	X	n/a	n/a	n/a
36	K Street NE / WUS Underground Parking Facility	n/a	n/a	n/a	n/a	n/a	n/a

"A" indicates that the degradation in traffic operations, if any, is within an acceptable range. "X" indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative D:

- Eight intersections would degrade to LOS F in at least one peak period.
- Twenty-six intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 19 projected to do so in both peak hours.
- Twenty-two intersections would experience delay increases of more than 5 seconds, with 18 projected to do so in both peak hours.

5.5.5.2 Indirect Operational Impacts

Alternative D would have moderate adverse indirect operational impacts on multimodal transportation because of the trips generated by the potential Federal air-rights development.

In Alternative D, approximately 688,050 square feet of Federal air rights within the footprint of the existing parking garage and bus facility would be potentially available for development separately from the Project. For the purposes of the transportation analysis, it was conservatively assumed that this space would become office space. This is a conservative assumption because office space is the use that would generate the most peak-hour vehicular trips.

Table 5-109 shows the multimodal trips that would be generated by the Federal air-rights development under this assumption. The vehicular trips were considered in the traffic analysis for Alternative D.

Table 5-109. Federal Air-rights Development Trip Generation, Alternative D

	AM Peak			PM Peak		
	Total Trips	**Inbound**	**Outbound**	**Total Trips**	**Inbound**	**Outbound**
Parking	228	201	27	216	37	179
Private Pick-Up/Drop-Off	0	0	0	0	0	0
For-hire	16	14	2	16	3	13
Car Rental	0	0	0	0	0	0
Amtrak Express	7	7	0	8	2	6
Amtrak Corridor	0	0	0	0	0	0
MARC	100	96	4	106	16	90
VRE	57	55	2	60	9	51
Metrorail	215	206	9	227	35	192
Streetcar	21	20	1	23	4	19
City/Commuter Bus	43	41	2	45	7	38
Pedestrian	72	69	3	76	12	64
Bicycle	72	69	3	76	12	64

The Federal air-rights development would add trips to local transportation modes, an adverse impact. The number of additional trips would be typical of an office space development of its size, however, and represent a small increment over those directly generated by Alternative D. Therefore, this adverse impact would be moderate.

5.5.5.3 Construction Impacts

With regard to construction, Alternative D would be very similar to Alternative C, placing similar elements in similar locations (one level of below-ground parking, above-ground parking facility north of H Street NE, and bus slips adjacent to the new train hall). The anticipated construction period would be the same (12 years and 3 months) and each phase, including Phase 4, would take the same amount of time. Impacts would be as in Alternative C with the West Option. **Section 5.5.4.3**, *Construction Impacts* addresses these impacts.

5.5.6 Alternative E

The following sections describe the direct, indirect, and construction impacts of Alternative E. **Figure 5-20** illustrates the key transportation elements of Alternative E.

5.5.6.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative E would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

<u>**Intercity Railroad Service**</u>

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Intercity Road Service*.

<u>**MARC**</u>

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, MARC*.

<u>**VRE**</u>

Impacts would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, VRE*.

Figure 5-20. Key Transportation Element Locations, Alternative E

Private Train Cars

Relative to the No-Action Alternative, Alternative E would have no direct operational impact on train operations.

The impacts of Alternative E would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Private Train Cars.*

WMATA Metrorail

Relative to the No-Action Alternative, Alternative E would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would aggravate train overcapacity and station circulation issues.

Increased train service and ridership at WUS, as well as the reduction in parking capacity and the new retail uses, would generate increased demand on Metrorail. Modeled AM peak and PM peak activity in Alternative E is shown in **Table 5-110** and **Table 5-111,** respectively.

Table 5-110. AM Peak Metrorail Activity, Alternative E

	Alternative E		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[99]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,397	1,630	5,202	1,010	2,802	528
WUS Alightings	5,096	3,459	4,128	2,803	923	3,644
Through Ridership	9,168	1,260	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,565	2,890	14,725	2,457	10,378	1,955
V/C Departing WUS	102%	17%	86%	14%	69%	13%
Excess Passengers	422	0	0	0	0	0

[99] Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

Table 5-111. PM Peak Metrorail Activity, Alternative E

	Alternative E		No-Action Alternative		Existing Conditions	
	Shady Grove	**Glenmont**	**Shady Grove**	**Glenmont**	**Shady Grove**	**Glenmont**
Passengers Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS	20%	115%	20%	107%	19%	72%
WUS Boardings	3,244	4,643	2,559	3,661	3,265	918
WUS Alightings	1,558	8,268	1,154	6,126	582	3,090
Through Ridership	1,642	9,891	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,886	14,534	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Passengers	0	2,421	0	1,110	0	0

By 2040, in Alternative E, volumes would exceed capacity in the Shady Grove direction during the AM peak when leaving WUS. In the PM peak, volumes would exceed capacity in the Glenmont direction when arriving at WUS.

In the AM peak, Alternative E would cause the V/C ratio leaving WUS toward Shady Grove to reach 102 percent, against 91 percent in the No-Action Alternative. As a result, Alternative E would create a new excess demand of approximately 422. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate within the Red Line core. [100]

In the PM peak, capacity exceedance toward Glenmont (115 percent) would be greater in Alternative E than in the No-Action Alternative (107 percent). Alternative E would aggravate the level of crowding, generating an additional excess demand of approximately 1,311 passengers, for a total of 2,421.

In the PM peak, departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative E would cause no additional exceedance of this threshold relative to the No-Action Alternative.

The increase in Metrorail ridership at WUS would also affect passenger circulation as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail*.

[100] The Red Line core, as defined by WMATA, consists of the line segment between Dupont Circle and WUS.

<u>**Comparison to Existing Conditions**</u>

Relative to existing conditions, Alternative E would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

In the AM peak, Alternative E would cause the V/C ratio leaving WUS toward Shady Grove to reach 102 percent, against 69 percent in existing conditions. Alternative E would increase the overall demand in the AM peak in the Shady Grove direction by approximately 7,187 passengers.

In the PM peak, the V/C ratio toward Glenmont arriving at WUS in Alternative E would be 115 percent, against 72 percent under existing conditions. Alternative E would increase overall demand in this direction by around 8,211 passengers.

The increase in Metrorail ridership at WUS would also affect passenger circulation relative to existing conditions as described in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail, Comparison to Existing Conditions.*

DC Streetcar

Relative to the No-Action Alternative, Alternative E would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Alternative E would generate the same level of additional Streetcar ridership as Alternative A, presented in **Section 5.5.2.1**, *Direct Operational Impacts, DC Streetcar.*

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative E would have a moderate adverse direct operational impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Alternative E would have a negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

Alternative E would provide the same bus facility and have the same impacts as Alternative D: see **Section 5.5.5.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses.*

Loading

Relative to the No-Action Alternative, Alternative E would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

The impacts of Alternative E on loading would be the same as those of Alternative A and the other Action Alternatives. See **Section 5.5.2.1**, *Direct Operational Impacts, Loading.*

Pedestrians

Relative to the No-Action Alternative, Alternative E would have a major direct operational impact on pedestrian circulation inside WUS. Additional access points would disperse pedestrian traffic and make access to WUS easier. Outside of WUS, Alternative E would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

The impacts of Alternative E would be similar to those of Alternative B, described in **Section 5.5.3.1**, *Direct Operational Impacts, Pedestrians*.

Bicycle Activity

Relative to the No-Action Alternative, Alternative E would result in a minor adverse direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be offset by increased conflicts with pedestrians and vehicles on both First Street and K Street NE.

The impacts of Alternative E would be the same as those of Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, Bicycle Activity.*

City and Commuter Buses

Relative to the No-Action Alternative, Alternative E would have a minor adverse direct operational impact on city and commuter buses because increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delay experienced by all buses. There would also be a moderate adverse direct operational impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

The impacts of Alternative E on ridership would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses.* The impacts of Alternative E on bus operations would be the same as those of Alternative B (see **Section 5.5.3.1**, *Direct Operational Impacts, City and Commuter Buses*).

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative E would have a minor adverse direct operational impact on parking at WUS because of a reduction in parking capacity. Alternative E would have a minor beneficial direct operational impact on rental car operations.

The impacts of Alternative E would be the same as those of Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*.

For-hire Vehicles

Relative to the No-Action Alternative, Alternative E would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative E would also have a moderate adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The following five pick-up and drop-off locations would be provided in Alternative E:

- **Front of WUS:** See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. A projected 40 percent of for-hire drop-off activity and 30 percent of for-hire pick-up activity is anticipated to occur in front of WUS.
- **Adjacent to the east-west train hall on the deck level:** For-hire vehicles would access this location via the west intersection on H Street NE and southwest road. Egress would be either via the southeast road and east intersection to H Street NE or via the east ramp to F Street NE or the front of WUS. A projected 35 percent of for-hire drop-off activity and 25 percent of for-hire pick-up activity is projected to occur at this location.
- **New H Street Concourse entrance on First Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative E, 20 percent of for-hire drop-off activity and 20 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on 2nd Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. An anticipated 5 percent of for-hire drop-off activity and 5 percent of for-hire pick-up activity would occur at this location.
- **New below-ground parking facility:** See **Section 5.5.3.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. A projected 20 percent of for-hire pick-up activity would occur in the underground facility; no for-hire drop-off activity would be permitted in the facility.

The anticipated number of peak-hour for-hire vehicle trips in Alternative E would be the same as in Alternative B. They are shown in **Table 5-112**. However, the peak-hour trips would make use of the full length of the southwest road, east-west train hall, and southeast road. This loop would provide more space for vehicle circulation and passenger loading and unloading activity than in Alternative B. The for-hire trips were incorporated in the traffic impact analysis.

Table 5-112. Peak-hour For-hire Trips, Alternative E

	Alternative E		No-Action Alternative		Existing Conditions	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Ins	968	1,037	262	431	197	324
Outs	968	1,037	262	431	197	324
Total	**1,936**	**2,074**	**524**	**862**	**394**	**648**

As explained in **Section 5.5.6.1,** *Direct Operational Impacts, Vehicular Traffic*, volumes associated with for-hire as well as private pick-up and drop-off activity in front of WUS could create queueing and congestion, resulting in a moderate adverse impact on for-hire vehicle operations at WUS.

Comparison to Existing Conditions

The impacts of Alternative E relative to existing conditions would be as described for Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, For-hire Vehicles, Comparison to Existing Conditions*.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative E would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for pick-ups and drop-offs for these activities. These locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips, but queuing may occur. Alternative E would also have a moderate adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

The same locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be allowed to use the east ramp to reach the front of WUS. The anticipated distribution of trips would be the same as for for-hire vehicles trips.

The anticipated number of peak-hour private pickup and drop-off trips in Alternative E would be the same as in Alternative B (see **Table 5-74**). However, the peak-hour trips would make use of the full length of the southwest road, east-west train hall, and southeast road. This loop would provide more space for vehicle circulation and passenger loading and unloading than in Alternative B.

As explained in **Section 5.5.6.1,** *Direct Operational Impacts, Vehicular Traffic*, volumes associated with private pick-up and drop-off as well as for-hire activity in front of WUS could create queueing and congestion, resulting in a moderate adverse impact on for-hire vehicle operations at WUS.

Comparison to Existing Conditions

The impacts of Alternative E relative to existing conditions would be the same as those of Alternative B: See **Section 5.5.3.1**, *Direct Operational Impacts, Private Pick-up and Drop-off, comparison to Existing Conditions*.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative E would have major adverse direct operational impacts on traffic operations at several intersections near WUS because of increased traffic volumes and changes in traffic patterns due to the new parking facility location. During at least one of the peak periods, out of 36 intersections in the Local Study Area, four would degrade to LOS F; 16 would experience an increase in queue length of more than 150 feet; and 20 intersections would experience an increase in average delay of more than 5 seconds.

Trip generation and Circulation

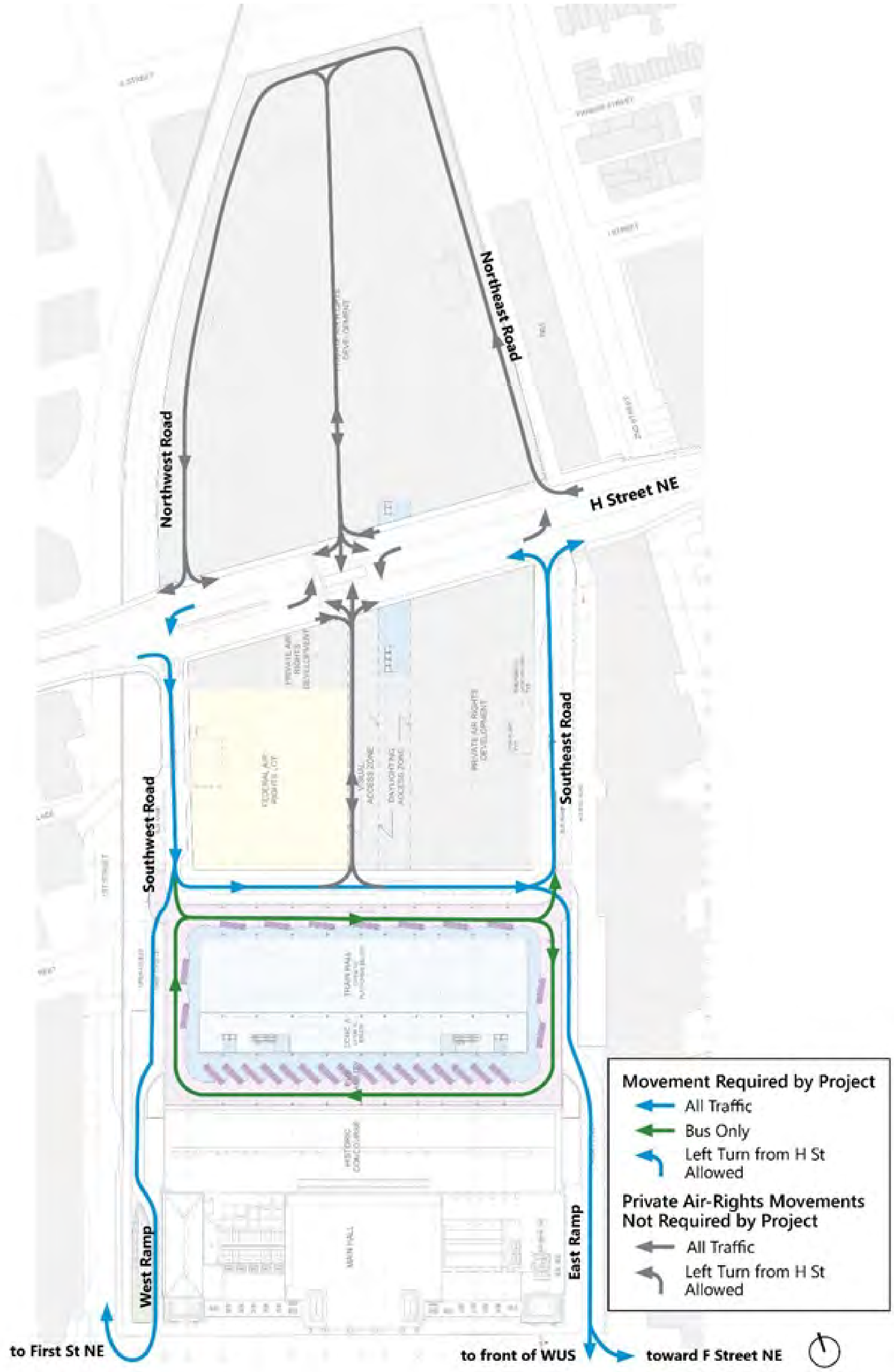
WUS-related vehicular activity in Alternative E would be primarily distributed across five locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility and new pick-up/drop-off location accessed from H Street NE;
- The new below-ground parking facility accessed from K Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse); and
- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse).

The anticipated distribution of WUS-related vehicular trips by access point and type of trip in Alternative E would be the same as in Alternative B, shown in **Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Traffic,* **Table 5-75**. All parking and rental car activity would be concentrated in the below-ground parking facility accessed from K Street NE. Private and for-hire pick-up and drop-off activity would be spread across all five access locations. Approximately 70 percent of WUS-related traffic would travel to and from points west of WUS and 30 percent to and from points east. Deck-level circulation in Alternative E is represented in **Figure 5-21.** [101]

[101] Figure 5-21 shows all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Figure 5-21. Deck Level Circulation (All Movements), Alternative E



AM and PM peak WUS-related traffic volumes in Alternative E would be the same as in Alternative B. They are shown in **Table 5-76** (AM peak) and **Table 5-77** (PM peak). Compared to the No-Action Alternative, Alternative E would generate 2,388 additional AM peak trips (237 percent increase) and 1,700 additional PM peak trips (108 percent increase). These increases in volume would result in major adverse impact to traffic operations. An operational analysis of the local traffic network is provided below under *Intersection Analysis.*

Curbside Analysis

The anticipated impacts of for-hire and private pick-up and drop-off activity on curbside activity at the H Street deck level would be the same as those described for Alternative C (see **Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis*).

The front of WUS, First Street, and 2nd Street would also experience curbside activity. Queues at the front may spill back into travel lanes on Massachusetts Avenue. The pick-up and drop-off lanes on First and 2nd Streets would help accommodate the excess volumes. No queues are expected to form at the First Street or 2nd Street pick-up and drop-off areas. On First Street, 251 pick-ups and drop-offs would occur in the AM peak and 221 would occur in the PM peak. On 2nd Street, 75 pick-ups and drop-offs would occur in the AM peak and 65 would occur in the PM peak. An estimated 94 pick-ups and drop-offs in the AM peak ad 83 pick-ups and drop-offs in the PM peak would use the below-ground facility accessed from K Street NE.

Intersection Analysis

As with all of the Action Alternatives, three indicators were used to assess the impacts on traffic operations in Alternative E, based on comparison to the No-Action Alternative: degradation of intersection LOS to F due to vehicle trips generated by the Project; an increase in average vehicle delay at an intersection by more than 5 seconds; and an increase in 95th-percentile queue lengths of more than 150 feet for any lane group in an intersection.

Table 5-113 shows intersections projected to operate at LOS F in Alternative E. The peak hour LOS of each intersection are shown in **Figure 5-22**. In Alternative E, four intersections would degrade to LOS F during at least one peak hour relative to the No-Action Alternative.

Table 5-114 shows intersections with unacceptable queue increases in Alternative E. Sixteen intersections would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Of these, ten would experience such a queue increase in both peak hours.

Table 5-115 shows study intersections with projected delay increases exceeding 5 seconds compared to the No-Action Alternative. In Alternative E, 20 intersections would experience an increased delay relative to the No-Action Alternative of more than 5 seconds in at least one peak period. Twelve would see such a delay increase in both peak hours.

Table 5-113. Intersections with Failing LOS, Alternative E

Int. No.	Intersection Name	Alternative E		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	**North Capitol Street / K Street**	F	**F**	F	E	F	D
2	**First Street / K Street**	F	**F**	F	E	F	E
5	**North Capitol Street / H Street**	F	F	F	F	C	C
8	**WUS East Intersection / H Street NE**	F	B	F	B	B	A
9	**3rd Street / H Street NE**	F	D	F	C	E	C
17	**First Street / E Street / Mass. Avenue NE**	**F**	C	E	B	D	B
20	**Louisiana Avenue / D Street NW**	F	E	F	E	F	F
21	**Louisiana Avenue / North Capitol Street**	F	F	F	F	F	D
32	**3rd Street / Massachusetts Avenue/ H Street NW**	D	F	D	F	E	D
35	**WUS Central Intersection / H Street NE**	**F**	B	B	B	-	-

Figure 5-22. Peak Hour Intersection Analysis LOS in Alternative E

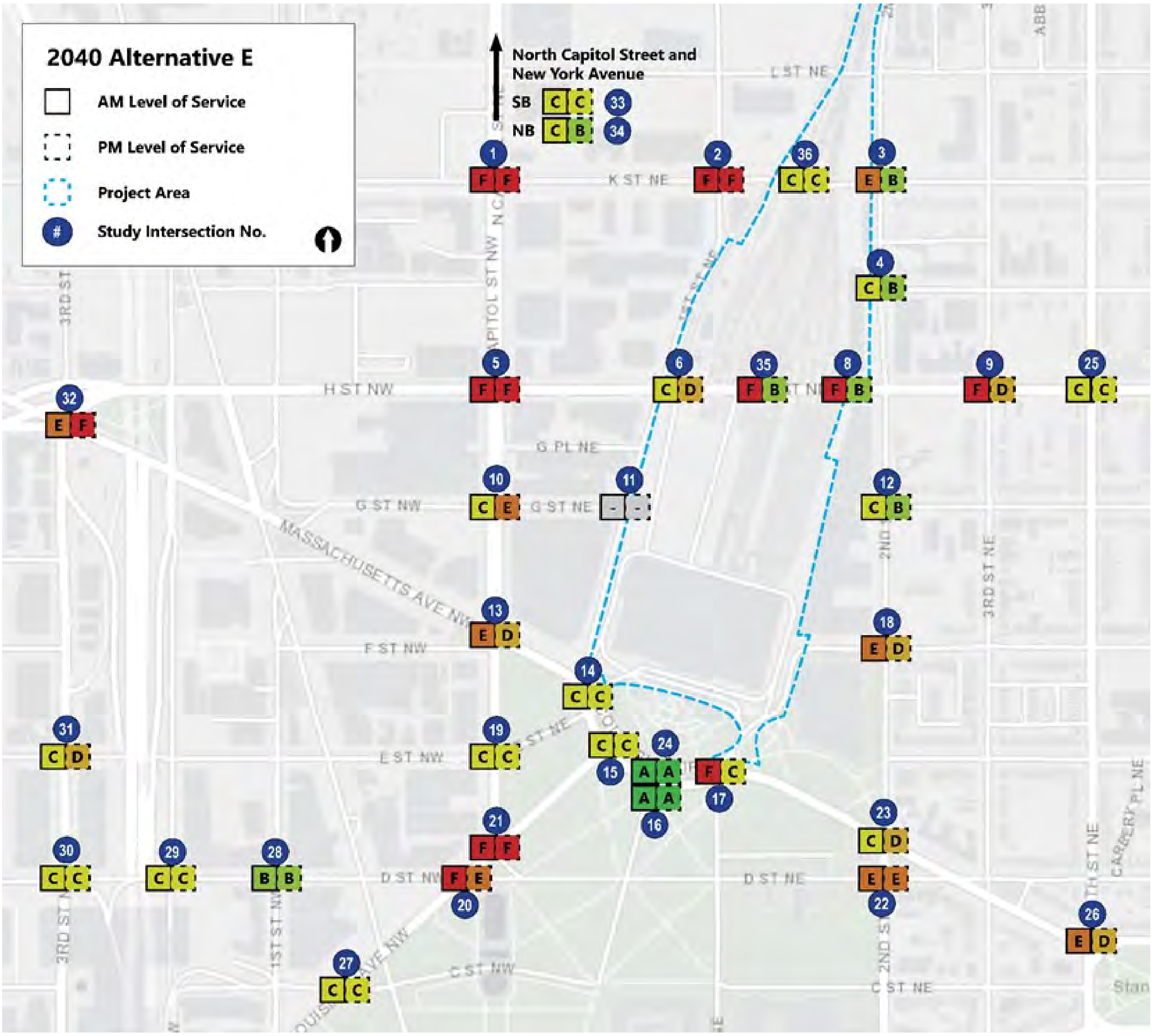


Table 5-114. Intersections with Queue Increase > 150 Feet, Alternative E

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	North Capitol Street / K Street	3 / 11	5 / 9	7 / 10	6 / 10
2	First Street / K Street NE	1 /5	3 /5	1 / 6	4 / 6
3	2nd Street / K Street NE	0 / 6	0 / 6	1 / 6	4 / 6
5	North Capitol Street / H Street	4 /10	2 / 10	6 / 9	6 / 6
6	WUS West Intersection / H Street NE	0 / 6	1 / 6	2 / 3	2 / 3
8	WUS East Intersection / H Street NE	2 / 7	2 / 7	2 / 2	2 / 2
9	3rd Street / H Street NE	1/ 8	0 / 8	4 / 7	2 / 7
10	North Capitol Street / G Street	3 / 7	2 / 6	2 / 6	2 / 6
13	North Capitol Street / Massachusetts Avenue	2 / 10	0 / 10	5 / 10	4 / 10
15	Louisiana Avenue / Massachusetts Avenue NE	0 / 5	0 / 5	3 / 5	0 / 5
17	First Street / Massachusetts Avenue NE	0 / 5	0 / 6	3 / 7	1 / 7
19	North Capitol Street / E Street	1 / 10	0 / 10	2 / 10	2 / 10
20	Louisiana Avenue / D Street NW	1 / 8	2 / 8	2 / 9	2 / 9
21	Louisiana Avenue / North Capitol Street	0 / 6	0 / 6	1 / 5	2 / 5
22	2nd Street / D Street NE	1 / 4	1 / 4	1 / 4	1 / 4
23	2nd Street / Massachusetts Avenue NE	0 / 7	1 / 6	2 / 7	2 / 7
25	4th Street / H Street NE	0 / 6	0 / 6	2 / 6	0 / 6
26	Massachusetts Avenue / C Street / 4th Street NE	0 /5	2 /5	3 /5	2 /5
27	Louisiana Avenue / C Street NW	2 / 11	2 / 11	3 / 11	1 / 10
29	2nd Street / D Street NW	0 / 4	0 / 4	2 / 5	0 / 5
30	3rd Street / I-395 On-ramp / D Street NW	0 / 10	0 / 10	1 / 11	1 / 11
31	3rd Street / E Street NW	1 / 11	1 / 11	4 / 11	2 / 10
32	3rd Street / Massachusetts Avenue/ H St NW	0 / 6	0 / 6	0 / 6	3 / 6
33	North Capitol Street (SB Ramp) / New York Avenue	0 / 6	0 / 6	3 / 6	2 / 6
34	North Capitol Street (NB Ramp) / New York Avenue	0 / 6	0 / 6	2 / 6	0 / 6
35	WUS Central Intersection / H Street NE	2 / 8	2 / 8	-	-

Table 5-115. Intersections with Delay Increase > 5 Seconds, Alternative E

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	North Capitol Street / K Street	141.8	212.6	188.8	248.1
2	First Street / K Street NE	53.1	228.2	124.9	246.6

3	**2nd Street / K Street NE**	38.8	< 5	50.1	5.7
4	**2nd Street / I Street NE**	< 5	< 5	5.0	< 5
5	**North Capitol Street / H Street**	113.7	169.9	274.9	435.5
6	**WUS West Intersection / H Street NE**	13.5	< 5	24.0	30.8
8	**WUS East Intersection / H Street NE**	10.6	< 5	171.4	17.0
9	**3rd Street / H Street NE**	64.1	< 5	108.8	10.4
10	**North Capitol Street / G Street**	19.9	46.6	18.6	49.9
13	**North Capitol Street / Massachusetts Avenue**	29.5	< 5	33.4	14.1
15	**Louisiana Avenue / Massachusetts Avenue NE**	< 5	< 5	10.0	< 5
17	**First Street / Massachusetts Avenue NE**	53.9	< 5	76.0	5.1
18	**2nd Street / F Street NE**	23.3	10.4	27.7	12.3
19	**North Capitol Street / E Street**	< 5	< 5	5.7	< 5
20	**Louisiana Avenue / D Street NW**	92.6	15.2	< 5	< 5
21	**Louisiana Avenue / North Capitol Street**	73.6	24.4	251.4	185.8
22	**2nd Street / D Street NE**	29.5	21.5	25.4	< 5
23	**2nd Street / Massachusetts Avenue**	6.8	5.2	6.3	9.0
25	**4th Street / H Street NE**	< 5	< 5	8.0	11.6
26	**Massachusetts Avenue / C Street / 4th St NE**	14.3	10.7	25.6	12.0
27	**Louisiana Avenue / C Street NW**	14.0	7.1	20.1	11.2
31	**3rd Street / E Street NW**	< 5	6.3	5.8	13.1
32	**3rd Street / Massachusetts Avenue/ H Street NW**	24.4	30.3	10.3	62.9
35	**WUS Central Intersection / H Street NE**	84.9	< 5	-	-

Table 5-116 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and Existing Conditions across the three indicators for traffic operations impacts in Alternative E.

Table 5-116. MOE Summary Table, Alternative E

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	X	X
4	2nd Street / Eye Street NE	A	A	A	A	A	A
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	A	X	X	A	X	X
7	WUS Bus Exit / H Street NE	n/a	n/a	n/a	n/a	n/a	n/a
8	WUS East Intersection / H Street NE	A	X	X	X	X	X
9	3rd Street / H Street NE	A	X	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	A	X	X	A	X	X
14	Massachusetts Avenue / E Street / First Street NE	A	A	A	A	A	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	A	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	A	A	X	X
20	Louisiana Avenue / D Street NW	A	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	X
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	A	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	X	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	A	A	X	A
30	3rd Street / I-395 On-ramp / D Street NW	A	A	A	A	X	A
31	3rd Street / E Street NW	A	X	X	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	A

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	X	X	X	n/a	n/a	n/a
36	K Street NE / WUS Underground Parking Facility	n/a	n/a	n/a	n/a	n/a	n/a

"A" indicates that the degradation in traffic operations, if any, is within an acceptable range. "X" indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative E:

- Eight intersections would degrade to LOS F in at least one peak period.
- Twenty-five intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 20 projected to do so in both peak hours.
- Twenty-one intersections would experience delay increases of more than 5 seconds, with 18 projected to do so in both peak hours.

5.5.6.2 Indirect Operational Impacts

Alternative E would have moderate adverse indirect operational impacts on multimodal transportation because of the trips generated by the potential Federal air-rights development.

In Alternative E, the potential Federal air-rights development would be the same as in Alternative D. The same multimodal trip volumes would be generated. They are shown in **Table 5-108**.

As in the other Action Alternatives, the number of trips the development generate would be typical of an office space development of its size and represent a small increment over those directly generated by Alternative E.

5.5.6.3 Construction Impacts

With regard to construction, Alternative E would be very similar to Alternative B, as both alternatives include two levels of below-ground parking. The anticipated construction period would be the same (14 years and 4 months) and each phase, including Phase 4, would take the same amount of time. Therefore, impacts would be as described for Alternative B in **Section 5.5.3.3**, *Construction Impacts*.

5.5.7 Alternative A-C (Preferred Alternative)

The following sections describe the direct, indirect, and construction impacts of Alternative A-C. **Figure 5-23** illustrates the key transportation elements of Alternative A-C.

5.5.7.1 Direct Operational Impacts

Commuter and Intercity Railroads

Relative to the No-Action Alternative, Alternative A-C would have a major beneficial direct operational impact on commuter and intercity railroad service, as it would support increased service accommodating many more passengers than the No-Action Alternative.

<u>Intercity Railroad Service</u>

The impacts of Alternative A-C would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Intercity Railroad Service*.

<u>MARC</u>

The impacts of Alternative A-C would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, MARC*.

<u>VRE</u>

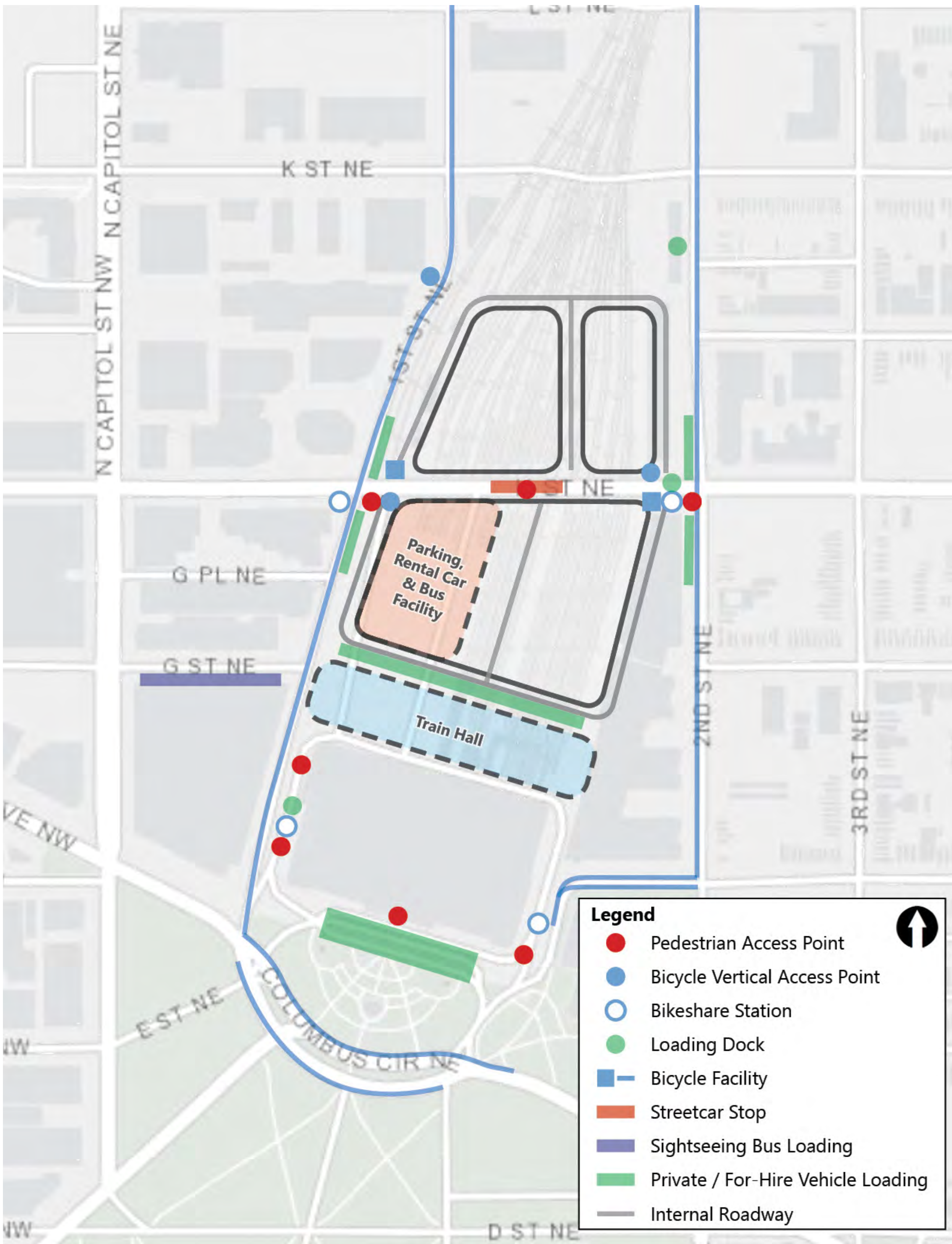
The impacts of Alternative A-C would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1***, Direct Operational Impacts, Commuter and Intercity Railroads, VR*E.

<u>Private Train Cars</u>

Relative to the No-Action Alternative, Alternative A-C would have no operational impact on private train operations.

The impacts of Alternative A-C would be the same as those of Alternative A and the other Action Alternatives: See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Private Train Cars*.

Figure 5-23. Key Transportation Element Locations, Alternative A-C



WMATA Metrorail

Relative to the No-Action Alternative, Alternative A-C would have a moderate adverse direct operational impact on Metrorail operations because of increased demand that would aggravate train overcapacity and station circulation issues.

Increased train service and ridership at WUS, as well as the reduction in parking capacity and the new retail uses, would generate increased demand on Metrorail in Alternative A-C. Modeled AM peak and PM peak activity are shown in **Table 5-117** and **Table 5-118,** respectively.

Table 5-117. AM Peak Metrorail Activity, Alternative A-C

	Alternative A-C		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	14,264	4,719	13,651	4,250	8,499	5,071
V/C Arriving at WUS[102]	83%	28%	80%	25%	57%	34%
WUS Boardings	8,365	1,623	5,202	1,010	2,802	528
WUS Alightings	5,042	3,423	4,128	2,803	923	3,644
Through Ridership	9,222	1,296	9,523	1,447	7,576	1,427
Ridership Departing WUS	17,587	2,929	14,725	2,457	10,378	1,955
V/C Departing WUS	103%	17%	86%	14%	69%	13%
Excess Passengers	444	0	0	0	0	0

Table 5-118. PM Peak Metrorail Activity, Alternative A-C

	Alternative A-C		No-Action Alternative		Existing Conditions	
	Shady Grove	Glenmont	Shady Grove	Glenmont	Shady Grove	Glenmont
Passengers Arriving at WUS	3,200	18,159	3,107	16,848	2,592	9,948
V/C Arriving at WUS	20%	115%	20%	107%	19%	72%
WUS Boardings	3,201	4,580	2,559	3,661	3,265	918
WUS Alightings	1,550	8,221	1,154	6,126	582	3,090
Through Ridership	1,650	9,938	1,953	10,722	2,010	6,858
Ridership Departing WUS	4,851	14,518	4,512	14,383	5,275	7,776
V/C Departing WUS	31%	92%	29%	91%	38%	56%
Excess Passengers	0	2,421	0	1,110	0	0

[102] Red Line hourly nominal capacity at the peak hour is 19,200 passengers (trains every 3 minutes, 120 passenger capacity, and 100 percent 8-car train operations). However, in this analysis, capacity was curtailed due to peaking factors. As a result, the initial v/c upon arrival at WUS is based on a 1.12 multiplier of actual volumes in the AM peak and 1.22 multiplier of actual volumes in the PM peak.

In 2040, Alternative A-C volumes would exceed capacity in the Shady Grove direction departing WUS during the AM peak. During the PM peak, capacity would be exceeded arriving at WUS in the Glenmont direction.

In the AM peak, Alternative A-C would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 86 percent in the No-Action Alternative. As a result, Alternative A-C would create an excess demand of 444 passengers. Based on WMATA ridership trends, overcapacity conditions are anticipated to dissipate within the Red Line core. [103]

In the PM peak, capacity exceedance toward Glenmont (115 percent) would be greater in Alternative A-C than in the No-Action Alternative (107 percent). Alternative A-C would aggravate the level of crowding, generating an additional excess demand of an estimated 1,311 passengers, for a total excess demand of 2,421.

In the PM peak, departing from WUS toward Glenmont, WMATA's 100 passengers per car (84 percent of capacity) planning threshold would be exceeded, with a V/C ratio of 92 percent. This would also be the case in the No-Action Alternative, with 91 percent V/C ratio. Alternative A-C would cause no additional exceedance of this threshold relative to the No-Action Alternative.

The increase in Metrorail ridership at WUS would also affect passenger circulation as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail*.

Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would have a major adverse direct operational impact on Metrorail operations at WUS. The increase in overcrowding and need for extra capacity would be greater compared to existing conditions than to the No-Action Alternative.

In the AM peak, Alternative A-C would cause the V/C ratio leaving WUS toward Shady Grove to reach 103 percent, against 69 percent in existing conditions. Alternative A-C would increase the overall demand in the AM peak in the Shady Grove direction by an estimated 7,209 passengers.

In the PM peak, the V/C ratio arriving at WUS toward Glenmont would be 115 percent, against 72 percent under existing conditions. Alternative A-C would increase overall demand in this direction by around 8,211 passengers.

The increase in Metrorail ridership at WUS would also affect passenger circulation relative to existing conditions as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail, Comparison to Existing Conditions.*

[103] The Red Line core, as defined by WMATA, consists of the line segment between Dupont Circle and WUS.

DC Streetcar

Relative to the No-Action Alternative, Alternative A-C would result in a minor beneficial direct operational impact on DC Streetcar operations. The benefits increased ridership would generate would be partially offset by greater operational delays.

Alternative A-C would generate the same level of additional Streetcar ridership as Alternative A, presented in **Section 5.5.2.1**, *Direct Operational Impacts, DC Streetcar.*

Intercity, Tour/Charter, and Sightseeing Buses

Relative to the No-Action Alternative, Alternative A-C would have a moderate adverse direct operational impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Alternative A-C would have a negligible adverse direct operational impact on hop-on/hop-off sightseeing buses as a result of their relocation to G Street NE.

Alternative A-C would provide a bus facility similar to, and at the same location as, Alternative A. Impacts would be as described in **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*, with the exception that in Alternative A-C, the west intersection would be an offset intersection, like in the No-Action Alternative. This would make the intersection potentially more complicated for bus from the east to navigate but is not expected to substantially affect bus operations.

Loading

Relative to the No-Action Alternative, Alternative A-C would have no adverse direct operational impacts on loading space availability. Demand would increase but it would be met through continued use of the existing docks and the provision of a new dock on 2nd Street NE.

The impacts of Alternative A-C on loading would be the same as those of Alternative A and the other Action Alternatives. See **Section 5.5.2.1**, *Direct Operational Impacts, Loading.*

Pedestrians

Relative to the No-Action Alternative, Alternative A-C would have a major beneficial direct operational impact on pedestrian circulation inside WUS. Additional access points would disperse pedestrian traffic and make access to WUS easier. Outside of WUS, Alternative A would have a minor adverse direct operational impact on pedestrian circulation because of increased queueing at certain crossings near the station.

The impacts of Alternative A-C would be the same as those of Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians.*

Bicycle Activity

Relative to the No-Action Alternative, Alternative A-C would result in a minor beneficial direct operational impact on bicycle activity. Anticipated demand for private bicycle parking and storage would be accommodated by the provision of 104 Bikeshare spaces and 200 bicycle storage spots. However, this benefit would be partially offset by increased conflicts with pedestrians and vehicles.

The impacts of Alternative A-C would be the same as those of Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, Bicycle Activity.*

City and Commuter Buses

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse direct operational impact on city and commuter buses. Increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delay experienced by all buses. There would also be a moderate adverse direct operational impact on some employee shuttles, which would have to stop operating out of the WUS bus facility.

The impacts of Alternative A-C on city and commuter buses would be the same as those of Alternative A: See **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses.*

Vehicular Parking and Rental Cars

Relative to the No-Action Alternative, Alternative A-C would have a moderate adverse direct operational impact on parking at WUS because of a reduction in parking capacity. There would be a minor beneficial direct operational impact on rental car operations.

In Alternative A-C, all parking and rental car activity would be in an above-ground facility located (multimodal surface transportation center) within the same general footprint as the existing WUS parking garage, with access from H Street NE via the west intersection and the new southwest road. The new parking facility would have capacity for approximately 850 fewer cars than the existing one, which would continue to be used in the No-Action Alternative. This would be an adverse impact. This adverse impact would be moderate because the new facility would meet the parking program for the Project and while it would not meet the projected parking demand, it is anticipated that users not able to park would use different modes to reach the station.[104] Fewer passengers or visitors are anticipated to drive and park at WUS by 2040. [105] The impacts of the reduction in parking capacity on other modes of travel were taken into account in the impact analyses conducted for those modes.

[104] Appendix A6, *Parking Program Memorandum*, provides more information on parking demand projections and the development of the parking program.

[105] The MWCOG Model estimates a 10% reduction in single-occupancy vehicle trips in the WUS area to 2040.

WUS activity in Alternative A-C would generate more peak-hour parking trips than would be the case in the No-Action Alternative as shown in **Table 5-119**. In the AM peak, the difference between Alternative A-C and the No-Action Alternative would be 88 trips (47 percent). In the PM peak, the difference would be 11 trips (4 percent). These trips were incorporated in the traffic impact analysis. While Alternative A-C would generate the same number of peak-hour parking trips as in Alternative A, the different access approaches would have different impacts on the local roadway network. In Alternative A-C, parking trips would enter the facility from the new southwest and east-west roads. Exiting parking trips would continue to the southeast road and H Street or the east ramp. In Alternative A, trips enter from H Street and the southwest road and exit via the west ramp onto First Street NE.

Table 5-119. Peak-Hour Parking Trips, Alternative A-C

	Alternative A-C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	190	83	127	102	104	53
Outs	87	227	62	197	24	154
Total	**277**	**310**	**189**	**299**	**128**	**207**

Increased WUS activity in Alternative A-C would generate the same number of rental car trips as in Alternative A. These trips are shown in **Table 5-57**. As in the other Action Alternatives, the design of the new rental car facility would address the capacity issues that would occur in the No-Action Alternative, resulting in a beneficial impact. This beneficial impact would be minor, being partially offset by the increase in operations.

<u>**Comparison to Existing Conditions**</u>

The impacts of Alternative A-C on parking and rental car activity would be the same relative to existing conditions as relative to the No-Action Alternative since the existing parking garage and rental car facility would be in use in both baselines. The reduction in parking capacity would be the same relative to existing conditions as relative to the No-Action Alternative.

Alternative A-C would generate proportionately more peak-hour parking trips relative to existing conditions than relative to the No-Action Alternative. In the AM peak, the difference between Alternative A-C and existing conditions would be 149 more trips (116 percent). In the PM peak, the difference would be 103 trips (50 percent).

With regard to rental cars, in the AM peak, the number of trips would increase by 64 (156 percent). In the PM peak, trips would increase by 56 (156 percent).

For-hire Vehicles

Relative to the No-Action Alternative, Alternative A-C would have a moderate beneficial direct operational impact on for-hire vehicle activity because of the provision of new

locations for pick-ups and drop-offs. These locations would adequately accommodate the anticipated growth in for-hire trips, but queuing would not be eliminated. Alternative A-C would also have a moderate adverse direct operational impact on for-hire vehicles due to increased traffic congestion.

The following four pick-up and drop-off locations would be provided in Alternative A-C:

- **Front of WUS:** See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative A-C, a projected 40 percent of for-hire drop-off activity and 40 percent of for-hire pick-up activity is anticipated to occur in front of WUS.
- **Adjacent to the east-west train hall on the deck level:** For-hire vehicles would access this location via the west intersection on H Street NE and southwest road, or from the west ramp access off of First Street NE. Egress would be either via the southeast road and east intersection to H Street NE or via the east ramp to F Street NE or the front of WUS. A projected 35 percent of for-hire drop-off activity and 35 percent of for-hire pick-up activity is projected to occur at this location.
- **New H Street Concourse entrance on First Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. In Alternative A-C, 20 percent of for-hire drop-off activity and 20 percent of for-hire pick-up activity would occur at this location.
- **New H Street Concourse entrance on 2nd Street NE**: See **Section 5.5.2.1**, *Direct Operational Impacts, For-hire Vehicles* for a description. An anticipated 5 percent of for-hire drop-off activity and 5 percent of for-hire pick-up activity would occur at this location.

Table 5-120 shows the number of anticipated peak-hour WUS-related for-hire activity in Alternative A-C. [106] Relative to the No-Action Alternative, Alternative A-C would generate an estimated additional 1,404 trips in the AM peak hour (268 percent increase) and 1,206 in the PM peak hour (140 percent increase). The principal source of increased peak-hour for-hire trips is the increase in intercity rail activity. These trips were incorporated in the traffic impact analysis.

Table 5-120. Peak-hour For-hire Activity, Alternative A-C

	Alternative A-C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	964	1,034	262	431	197	324
Outs	964	1,034	262	431	197	324
Total	**1,928**	**2,068**	**524**	**862**	**394**	**648**

[106] A single for-hire pick-up or drop-off trip creates both an in and an out trip as the vehicle arrives and then departs WUS. A single for-hire vehicle pick-up or drop-off was assumed to generate 1.5 trips to reflect linking of trips in the WUS circulation network.

While Alternative A-C would generate the same number of for-hire trips as in Alternative A, the different configuration of the H Street circulation pattern would better accommodate for-hire activity. The peak-hour trips would make use of the full length of the southwest road, east-west train hall, and southeast road. This loop would provide more space for vehicle circulation and passenger loading and unloading activity than in Alternative A. The additional Impacts from queuing and congestion at the front of WUS would be as described for Alternative A in **Section 5.5.2.1,** *Direct Operational Impacts, For-Hire Vehicles.* Curbside analysis is described in **Section 5.5.7.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis*.

Comparison to Existing Conditions

The impacts of Alternative A-C on for-hire vehicle activities would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in activity would be proportionately greater. Relative to existing conditions, Alternative A-C would generate an estimated 1,534 new AM peak-hour for-hire trips (389 percent increase) and 1,420 new PM peak-hour for-hire trips (219 percent increase). The principal source of increased peak-hour for-hire trips is the increase in intercity rail activity.

Private Pick-up and Drop-off

Relative to the No-Action Alternative, Alternative A-C would have a moderate beneficial direct operational impact on private pick-up and drop-off activities because of the provision of new locations for these activities. The new locations would adequately accommodate the anticipated growth in private pick-up and drop-off trips, but queuing may occur. Alternative A-C would also have a moderate adverse direct operational impact on private pick-up and drop-off due to increased traffic congestion.

The same locations used by for-hire vehicles would be available for private pick-up and drop-off activity. However, private vehicles would not be able to use the east ramp to the front of WUS. The anticipated distribution of activity would be the same as for for-hire vehicles activity.

Table 5-121 shows the anticipated number of WUS-related peak-hour private pick-up and drop-off activity in Alternative A-C. [107]

[107] A single private pick-up or drop-off vehicle generates two trips: one in and one out as the vehicle arrives at, and then departs, WUS.

Table 5-121. Private Pick-up and Drop-off Activity, Alternative A-C

	Alternative A-C		No-Action Alternative		Existing Conditions	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Ins	842	770	436	474	328	356
Outs	842	770	436	474	328	356
Total	**1,684**	**1,540**	**872**	**948**	**656**	**712**

Relative to the No-Action Alternative, Alternative A-C would generate an estimated 812 additional AM peak-hour trips (93 percent) and 592 additional PM peak hour trips (63 percent). The principal source of increased peak-hour private pick-up/drop-off trips is the increase in intercity rail activity. The impacts of these trips are considered in the traffic impact analysis.

While Alternative A-C would generate the same number of for-hire trips as in Alternative A, the different configuration of the H Street circulation pattern would better accommodate for-hire activity. The peak-hour trips would make use of the full length of the southwest road, east-west train hall, and southeast road. This loop would provide more space for vehicle circulation and passenger loading and unloading activity than in Alternative A. Impacts from queuing and congestion at the front of WUS would be as described for Alternative A in **Section 5.5.2.1**, *Direct Operational Impacts, Private Pick-up and Drop-off*. Curbside analysis is described in **Section 5.5.7.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis* below.

<u>**Comparison to Existing Conditions**</u>

The beneficial impacts of Alternative A-C on private pick-up and drop-off activity would be the same relative to existing conditions as relative to the No-Action Alternative since pick-up and drop-off locations would be the same in both baselines. The increase in activity would be proportionately greater. Relative to existing conditions, Alternative A-C would generate an estimated 1,028 additional private pick-up and drop-off trips in the AM peak hour (157 percent) and an estimated 828 additional private pick-up and drop-off trips in the PM peak hour (116 percent). The principal source of increased peak-hour private pick-up/drop-off trips is the increase in intercity rail activity.

Vehicular Traffic

Relative to the No-Action Alternative, Alternative A-C would have major adverse direct operational impacts on traffic operations at several intersections near WUS because of increased traffic volumes and changes in traffic patterns due to the new parking facility's entrance's location. During at least one of the peak periods, out of 35 intersections in the Local Study Area, five would degrade to LOS F; 19 would experience an increase in queue length of more than 150 feet; and 22 would experience an increase in average delay of more than 5 seconds.

Trip generation and Circulation

WUS-related vehicular activity in Alternative A-C would be primarily distributed across four locations:

- The pick-up/drop-off loop at the front of WUS;
- The new bus facility and new pick-up/drop-off location accessed from H Street NE;
- The new curbside drop-off location on First Street NE (serving the new H Street Concourse); and
- The new curbside drop-off location on 2nd Street NE (serving the new H Street Concourse).

Parking and rental car activity would converge onto H Street NE to reach the parking facility. Private and for-hire pick-up and drop-off activity would be spread across all four locations, with the H Street deck level served from both H Street NE and the west ramp from First Street NE. Approximately 70 percent of WUS-related traffic in Alternative A-C would travel to and from points west of WUS and 30 percent to and from points east. Deck-level circulation in Alternative A-C is represented in **Figure 5-24**. [108]

Table 5-122 shows the anticipated distribution of WUS-related vehicular activity by access point and type of trip in Alternative A-C.

Table 5-122. Trip Distribution by WUS Access Point and Trip Type, Alternative A-C

	First Street	2nd Street	Front of WUS	H Street
For-hire Drop-Off	20%	5%	40%	35%
For-hire Pick-Up	20%	5%	40%	35%
Private Pick-up/Drop-off	20%	5%	40%	35%
Parking	0%	0%	0%	100%
Rental Car	0%	0%	0%	100%

Table 5-123 and **Table 5-124**, respectively, show AM and PM peak WUS-related traffic volumes in Alternative A-C, along with the corresponding information for the No-Action Alternative and existing conditions.

[108] Figure 5-24 shows all movements, including those assumed in consultation with DDOT for the private air-rights development, to provide a better understanding of anticipated traffic operations on the H Street Bridge. Arrows indicate movements, not planned street alignments.

Figure 5-24. Deck Level Circulation (All Movements), Alternative A-C

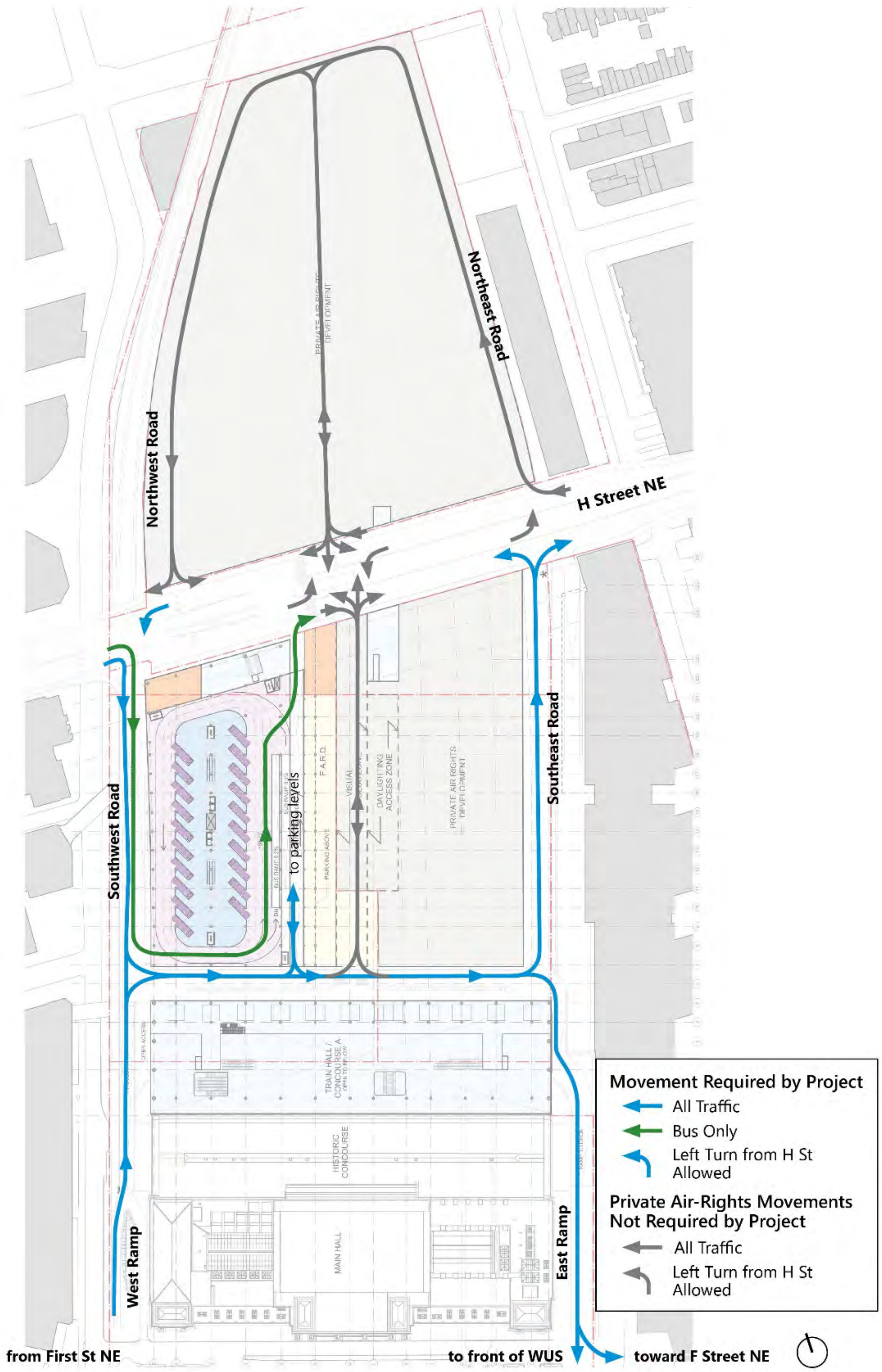


Table 5-123. AM Peak-hour Traffic Volumes, Alternative A-C

	Alternative A-C			No-Action Alternative			Existing Conditions		
	Total Activity	In	Out	Total Activity	In	Out	Total Activity	In	Out
Parking	277	190	87	189	127	62	128	104	24
Private Pick-Up/Drop-Off	1,684	842	842	872	436	436	656	328	328
For-hire Vehicles	1,928	964	964	524	262	262	394	197	197
Car Rental	105	57	48	46	28	18	41	26	15
Total Activity	**3,994**	**2,053**	**1,941**	**1,631**	**853**	**778**	**1,219**	**655**	**564**

Table 5-124. PM Peak-hour Traffic Volumes, Alternative A-C

	Alternative A-C			No-Action Alternative			Existing Conditions		
	Total Activity	In	Out	Total Activity	In	Out	Total Activity	In	Out
Parking	310	83	227	299	102	197	207	53	154
Private Pick-Up/Drop-Off	1,540	770	770	948	474	474	712	356	356
For-hire Vehicles	2,068	1,034	1,034	862	431	431	648	324	324
Car Rental	92	37	55	45	17	28	36	13	23
Total Activity	**4,010**	**1,924**	**2,086**	**2,154**	**1,024**	**1,130**	**1,603**	**746**	**857**

Compared to the No-Action Alternative, Alternative A-C would generate 2,363 additional AM peak trips (145 percent increase) and 1,856 additional PM peak trips (86 percent increase). These volume increases would result in major adverse impacts to traffic operations at some study intersections, as described below (*Intersection Analysis*).

Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would generate 2,775 additional AM peak hour trips (228 percent increase) and 2,407 additional PM peak hour trips (150 percent increase).

<u>**Curbside Analysis**</u>

The anticipated for-hire and private pick-up and drop-off activity at the front of WUS would create conflicts and queueing, as in Alternative A (see **Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Traffic, Curbside Analysis*). At the H Street deck level, queueing analysis indicates that the approximately 550 feet of curbside space adjacent to the east-west train hall would accommodate for-hire vehicles and private pick-up and drop-off without spill-back onto H Street NE.

No queue would form at the First Street or 2nd Street pick-up and drop-off areas. On First Street NE, there would be 266 pick-ups and drop-offs in the AM peak and 232 in the PM peak. On 2nd Street NE, there would be 77 pick-up and drop-offs in the AM peak and 65 in the PM peak.

Intersection Analysis

As with all Action Alternatives, three indicators were used to assess impacts on traffic operations in Alternative A-C relative to the No-Action Alternative: degradation of intersection LOS to F due to vehicle activity generated by the alternative; increase in average vehicle delay at an intersection by more than 5 seconds; and increase in 95th-percentile queue lengths of more than 150 feet for any lane group. In Alternative A-C, relative to the No-Action Alternative, five intersections would degrade to LOS F from a better LOS in at least one peak hour (**Table 5-125**). The peak hour LOS of each intersection are shown in **Figure 5-25**.

Table 5-125. Intersections with Failing LOS, Alternative A-C

Int. No.	Intersection Name	Alternative A-C		No-Action Alternative		Existing Conditions	
		AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
1	North Capitol Street / K Street	F	**F**	F	E	F	D
2	First Street / K Street	F	**F**	F	E	F	E
5	North Capitol Street / H Street	F	F	F	F	C	C
8	WUS East Intersection / H Street NE	F	C	F	B	A	A
9	3rd Street / H Street NE	F	D	F	C	E	C
13	North Capitol Street / Massachusetts Avenue / F Street	**F**	E	D	D	D	D
17	First Street / Mass. Avenue NE (WUS Entrance)	**F**	C	E	B	D	B
20	Louisiana Avenue / D Street NW	F	**F**	F	E	F	F
21	Louisiana Avenue / North Capitol Street	F	F	F	F	F	D
32	3rd Street / Massachusetts Avenue/ H Street NW	E	F	D	F	E	D

WASHINGTON UNION STATION
STATION EXPANSION

Figure 5-25. Intersection Peak Hour LOS in Alternative A-C

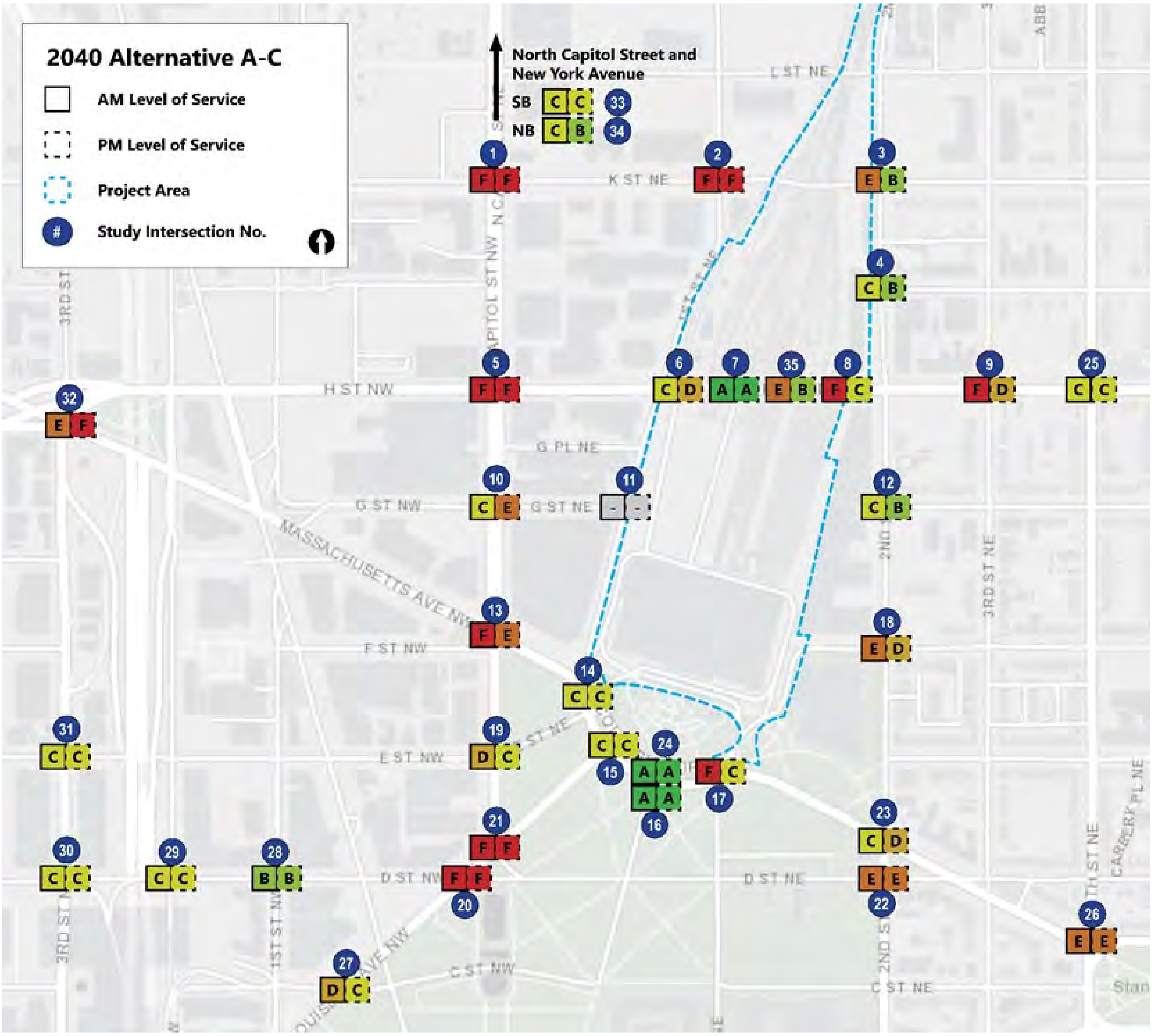


Table 5-126 shows a list of intersections with unacceptable queue increases. Nineteen intersections out of 35 study intersections would experience an increase in queue length of more than 150 feet for one or more lane groups relative to the No-Action Alternative. Of these, 13 would experience such a queue increase in both peak hours.

Table 5-126. Intersections with Queue Increase > than 150 Feet, Alternative A-C

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(lane groups with queue increase / total lane groups)			
1	**North Capitol Street / K Street**	3 / 11	5 / 9	5 / 10	5 / 9
2	**First Street / K Street NE**	1 / 7	2 / 6	1 / 7	3 / 7
5	**North Capitol Street / H Street**	2 / 10	2 / 10	6 / 9	6 / 6
6	**WUS West Intersection / H Street NE**	2 / 7	1 / 7	4 / 4	4 / 4
8	**WUS East Intersection / H Street NE**	4 / 8	4 / 8	-	-
9	**3rd Street / H Street NE**	1 / 8	0 / 8	4 / 8	2 / 8
10	**North Capitol Street / G Street**	3 / 7	2 / 6	2 / 7	2 / 6
13	**North Capitol Street / Massachusetts Avenue**	3 / 9	0 / 9	5 / 10	5 / 10
14	**Massachusetts Avenue / E Street / First Street NE**	1 / 9	1 / 9	2 / 10	1 / 10
15	**Louisiana Avenue / Massachusetts Avenue NE**	0 / 5	0 / 5	3 / 5	0 / 5
17	**First Street / Massachusetts Avenue NE**	2 / 7	0 / 7	3 / 7	1 / 7
19	**North Capitol Street / E Street**	1 / 10	0 / 10	2 / 10	2 / 10
20	**Louisiana Avenue / D Street NW**	3 / 7	2 / 7	3 / 7	2 / 7
21	**Louisiana Avenue / North Capitol Street**	0 / 6	0 / 6	0 / 6	2 / 6
22	**2nd Street / D Street NE**	1 / 4	1 / 4	1 / 4	1 / 4
23	**2nd Street / Massachusetts Avenue NE**	0 / 7	1 / 6	2 / 7	2 / 6
25	**4th Street / H Street NE**	0 / 6	0 / 6	2 / 6	0 / 6
26	**Massachusetts Avenue / C Street / 4th Street NE**	1 /5	1 /5	3 /5	2 /5
27	**Louisiana Avenue / C Street NW**	3 / 8	4 / 7	4 / 8	3 / 7
29	**2nd Street / D Street NW**	0 / 4	0 / 4	2 / 4	0 / 4
30	**3rd Street / I-395 On-ramp / D Street NW**	1 / 10	0 / 10	1 / 10	1 / 10
31	**3rd Street / E Street NW**	3 / 11	1 / 10	4 / 11	2 / 10
32	**3rd Street / Massachusetts Avenue/ H St NW**	0 / 6	0 / 6	3 / 6	3 / 6
33	**North Capitol Street (SB Ramp) / New York Avenue**	0 / 6	0 / 6	3 / 6	2 / 6
34	**North Capitol Street (NB Ramp) / New York Avenue**	0 / 6	0 / 6	2 / 6	0 / 6
35	**WUS Central Intersection / H Street NE**	2 / 8	2 / 8	-	-

Table 5-127 shows study intersections with projected delay increases exceeding 5 seconds compared to the No-Action Alternative. In Alternative A-C, 22 of the 35 study intersections would experience an increased delay relative to the No-Action Alternative of more than 5 seconds in at least one peak period. Sixteen would see such a delay increase in both peak hours.

Table 5-127. Intersections with Delay Increase > 5 seconds, Alternative A-C

Int. No.	Intersection Name	Relative to No-Action		Relative to Existing	
		AM Peak	PM Peak	AM Peak	PM Peak
		(Increased Delay in seconds)			
1	**North Capitol Street / K Street**	146.2	164.2	193.2	199.7
2	**First Street / K Street NE**	< 5	169.9	75.5	188.3
3	**2nd Street / K Street NE**	18.1	< 5	29.4	4.9
4	**2nd Street / I Street NE**	< 5	< 5	5.4	< 5
5	**North Capitol Street / H Street**	68.6	159.6	229.8	425.2
6	**WUS West Intersection / H Street NE**	15.5	< 5	26.0	29.8
8	**WUS East Intersection / H Street NE**	22.1	10.8	182.9	24.5
9	**3rd Street / H Street NE**	56.5	9.8	101.2	17.0
10	**North Capitol Street / G Street**	23.4	53.5	22.1	56.8
13	**North Capitol Street / Massachusetts Avenue**	40.7	11.2	44.6	21.2
15	**Louisiana Avenue / Massachusetts Avenue NE**	< 5	< 5	12.2	< 5
17	**First Street / Massachusetts Avenue NE**	63.3	5.2	85.4	6.0
18	**2nd Street / F Street NE**	22.3	11.1	26.7	13.0
19	**North Capitol Street / E Street**	14.9	< 5	18.2	< 5
20	**Louisiana Avenue / D Street NW**	117.3	31.9	< 5	< 5
21	**Louisiana Avenue / North Capitol Street**	115.3	55.3	293.1	216.7
22	**2nd Street / D Street NE**	26.1	21.8	22.0	< 5
23	**2nd Street / Massachusetts Avenue**	5.4	< 5	< 5	8.4
25	**4th Street / H Street NE**	< 5	10.5	6.8	20.6
26	**Massachusetts Avenue / C Street / 4th St NE**	24.9	12.3	36.2	13.6
27	**Louisiana Avenue / C Street NW**	27.3	10.2	33.4	14.3
31	**3rd Street / E Street NW**	5.7	7.6	7.7	14.4
32	**3rd Street / Massachusetts Avenue/ H Street NW**	34.5	33.8	8.2	41.0
35	**WUS Central Intersection / H Street NE**	59.9	7.1	-	-

Table 5-128 provides a snapshot of each study intersection's performance relative to both the No-Action Alternative and Existing Conditions across the three indicators for traffic operations impacts in Alternative A-C.

Table 5-128. MOE Summary Table, Alternative A-C

Int. No.	Intersection Name	Relative to No-Action			Relative to Existing		
		LOS	Queuing	Delay	LOS	Queuing	Delay
1	North Capitol Street / K Street	X	X	X	X	X	X
2	First Street / K Street NE	X	X	X	X	X	X
3	2nd Street / K Street NE	A	A	X	A	A	X
4	2nd Street / Eye Street NE	A	A	A	A	A	X
5	North Capitol Street / H Street	A	X	X	X	X	X
6	WUS West Intersection / H Street NE	A	X	X	A	X	X
7	WUS Bus Exit / H Street NE	A	A	A	A	A	A
8	WUS East Intersection / H Street NE	A	X	X	X	n/a	X
9	3rd Street / H Street NE	A	X	X	X	X	X
10	North Capitol Street / G Street	A	X	X	A	X	X
11	First Street / G Street NE	A	A	A	A	A	A
12	2nd Street / G Street NE	A	A	A	A	A	A
13	North Capitol Street / Massachusetts Avenue	X	X	X	X	X	X
14	Massachusetts Avenue/ E Street / First Street NE	A	X	A	A	X	A
15	Louisiana Avenue / Massachusetts Avenue NE	A	A	A	A	X	X
16	Delaware Avenue / Massachusetts Avenue NE	A	A	A	A	A	A
17	First Street / Massachusetts Avenue NE	X	X	X	X	X	X
18	2nd Street / F Street NE	A	A	X	A	A	X
19	North Capitol Street / E Street	A	X	X	A	X	X
20	Louisiana Avenue / D Street NW	X	X	X	A	X	A
21	Louisiana Avenue / North Capitol Street	A	A	X	X	X	X
22	2nd Street / D Street NE	A	X	X	A	X	A
23	2nd Street / Massachusetts Avenue NE	A	X	X	A	X	X
24	Massachusetts Avenue WB / Delaware Avenue NE	A	A	A	A	A	A
25	4th Street / H Street NE	A	A	X	A	X	X
26	Massachusetts Avenue / C Street / 4th Street NE	A	X	X	A	X	X
27	Louisiana Avenue / C Street NW	A	X	X	A	X	X
28	First Street / D Street NW	A	A	A	A	A	A
29	2nd Street / D Street NW	A	A	A	A	A	A
30	3rd Street / I-395 On-ramp / D Street NW	A	X	A	A	X	A
31	3rd Street / E Street NW	A	X	X	A	X	X
32	3rd Street / Massachusetts Avenue / H Street NW	A	A	X	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue	A	A	A	A	X	A
34	North Capitol Street (NB Ramp) / New York Avenue	A	A	A	A	X	A
35	WUS Central Intersection / H Street NE	A	X	X	n/a	n/a	n/a

"A" indicates that the degradation in traffic operations, if any, is within an acceptable range. "X" indicates an unacceptable level of degradation in traffic operations.

Comparison to Existing Conditions

Relative to existing conditions, in Alternative A-C:

- Nine intersections would degrade to LOS F in at least one peak period.
- Twenty-four intersections would experience an increase in queue length of more than 150 feet for one or more lane groups, with 20 projected to do so in both peak hours.
- Twenty-two intersections would experience delay increases of more than 5 seconds, with 17 projected to do so in both peak hours.

5.5.7.2 Indirect Operational Impacts

Alternative A-C would have minor adverse indirect operational impacts on multimodal transportation because of the activity generated by the potential Federal air-rights development.

In Alternative A-C, approximately 380,000 square feet of Federal air rights within the existing Federal air-right property would be potentially available for development separately from the Project. For the purposes of the transportation analysis, it was conservatively assumed that this space would become office space. This is a conservative assumption because office space is the use that would generate the most peak-hour vehicular activity.

Table 5-129 shows the multimodal activity that would be generated by the Federal air-rights development under this assumption in Alternative A-C. The vehicular trips were incorporated in the traffic impact analysis.

Table 5-129. Federal Air-rights Development Trip Generation, Alternative A-C

	AM Peak			PM Peak		
	Total Activity	**Inbound**	**Outbound**	**Total Activity**	**Inbound**	**Outbound**
Parking	121	117	4	115	19	96
Private Pick-Up/Drop-Off	0	0	0	0	0	0
For-hire	9	8	1	8	1	7
Car Rental	0	0	0	0	0	0
Amtrak Express	5	5	0	5	1	4
Amtrak Corridor	0	0	0	0	0	0
MARC	66	64	2	63	10	53
VRE	38	37	1	36	6	30
Metrorail	142	138	4	136	22	114
Streetcar	14	14	0	13	2	11
City/Commuter Bus	29	28	1	27	4	23
Pedestrian	47	46	1	45	7	38
Bicycle	47	46	1	45	7	38

The potential Federal air-rights development would add activity to local transportation modes, an adverse impact. The number of additional activity would be typical of an office space development of its size. The development would be of relatively modest size in Alternative A-C and its impacts on transportation demand would be minor.

5.5.7.3 Construction Impacts

With regard to construction, Alternative A-C would be very similar to Alternative A, placing similar elements in similar locations (bus facility and above-ground parking facility southwest of H Street NE) and involving the same depth of excavation. Therefore, the anticipated construction period would be the same (11 years and 5 months) and impacts would be as described for Alternative A in **Section 5.5.2.3**, *Construction Impacts*.

5.6 Comparison of Alternatives

Each Action Alternative entails some level of impact to the multimodal transportation network in the Local Study Area relative to the No-Action Alternative. **Table 5-130** summarizes the intensity of the potential impacts by mode for each Action Alternative relative to the Existing Conditions and the No-Action Alternative. **Table 5-131** provides more detailed information and estimates.

5.7 Avoidance, Minimization, and Mitigation Evaluation

The transportation impacts analysis identified a series of potential impacts that may require actions that would avoid, minimize, or mitigate these impacts. **Table 5-132** lists avoidance, minimization, and mitigation actions FRA is considering for each type of potential impact.

5.8 Permits and Regulatory Compliance

The following regulatory processes are required to implement the transportation elements of the Project:

- Section 4(f) of the Department of Transportation Act of 1966: Chapter 6 of the DEIS contains a draft Section 4(f) evaluation for the Project.
- Amtrak Engineering Requirements: The track and platform plan implemented as part of this Project, as well as any structures that interact with the tracks, platforms, and overhead catenary systems, would need to be approved by Amtrak’s Engineering Department.
- DDOT Comprehensive Transportation Review: As a large project located within the District, WUS would complete a Comprehensive Transportation Review with DDOT.

- DDOT Design and Engineering Manual: Designs for public right-of-way must comport with requirements in the Design and Engineering Manual, unless waivers are obtained.
- DC Zoning Commission Review: As part of the expected rezoning of the Federal air-rights development parcel, transportation conditions governing the Federal air-rights development are expected.

The following permits are expected to implement the transportation elements of the Project:

- DDOT permits governing the use of the public right-of-way and creation of roadway access permits would be required, [109] including:
    - Public Space Permit – Construction
    - Public Space Permit - Occupancy
    - Traffic Control Plan for both Construction and Occupancy Permits
- Project Proponents are expected to coordinate with DDOT to obtain necessary permits and permissions through the Transportation Online Permitting System (TOPS).
- The transfer of the H Street underpass right-of-way would be coordinated through the DC Surveyors Office (DCSO) and the Council of the District of Columbia.
- Utility and maintenance access easements would be coordinated with DDOT, DCSO, and the appropriate utilities.
- DDOT manuals and guidance would need to be followed in the design and implementation of the transportation elements, including:
    - DDOT DC Temporary Traffic Control Manual
    - DC Streetcar Design Criteria
    - DC Streetcar Utilities Standard of Practice
- WMATA permits governing adjacent construction and service closure would be required. WMATA's *Adjacent Construction Project Manual* outlines the requirements applicable to all projects next to or impacting WMATA facilities.[110]

[109] District Department of Transportation Public Space Permit. Accessed from https://ddot.dc.gov/node/496092. Accessed on March 29, 2020.

[110] WMATA. September 1, 2015. *Adjacent Construction Project Manual.* Accessed from https://www.wmata.com/business/adjacent-construction/upload/ACPM-Rev-5a-09-21-15.pdf. Accessed on April 24, 2019.

Table 5-130. Comparison of Alternatives

<table>
<tr><th>Mode</th><th>Type of Impact</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred Alternative)</th></tr>
<tr><td rowspan="2">Commuter and Intercity Railroads</td><td>Direct Operational</td><td>Major adverse impact</td><td colspan="6">Major beneficial impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="2">WMATA Metrorail</td><td>Direct Operational</td><td colspan="7">Moderate adverse impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="2">DC Streetcar</td><td>Direct Operational</td><td>Moderate beneficial impact (ridership); Minor adverse impact (new intersections)</td><td colspan="6">Minor beneficial impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="2">Intercity, Tour/Charter, and Sightseeing Buses</td><td>Direct Operational</td><td>Major adverse impact</td><td colspan="6">Negligible (hop-on/hop-off buses) or moderate (all others) adverse impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="2">Major adverse impact</td><td>East Option: Minor adverse impact
West Option: Major adverse impact</td><td colspan="3">Major adverse impact</td></tr>
<tr><td rowspan="2">Loading</td><td>Direct Operational</td><td>No impact</td><td colspan="6">No impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Major adverse impact</td></tr>
<tr><td rowspan="2">Pedestrians</td><td>Direct Operational</td><td>Major adverse impact</td><td colspan="2">Major beneficial impact (inside WUS) and minor adverse impact (outside WUS)</td><td colspan="2">Moderate beneficial impact (inside WUS) and minor adverse impact (outside WUS)</td><td colspan="2">Major beneficial impact (inside WUS) and minor adverse impact (outside WUS)</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="2">Bicycle activity</td><td>Direct Operational</td><td>Moderate adverse impact</td><td>Minor beneficial impact</td><td colspan="4">Minor adverse impact</td><td>Minor beneficial impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Major adverse impact</td></tr>
<tr><td rowspan="2">City and Commuter Buses</td><td>Direct Operational</td><td>Moderate adverse impact</td><td colspan="6">Minor adverse impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td>Negligible adverse impact</td><td colspan="4">Minor adverse impact</td><td>Negligible adverse impact</td></tr>
<tr><td rowspan="2">Employee Shuttles</td><td>Direct Operational</td><td>No impact</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="2">Vehicular Parking</td><td>Direct Operational</td><td>No impact</td><td>Moderate adverse impact</td><td>Minor adverse impact</td><td colspan="2">Moderate adverse impact</td><td>Minor adverse impact</td><td>Moderate adverse impact</td></tr>
<tr><td>Construction</td><td>N/A</td><td colspan="6">Major adverse impact</td></tr>
</table>

Mode	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative A-C (Preferred Alternative)
Rental Cars	Direct Operational	Minor adverse impact	Minor beneficial impact					
	Construction	N/A	Major adverse impact					
For-hire Vehicles	Direct Operational	Major adverse impact	Moderate beneficial impact (facilities) and major adverse impact (traffic congestion)		Moderate beneficial impact (facilities) and moderate adverse impact (traffic congestion			
	Construction	N/A	Major adverse impact					
Private Pick-up/drop-off	Direct Operational	Major adverse impact	Moderate beneficial impact (facilities) and major adverse impact (traffic congestion)		Moderate beneficial impact (facilities) and moderate adverse impact (traffic congestion)			
	Construction	N/A	Moderate adverse impact					
Vehicular Traffic	Direct Operational	Major adverse impact						
	Construction	N/A	Major adverse impact					
All Modes	Indirect Operational	N/A	Minor adverse impact	Moderate adverse impact				Minor adverse impact

Table 5-131. Detailed Comparison of Alternatives

Mode	No-Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative A-C (Preferred)
			Direct Operational Impacts				
Commuter and Intercity Railroad	Major adverse impact: constraint on ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.	Major beneficial impact: ability to accommodate ridership growth.
Amtrak							
Daily Train Volume	144	288	288	288	288	288	288
Peak Train Volume	17	20	20	20	20	20	20
Daily Ridership	21,800	32,000	32,000	32,000	32,000	32,000	32,000
Private Cars	Storage Available.	Storage Available.	Storage Available.	Storage Available.	Storage Available.	Storage Available.	Storage Available.
MARC							
Daily Train Volume	106	250	250	250	250	250	250
Peak Train Volume	15	34	34	34	34	34	34
Daily Ridership	37,900	70,700	70,700	70,700	70,700	70,700	70,700
VRE							
Daily Train Volume	34	92	92	92	92	92	92
Peak Train Volume	4	16	16	16	16	16	16
Daily Ridership	4,900	13,600	13,600	13,600	13,600	13,600	13,600
WMATA Metrorail	Moderate adverse impact due to capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.	Moderate adverse impact due to increased capacity exceedance.
AM V/C Arriving at WUS toward Shady Grove	80%	83%	83%	83%	83%	83%	83%
AM V/C Leaving WUS toward Shady Grove	86%	103%	102%	103%	103%	102%	103%
Excess Passengers Shady Grove	0	469	400	444	448	422	444
PM V/C Arriving at WUS toward Glenmont	107%	115%	115%	115%	115%	115%	115%
PM V/C Leaving WUS toward Glenmont	91%	92%	92%	92%	92%	92%	92%
Excess Passengers Glenmont	1,110	2,421	2,421	2,421	2,421	2,421	2,421
DC Streetcar	Moderate beneficial impact from additional ridership and minor adverse impact from new intersections.	Moderate beneficial impact from additional ridership within capacity.	Moderate beneficial impact from additional ridership within capacity.	Moderate beneficial impact from additional ridership within capacity.	Moderate beneficial impact from additional ridership within capacity.	Moderate beneficial impact from additional ridership within capacity.	Moderate beneficial impact from additional ridership within capacity.
V/C Eastbound AM (PM) Arriving at WUS	15% (20%)	18% (31%)	18% (31%)	18% (31%)	18% (31%)	18% (31%)	18% (31%)
V/C Eastbound AM (PM) Leaving WUS	33% (27%)	42% (42%)	42% (42%)	42% (42%)	42% (42%)	42% (42%)	42% (42%)
V/C Westbound AM (PM) Arriving at WUS	50% (17%)	65% (25%)	65% (25%)	65% (25%)	65% (25%)	65% (25%)	65% (25%)
V/C Westbound AM (PM) Leaving WUS	32% (7%)	50% (8%)	50% (8%)	50% (8%)	50% (8%)	50% (8%)	50% (8%)

Mode	No-Action Alternative	Action Alternative A	Action Alternative B	Action Alternative C	Action Alternative D	Action Alternative E	Alternative A-C (Preferred)
Intercity, Tour/Charter, and Sightseeing Bus	Major adverse impact on bus passenger facilities' ability to accommodate projected increases in users.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.	Moderate adverse impact on intercity and tour/charter bus operations because of the new 30-minute time limit for buses at WUS. Negligible adverse impact on hop-on/hop-off sightseeing buses as a result of relocation to G Street NE.
Peak-hour Bus Activity AM (PM)	28 (39)	50 (67)	50 (67)	50 (67)	50 (67)	50 (67)	50 (67)
Loading	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.	No impact due to sufficient loading capacity.
Pedestrians	Major adverse impact due to increased volumes in and out of WUS.	Major beneficial impact inside and minor adverse impact outside of WUS.	Major beneficial impact inside and minor adverse impact outside of WUS.	Moderate beneficial impact inside and minor adverse impact outside of WUS.	Moderate beneficial impact inside and minor adverse impact outside of WUS.	Major beneficial impact inside and minor adverse impact outside of WUS.	Major beneficial impact inside and minor adverse impact outside of WUS.
Peak Interior Volumes AM (PM)	47,703 (61,646)	71,734 (92,356)	71,734 (92,356)	71,734 (92,356)	71,734 (92,356)	71,734 (92,356)	71,734 (92,356)
Peak Exterior Volumes AM (PM)	11,123 (10,819)	17,938 (16,766)	17,938 (16,766)	17,938 (16,766)	17,938 (16,766)	17,938 (16,766)	17,938 (16,766)
Bicycle Activity	Moderate adverse impact from increased volumes with no change to facilities. No impact to existing bicycle facilities.	Minor beneficial impact from added storage and parking capable of accommodating increased bicycle volumes, though increased conflicts would partially offset benefits.	Minor adverse impact from conflicts on First and K Street NE. Adverse impact partially offset by added storage and parking capable of accommodating increased bicycle volumes.	Minor adverse impact from conflicts on First and K Street NE. Adverse impact partially offset by added storage and parking capable of accommodating increased bicycle volumes.	Minor adverse impact from conflicts on First and K Street NE. Adverse impact partially offset by added storage and parking capable of accommodating increased bicycle volume.	Minor adverse impact from conflicts on First and K Street NE. Adverse impact partially offset by added storage and parking capable of accommodating increased bicycle volumes.	Minor beneficial impact from added storage and parking capable of accommodating increased bicycle volumes, though increased conflicts would partially offset benefits.
Peak Activity AM (PM)	207 (241)	285 (301)	285 (301)	285 (301)	285 (301)	285 (301)	285 (301)
City and Commuter Buses	Moderate adverse impact from overcrowding of some routes and increases in traffic congestion.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.	Minor adverse impact from incrementally greater overcrowding of some routes and traffic congestion. Moderate impacts on some employee shuttle.
V/C AM/PM (All Buses)	54% (48%)	65% (54%)	65% (54%)	65% (54%)	65% (54%)	65% (54%)	65% (54%)
Over Capacity Routes	All 16	All 16	All 16	All 16	All 16	All 16	All 16
Vehicular Parking and Rental Cars	No impact on parking. Minor adverse impacts on rental car operations from increased activity with same facilities.	Moderate adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.	Minor adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.	Moderate adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.	Moderate adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.	Minor adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.	Moderate adverse impact from loss of parking capacity. Minor beneficial adverse impacts on rental car operation because of new facility.
Change in Parking Capacity	0	- 700	- 450	- 800 (East Option) - 840 (West Option)	-800	- 450	-850
Peak-hour Parking Trips AM (PM)	189 (299)	277 (310)	321 (355)	262 (294)	262 (294)	321 (355)	277 (310)

Mode	No-Action Alternative	Action Alternative A	Action Alternative B	Action Alternative C	Action Alternative D	Action Alternative E	Alternative A-C (Preferred)
Peak-hour Rental Car Trips AM (PM)	46 (45)	105 (92)	105 (92))	105 (92)	105 (92)	105 (92)	105 (92)
For-hire Vehicles	Major adverse impact from increased volumes with no change to infrastructure.	Moderate beneficial impact from more location to accommodate increased volumes. Major adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Major adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.
Peak-hour For-hire Trips AM (PM)	524 (862)	1,928 (1,540)	1,696 (1,546)	1,694 (1,548)	1,694 (1,548)	1,696 (1,546)	1,928 (1,540)
Private Pick-up/Drop-off	Major adverse impact from increased volumes with no change to infrastructure.	Moderate beneficial impact from more location to accommodate increased volumes. Major adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Major adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.	Moderate beneficial impact from more location to accommodate increased volumes. Moderate adverse impact from traffic congestion.
Peak-hour Private Pick-up/Drop-off Trips AM (PM)	872 (948)	1,684 (1,540)	1,696 (1,546)	1,694 (1,548)	1,694 (1,548)	1,696 (1,546)	1,684 (1,540)
Vehicular Traffic	Major adverse impact to traffic operations relative to existing conditions. Six intersections degrading to F during at least on peak hour; 21 intersections experiencing increases in queue length of more than 150 feet; 18 intersections experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Seven intersections degrading to F during at least on peak hour; 16 intersections experiencing increases in queue length of more than 150 feet; 20 intersections experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Four intersections degrading to F during at least on peak hour; 15 intersections experiencing increases in queue length of more than 150 feet; 21 intersections experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Five (East Option) or four (west Option) intersections degrading to F during at least on peak hour; 19 (East Option) or 21 (West Option) intersections experiencing increases in queue length of more than 150 feet; 21 (East Option) or 20 (West Option) experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Four intersections degrading to F during at least on peak hour; 14 intersections experiencing increases in queue length of more than 150 feet; 20 intersections experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Four intersections degrading to F during at least on peak hour; 16 intersections experiencing increases in queue length of more than 150 feet; 20 intersections experiencing average delay increases of more than 5 seconds.	Major adverse impact to traffic operations relative to No-Action. Five intersections degrading to F during at least on peak hour; 19 intersections experiencing increases in queue length of more than 150 feet; 22 intersections experiencing average delay increases of more than 5 seconds.
Peak-hour Traffic Volumes AM (PM)	1,631 (2,154)	3,994 (4,010)	4,058 (4,067)	3,985 (3,998)	3,985 (3,998)	4,058 (4,067)	3,994 (4,010)
Indirect Operational Impacts							
Potential Federal Air-Rights Development		Minor adverse impact from generated activity.	Moderate adverse impact from generated activity.	Moderate adverse impact from generated activity.	Moderate adverse impact from generated activity.	Moderate adverse impact from generated activity.	Minor adverse impact from generated activity.
Size of Federal Air-rights Development (Square Feet)		323,720	917,420	952,600	688,050	688,050	380,000
Peak-hour Vehicular Trips AM (PM)		180 (180)	307 (302)	318 (313)	244 (232)	244 (232)	130 (123)
Peak-hour Combined Rail and Transit Trips AM (PM)		0	588 (629)	609 (653)	443 (469)	443 (469)	294 (280)
Construction Impacts							
Intercity and Commuter Railroads		Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [2 years 5 months])	Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [3 years]) and	Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [2 years 4 months])	Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [2 years 4 months])	Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [3 years]) and	Moderate adverse impacts due to limited train cancellations (maximum of 8 in Phase 2 [2 years 5 months])

Mode	No-Action Alternative	Action Alternative A	Action Alternative B	Action Alternative C	Action Alternative D	Action Alternative E	Alternative A-C (Preferred)
		and delays (maximum of 18.5 minutes in Phase 2).	delays (maximum of 18.5 minutes in Phase 2).	and delays (maximum of 18.5 minutes in Phase 2).	and delays (maximum of 18.5 minutes in Phase 2).	delays (maximum of 18.5 minutes in Phase 2).	and delays (maximum of 18.5 minutes in Phase 2).
WMATA Metrorail		Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (3 years 1 month).	Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (4 years 11 months).	Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (4 years).	Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (4 years).	Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (4 years 11 months).	Moderate adverse impacts to Red Line operations due to delays or intermittent stoppages on evenings and weekends during Phase 4 (3 years and 1 month).
DC Streetcar		Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.	Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.	Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.	Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.	Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.	Moderate adverse impact from temporary losses of direct access from WUS. H Street closure possible but unlikely.
Intercity, Tour/Charter, and Sightseeing Bus		Major adverse impacts in Phase 4 (3 years 1 month) between the demolition of the existing facility and completion of the new one.	Major adverse impacts in Phase 4 (4 years, 11 months) between the demolition of the existing facility and completion of the new one.	East Option: Minor adverse impacts in Phase 4 (4 years) until completion of the pick-up and drop-off area. West Option: Major adverse impacts in Phase 4 (4 years) between the demolition of the existing facility and completion of the new one.	Major adverse impacts in Phase 4 (4 years) between the demolition of the existing facility and completion of the new one.	Major adverse impacts in Phase 4 (4 years 11 months) between the demolition of the existing facility and completion of the new one.	Major adverse impacts in Phase 4 (3 years 1 months) between the demolition of the existing facility and completion of the new one.
Loading		Major adverse impacts from closure of the west dock in Phase 4 (3 years 1 month).	Major adverse impacts from closure of the west dock in Phase 4 (4 years 11 months).	Major adverse impacts from closure of the west dock in Phase 4 (4 years).	Major adverse impacts from closure of the west dock in Phase 4 (4 years).	Major adverse impacts from closure of the west dock in Phase 4 (4 years 11 months).	Major adverse impacts from closure of the west dock in Phase 4 (3 years 1 month).
Pedestrians		Moderate adverse impacts from disruption of interior and exterior spaces.	Moderate adverse impacts from disruption of interior and exterior spaces.	Moderate adverse impacts from disruption of interior and exterior spaces.	Moderate adverse impacts from disruption of interior and exterior spaces.	Moderate adverse impacts from disruption of interior and exterior spaces.	Moderate adverse impacts from disruption of interior and exterior spaces.
Bicycle Activity		Major adverse impact during reconstruction of First Street cycle track.	Major adverse impact during reconstruction of First Street cycle track.	Major adverse impact during reconstruction of First Street cycle track.	Major adverse impact during reconstruction of First Street cycle track.	Major adverse impact during reconstruction of First Street cycle track.	Major adverse impact during reconstruction of First Street cycle track.
City and Commuter Buses		Negligible adverse impact. H Street closure is unlikely.	Minor adverse impacts on K Street bus routes during construction of the below-ground parking entrance.	Minor adverse impacts on K Street bus routes during construction of the below-ground parking entrance.	Minor adverse impacts on K Street bus routes during construction of the below-ground parking entrance.	Minor adverse impacts on K Street bus routes during construction of the below-ground parking entrance.	Negligible adverse impact. H Street closure is unlikely.
Vehicular Parking and Rental Cars		Major adverse impact on parking in Phase 4 (3 years 1 month) between the demolition of the existing parking garage and the completion of the new parking facility.	Major adverse impact on parking in Phase 4 (4 years 11 months) between the demolition of the existing parking garage and the completion of the new parking facilities.	East Option: Major adverse impact on parking in Phase 4 (4 years) between the demolition of the existing parking garage and the completion of the below-ground parking facility. West Option: Major adverse impact on parking in Phase 4 (4 years) between the demolition of the existing parking garage and the completion of the below-	Major adverse impact on parking in Phase 4 (4 years) between the demolition of the existing parking garage and the completion of the new parking facilities.	Major adverse impact on parking in Phase 4 (4 years 11 months) between the demolition of the existing parking garage and the completion of the new parking facilities.	Major adverse impact on parking in Phase 4 (3 years 1 month) between the demolition of the existing parking garage and the completion of the new parking facility.

Mode	No-Action Alternative	Action Alternative A	Action Alternative B	Action Alternative C	Action Alternative D	Action Alternative E	Alternative A-C (Preferred)
				ground and above-ground parking facilities.			
For-hire Vehicles		Major adverse impacts from loss of queuing space.	Major adverse impacts from loss of queuing space.	Major adverse impacts from loss of queuing space.	Major adverse impacts from loss of queuing space.	Major adverse impacts from loss of queuing space.	Major adverse impacts from loss of queuing space.
Private Pick-up/Drop-off		Moderate adverse impacts due to temporary lane closures.	Moderate adverse impacts due to temporary lane closures.	Moderate adverse impacts due to temporary lane closures.	Moderate adverse impacts due to temporary lane closures.	Moderate adverse impacts due to temporary lane closures.	Moderate adverse impacts due to temporary lane closures.
Vehicular Traffic		Major adverse impacts from roads closures and construction traffic.	Major adverse impacts from roads closures and construction traffic.	Major adverse impacts from roads closures and construction traffic.	Major adverse impacts from roads closures and construction traffic.	Major adverse impacts from roads closures and construction traffic.	Major adverse impacts from roads closures and construction traffic.

Table 5-132. Potential Mitigation

Mode	Impact	Proposed Responsible Party[1]	Recommended Action
All Modes - Construction	All construction impacts on transportation	Proponents	Proponents to require the construction contractor to prepare an integrated Construction Transportation Management Plan defining the measures to be implemented by the construction contractor to avoid, minimize, or mitigate impacts from construction on all transportation modes in each phase of construction, along with procedures to enforce, monitor, and evaluate these measures.
Amtrak – Construction	During construction, up to two Amtrak trains may be canceled daily.	Amtrak	No mitigation is available.
MARC – Construction	During construction, up to 4 MARC trains may be canceled daily.	Amtrak	Amtrak to coordinate with MARC on alternative service options for affected MARC passengers, including the honoring of MARC tickets on alternative services.
VRE - Construction	During construction, up to 2 VRE trains may be canceled daily.	Amtrak	Amtrak to coordinate with VRE on alternative service options for affected VRE passengers, including the honoring of VRE tickets on alternative services.
Metrorail	Increase in passenger volumes would have moderate impact on passenger circulation at WUS WMATA Station.	Proponents	Proponents to contribute to improvements identified in WMATA's Station Access and Capacity Study that have not been addressed by the Concourse Modernization Project or by WMATA by the time of implementation.
Metrorail	Increase in passenger volumes would contribute to capacity issues on WMATA Red Line.	Proponents	Proponents to coordinate with WMATA about regional efforts to increase mainline capacity along Red Line.
Metrorail - Construction	During construction Phase 4, temporary schedule adjustments or intermittent stoppages may be required on evenings or during weekends.	Proponents	Proponents to coordinate with WMATA on construction approaches that would minimize delays and stoppages on the Red Line.

Mode	Impact	Proposed Responsible Party[1]	Recommended Action
DC Streetcar – Construction	During construction, activities may block direct access from Streetcar station to WUS facilities.	Proponents	Proponents to coordinate with DDOT on options for temporary Streetcar station access during construction. Proponents to take steps with the District State Safety Office to address issues that may affect Streetcar certification.
Intercity Bus	Active management approach may adversely affect intercity bus operations due to 30-minute timeframe limit during peak hour.	USRC	USRC to develop Bus Facility Operations Plan in concert with intercity and tour/charter operators. USRC to work with DDOT and DCOP on strategies to address potential off-site bus layover activities.
Intercity Bus	Active management approach may have impact on tour/charter bus parking needs within the District.	USRC	USRC to coordinate with DDOT on strategy to address bus parking capacity loss associated with the Project.
Intercity Bus	In Alternative C-East Option, the distance between the bus facility and WMATA or the front of WUS would be substantially increased.	USRC	In Alternative C-East Option, the Proponents to refine facility design to ensure that the connection among the different destinations is entirely covered or within the concourse environments of WUS.
Intercity Bus - Construction	In all Action Alternatives except Alternative C East Option, bus service would not be accommodated at WUS during Phase 4 of construction.	USRC	USRC to work with the District to identify a location for an adequately-sized interim bus facility or bus loading zones as close to WUS as possible.
Vehicular Parking and Rental Cars – Construction	Loss of parking during Phase 4 of construction.	USRC	USRC to identify adequately-sized interim parking facilities near WUS.
Private and For-hire Pick-up and Drop-off	The large increases in pick-up and drop-off volumes are likely to cause major congestion at the designated pickup points, which may also have a moderate impact on pedestrian safety due to conflicts with these vehicles. Increased	USRC	USRC to ensure there is sufficient staffing to monitor traffic levels and ensure safe pedestrian crossing at all designated pick-up and drop-off areas. USRC to coordinate with Metropolitan Police Department (MPD) on enforcement strategies.

Mode	Impact	Proposed Responsible Party[1]	Recommended Action
	traffic volumes may negatively affect pick-up and drop-off operations.		USRC to coordinate with District Department of Public Works and MPD to provide coordinated enforcement of active curb areas along public streets. USRC to coordinate with the District Department of For-Hire Vehicles (DDFHV) to develop regulatory strategies to manage taxis and TNCs' pick-up and drop-off activity at WUS, including a performance-based strategy for reducing impacts. USRC to coordinate with MPD to provide coordinated enforcement to minimize queues on public roadways. USRC to develop, in coordination with DDOT and DDFHV, an advanced vehicle dispatching strategy to distribute taxis and TNCs and maintain consistent queue lengths. USRC to manage, in coordination with DDOT and DDFHV, a regular monitoring program to reduce queues and spillback, particularly onto H Street NE from the deck roadways.
For-hire Pick-up – Construction	During Phase 4 of the construction period, the demolition of the west ramp and back ramp would be unavailable, forcing for-hire vehicles to queue on the southeast road and east ramp. This queue could interfere with traffic operations on the deck.	USRC	USRC to develop a for-hire vehicle plan as part of the integrated Construction Transportation Management Plan. The Plan should prioritize maintaining safe traffic operations and distributing pick-ups and drop-offs.
Pedestrian	The large increases in passenger volumes adjacent to WUS may have a	USRC	USRC to coordinate with DDOT to adjust signal timings to provide sufficient crossing time for pedestrians exiting the

Mode	Impact	Proposed Responsible Party[1]	Recommended Action
	moderate impact on pedestrian crossing and queueing conditions.		front of WUS and to pursue opportunities to provide enhanced pedestrian accommodations at the front of WUS. USRC to coordinate with DDOT on additional pedestrian safety infrastructure measures.
Bicycle – Construction	Work on First Street NE would disrupt use of the Cycle track during parts of the construction period.	USRC	USRC to coordinate with DDOT on appropriate bicycle accommodations and wayfinding plan, to direct bicyclists to 2nd Street shared use path portion of Metropolitan Branch Trail.
Bicycle – Operations	Conflicts between bicycles, pedestrians, and vehicles on the First Street cycle track.	USRC	USRC to coordinate with DDOT on appropriate bicycle facilities and strategies to reduce conflicts among bicyclists, pedestrians, and vehicles.
Hop-on/Hop-off Sightseeing Buses	Movement of hop-on/hop-off sightseeing buses from front of WUS.	USRC	USRC to provide enhanced facilities at new G Street hop-on/hop-off bus location and to work with DDOT to provide an enhanced pedestrian connection to WUS entrances.
Employee Shuttles	Loss of spaces for employee shuttles.	USRC	USRC to coordinate with USCIS and Gallaudet University to identify new stop locations convenient to WUS.
Vehicular Traffic	Increases in traffic volumes would result in increases in delay and queueing at multiple intersections.	Proponents	Proponents to work with DDOT to identify solutions out of a toolbox of traffic mitigation approaches, including, but not limited to, regular monitoring activities, turn restrictions, alternative intersection phasing, lane reassignment, parking restrictions, and street pattern changes, at the most severely impacted intersections in the study area. Proponents to coordinate with DDOT and WMATA on opportunities to achieve greater core transit capacity through additional lines or services, in order to accommodate a greater mode shift from vehicles to transit.

Mode	Impact	Proposed Responsible Party[1]	Recommended Action
			Proponents to coordinate with DDOT on transportation demand management, for-hire, and transit strategies to reduce the total number of 2040 trips by 20%.
Truck Traffic – Construction	During excavation, up to 120 daily construction trucks would enter and exit the site.	Proponents	Proponents to incorporate truck traffic plan into the integrated Construction Transportation Management Plan to limit impacts of truck traffic on residential neighborhoods. Truck traffic plan to be coordinated with DDOT. Affected ANCs to be given an opportunity to comment on the plan. If possible without major disruptions to train operations, Amtrak to allow for the use of work trains instead of dump trucks to haul away excavation spoil. This approach would substantially eliminate the work trucks associated with excavation. Typical construction truck traffic would be addressed by the Construction Management Plan.
Indirect Impacts	Potential Federal air-rights development would generate additional vehicular activity.	USRC	USRC to coordinate with DDOT on required transportation demand management practices to reduce traffic activity associated with the development through Comprehensive Transportation Review (CTR) process.

1. Attribution proposed on the basis of each Proponent's area of responsibility. Attribution to "Proponents" means shared or undetermined responsibility. Responsibilities will be finalized along with the mitigation measures.

6 Air Quality

6.1 Overview

This section addresses the potential impacts of the No-Action Alternative and the Action Alternatives on air quality. Air quality is the condition of ambient air determined through the measurement of air pollution. Ambient air is the portion of the atmosphere to which the general public has access outside of buildings. Air pollution is the presence of potentially harmful gases or particles (pollutants) in ambient air. Urban air pollution is the result of emissions from mobile sources (such as automobiles, trains, or trucks) or stationary sources (such as boilers or generators). If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies potential permitting and regulatory compliance requirements.

6.2 Regulatory Context and Guidance

Federal policies, regulations, and guidance pertaining to air quality and relevant to the Project and the analysis in this Section include:

- Clean Air Act (CAA) of 1970 (42 United States Code [USC] 7401);
- Conformity Rule (40 Code of Federal Regulations [CFR] 51 and 93);
- National Ambient Air Quality Standards (NAAQS) (40 CFR 50);
- Federal Railroad Administration (FRA) *Procedures for Considering Environmental Impacts* (64 Federal Register [FR] 28545);
- Control of Hazardous Air Pollutants from Mobile Sources 2007 (72 FR 8427);[1]
- Federal Highway Administration (FHWA) *Updated Interim Guidance on Mobile Source Air Toxic Analysis in National Environmental Policy Act (NEPA) Documents*;[2]

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1 U.S. Environmental Protection Agency. 2007. *Final Rule for Control of Hazardous Air Pollutants from Mobile Sources*. Accessed from https://www.epa.gov/mobile-source-pollution/final-rule-control-hazardous-air-pollutants-mobile-sources. Accessed on June 6, 2017.

2 U.S. Department of Transportation, Federal Highway Administration. 2016. *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*. Memorandum. Accessed from https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/. Accessed on June 12, 2017.

- FHWA Technical Advisory T6640.8A;[3]
- Environmental Protection Agency's (EPA) *Guideline for Modeling Carbon Monoxide from Roadway Intersections*;[4]
- EPA's *Using Motor Vehicle Emission Simulator (MOVES) 2014 in Project-Level Carbon Monoxide Analyses*; and[5]
- EPA's *Emission Factors for Locomotives guidance* (EPA-420-F-09-025).[6]

District of Columbia (District) policies, regulations, and guidance pertaining to air quality and relevant to the Project include:

- 20 District of Columbia Municipal Regulations (DCMR) 20-1 through 20-15, Air Quality;[7]
- 20 DCMR 605, Control of Fugitive Dust;[8]

3 U.S. Department of Transportation, Federal Highway Administration. 2018. Accessed from https://www.environment.fhwa.dot.gov/legislation/nepa/guidance_preparing_env_documents.aspx. FHWA Technical Advisory T6640.8A. Accessed on June 21, 2018.

4 U.S. Environmental Protection Agency. 1992. *Guideline for Modeling Carbon Monoxide from Roadway Intersections*. Accessed from https://nepis.epa.gov/Exe/ZyNET.exe/2000F7L2.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000014%5C2000F7L2.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL. Accessed on September 13, 2018.

5 U.S. Environmental Protection Agency. 2015. *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*. Accessed from https://nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P100M2FB.pdf. Accessed on September 13, 2018.

6 U.S. Environmental Protection Agency. 1997. *Emission Factors for Locomotives*. Accessed from https://nepis.epa.gov/Exe/ZyNET.exe/P1001Z8C.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C95thru99%5CTxt%5C00000022%5CP1001Z8C.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL. Accessed on September 14, 2018.

7 20 District of Columbia Municipal Regulations Chapters 20-1 through 20-15, *Air Quality*. Accessed from http://dcrules.elaws.us/dcmr/t20. Accessed on September 13, 2018.

8 20 District of Columbia Municipal Regulations Chapter 6, *Control of Fugitive Dust*. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/aqd.revch6_.pdf. Accessed on November 17, 2017.

- 20 DCMR 900, Engine Idling;[9]
- 20 DCMR 1501, General Conformity; and[10]
- 20 DCMR 7, Volatile Organic Compounds and Hazardous Air Pollutants.[11]

6.3 Study Area

The Local Study Area for air quality includes portions of the District near the air emission sources associated with the Project where the public has access to ambient air. It coincides with the Local Study Area for transportation to capture emissions from both stationary sources in the Project Area and mobile source emissions from roadway traffic associated with the Project (see **Figure 5-1)**.

The Regional Study Area (**Figure 6-1**) encompasses the jurisdictions that are members of the Metropolitan Washington Council of Governments (MWCOG). This is the area within which MWCOG conducts regional air quality modeling.[12]

6.4 Methodology

Section 6 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) presents the general approach used to assess air quality impacts. The following sections explain in more detail how the methodology was applied to assess air quality impacts.

6.4.1 Criteria Pollutants and General Conformity

The EPA has established NAAQS for several air pollutants (criteria pollutants) with the potential to affect human health: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), particulate matter sized 10 micrometers or less (PM_{10}) and 2.5 micrometers or less ($PM_{2.5}$), and lead (Pb).

9 20 District of Columbia Municipal Regulations Chapter 9, *Engine Idling*. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/chapter9revised.pdf. Accessed on November 17, 2017.

10 20 District of Columbia Municipal Regulations Chapter 15, *General Conformity*. Accessed from http://dcrules.elaws.us/dcmr/20-1501. Accessed on November 17, 2017.

11 20 District of Columbia Municipal Regulations Chapter 7, *Volatile Organic Compounds and Hazardous Air Pollutants*. Accessed from https://dcregs.dc.gov/Common/DCMR/RuleList.aspx?ChapterNum=20-7&ChapterId=467. Accessed on November 17, 2017.

12 Metropolitan Washington Council of Governments. *FY 2017-2022 Transportation Improvement Program - Amendment to Constrained Long-Range Transportation Plan (CLRP)*. November 2016. Accessed from http://www1.mwcog.org/clrp/resources/KeyDocs_2016.asp. Accessed on December 14, 2017.

Figure 6-1. Air Quality Regional Study Area

The NAAQS include primary and secondary standards. The primary standards are designed to protect human health with an adequate margin of safety, including sensitive populations such as children, the elderly, and persons with respiratory diseases. The secondary standards are designed to protect public welfare, damage to property, transportation hazards, economic values, and personal comfort and well-being. **Table 6-1** shows the NAAQS. The NAAQs are expressed in concentration over certain averaging periods.

The EPA assesses an area's compliance with the NAAQS by assigning it one of four designations for each criteria pollutant:

- **Attainment** when ambient air concentrations of the pollutant are below the NAAQS.
- **Nonattainment** when ambient air concentrations of the pollutant are above the NAAQS.
- **Maintenance** when an area has recently achieved attainment status after being previously designated as a Nonattainment area.
- **Unclassifiable** when **i**nsufficient data exist to assign a designation. Unclassifiable areas are generally treated as Attainment areas.

In area designated Nonattainment or Maintenance, a State Implementation Plan (SIP) is required to demonstrate a pathway back to NAAQS compliance. Projects that are proposed in a Nonattainment or Maintenance area must show conformity with the SIP.

General Conformity requirements, established under the CAA, ensure that the actions taken by Federal agencies in Nonattainment or Maintenance areas do not interfere with a state's plans to attain and maintain national standards for air quality. They are intended to ensure that Federal activities do not cause or contribute to new violations of NAAQS; that actions do not worsen existing violations of the NAAQS; and that attainment of the NAAQS is not delayed.

To determine whether a project meets General Conformity requirements, EPA established *de minimis* thresholds, or amounts of annual emissions a project should not exceed. If a project would cause emissions of a criteria pollutant that would exceed the applicable *de minimis* in an area that is in Nonattainment or Maintenance status for this pollutant, a Conformity Determination must be performed. To determine whether a project would require a Conformity Determination, a General Conformity Applicability Analysis is prepared.

Table 6-2 shows the *de minimis* levels for each criteria pollutant. *De minimis* levels vary according to the criteria pollutant and the degree of Nonattainment. For O_3, *de minimis* are defined for volatile organic compounds (VOC) and nitrogen oxides (NO_x), which are precursor pollutants that combine in the atmosphere to form O_3.

Table 6-1. National Ambient Air Quality Standards

Pollutant	Averaging Period	Primary Standard	Secondary Standard	Form
Carbon Monoxide (CO)	8-hour	9 ppm	-	Not to be exceeded more than once per year
	1-hour	35 ppm	-	
Nitrogen Dioxide (NO_2)	1-hour	100 ppb	-	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	1-year[a]	53 ppb	53 ppb	Annual Mean
Ozone (O_3)	8-hour[b]	0.070 ppm	0.070 ppm	Annual 4th highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter 2.5 ($PM_{2.5}$)	1-year	12 µg/m^3	15 µg/m^3	Annual mean, averaged over 3 years
	24-hour	35 µg/m^3	35 µg/m^3	98th percentile, averaged over 3 years
Particulate Matter 10 (PM_{10})	24-hour	150 µg/m^3	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	1-hour[c]	75 ppb	-	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-hour	-	0.5 ppm	Not to be exceeded more than once per year
Lead (Pb)	Rolling 3-month average[d]	0.15 µg/m^3	0.15 µg/m^3	Not to be exceeded

Source: EPA, 2016a.

ppm: parts per million; ppb: parts per billion; µg/m^3: micrograms per cubic meter.

a The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

b Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

c The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the require NAAQS.

d In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

Table 6-2. General Conformity *de minimis* Emissions Levels

Pollutant	Tons per Year	Area Type
O_3 (VOC or NO_x)	50	Serious Nonattainment
	25	Severe Nonattainment
	10	Extreme Nonattainment
	100	Other Areas Outside an Ozone Transport Region
O_3 (NO_x)	100	Marginal and Moderate Nonattainment Inside an Ozone Transport Region
	100	Maintenance
O_3 (VOC)	50	Marginal and Moderate Nonattainment Inside an Ozone Transport Region
	50	Maintenance Within an Ozone Transport Region
	100	Maintenance Outside an Ozone Transport Region
CO, SO_2, and NO_2	100	All Nonattainment and Maintenance
PM_{10}	70	Serious Nonattainment
	100	Moderate Nonattainment and Maintenance
$PM_{2.5}$[a]	70	Serious Nonattainment
	100	Moderate Nonattainment and Maintenance
Pb	25	All Nonattainment and Maintenance

Source: EPA, 2016b.
a Direct emissions, SO_2, NOx, (unless determined not to be a significant precursor), VOC or ammonia (if determined to be a significant precursor).

The Project would take place in the District, which EPA has designated as:

- A Marginal Nonattainment area for the 8-hour O_3 standard in an Ozone Transport Region
- A Moderate Maintenance area for CO and $PM_{2.5}$

Applicability analysis was conducted for these three criteria pollutants.

6.4.2 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. Operational impacts on air quality were analyzed on two scales: microscale analysis for local, direct impacts and mesoscale analysis for regional indirect impacts.

6.4.2.1 Microscale Methodology

The purpose of a microscale analysis is to determine a project's impacts on pollutant concentrations locally. The microscale analysis conducted for the No-Action and Action

Alternatives had three components: a CO hotspot analysis; a $PM_{2.5}$ hotspot analysis; and a parking facility hotspot analysis for CO emissions.

Carbon Monoxide Hotspot Analysis

The CO hotspot analysis evaluated CO concentrations at the most congested intersections near WUS. The intersections used for CO hotspot modeling were selected based on the procedures described in EPA's CO guidance documents.[13,14] These procedures recommend that intersections be ranked according to their levels of service (LOS) and total traffic volumes.

Consistent with this guidance, intersections in the Local Study Area were ranked based on traffic volumes and LOS for each alternative as determined as part of the transportation impact analysis document in Chapter 5, *Transportation*, of this report. The following intersections ranked highest in terms of LOS and volumes, depending on the specific alternative being analyzed:

- North Capitol Street and K Street
- North Capitol Street and H Street
- First Street and K Street
- Parking facility access and H Street
- North Capitol Street and Massachusetts Avenue

A CO hotspot analysis was conducted for a combination of these intersections, for each alternative, depending on which intersections ranked worst under that alternative's future traffic conditions.

Emission Factor Modeling

The vehicle emission factors used in the microscale CO analysis were obtained using the EPA's MOVES2014 model, which calculates emission factors from motor vehicles in grams per vehicle mile or grams per hour for existing and future conditions. The calculated emission rates were adjusted by the model to reflect conditions specific to the District – such as vehicle age distribution, the statewide Inspection and Maintenance (I/M) Program, and the Stage II Vapor Recovery System – based on inputs from MWCOG. The emission factors conservatively assumed winter season morning temperatures.

[13] *Guideline for Modeling Carbon Monoxide from Roadway Intersections*. U.S. Environmental Protection Agency. EPA-454/R-92-005. November 1992.

[14] *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*. U.S. Environmental Protection Agency. EPA-420-B-15-028. March 2015.

Dispersion Modeling

EPA's atmospheric dispersion modeling system (AERMOD) was used to predict CO concentrations at receptor locations for each intersection. [15] All modeling was in compliance with relevant EPA guidance for CO hotspot analysis.[16, 17] The modeled receptor locations were at sidewalks and other places accessible to the public. Receptors were placed at the edge of the roadway but not closer than 10 feet from the nearest travel lane to keep them outside the roadway “mixing cell” (the area within the roadway corridor that is subject to mixing and turbulence caused by the passage of vehicles).

The results calculated at these receptor locations represent the highest concentrations at each intersection. Receptor locations farther away from the modeled intersections would have lower concentrations because of CO dispersion characteristics. Receptor locations along the major roadways would also have lower CO concentrations than intersection receptors. This is because emission rates for traveling vehicles are much lower than those for vehicles queuing or idling at intersections in stop-and-go traffic. The modeled concentrations (including background concentrations) were compared to the NAAQS to assess the impact on air quality.

Particulate Matter Hotspot Analysis

This analysis evaluated $PM_{2.5}$ concentrations at select intersections in the Local Study Area. The intersections selected for $PM_{2.5}$ hotspot modeling were identified in accordance with the procedures described in the relevant EPA guidance.[18] Intersection selection for $PM_{2.5}$ modeling differs from selection for CO modeling because it focuses on the intersections that would experience the greatest increase in $PM_{2.5}$ emissions from heavy-duty diesel vehicles.

For the Project, diesel bus operations have the greatest potential for high $PM_{2.5}$ concentrations. Therefore, the intersections used to enter and exit the bus facility under each alternative were selected for modeling.

Emission Factor Modeling

Vehicle emission factors for the $PM_{2.5}$ hotspot analysis were developed using the same general approach as for the CO hotspot analysis. Factors were determined for winter, spring,

15 AERMOD, The American Meteorological Society/Environmental Protection Agency Regulatory Model. U.S. Environmental Protection Agency.

16 *Guideline for Modeling Carbon Monoxide from Roadway Intersections*. U.S. Environmental Protection Agency. EPA-454/R-92-005. November 1992.

17 *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*. U.S. Environmental Protection Agency. EPA-420-B-15-028. March 2015.

18 U.S. Environmental Protection Agency. November 2015. *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas*. EPA-420-B-15-084.

summer, and fall as well as for morning, midday, evening, and overnight. Emissions from vehicle exhausts, brake-wear, and tire-wear were included.

Dispersion Modeling

AERMOD[19] was used to predict $PM_{2.5}$ concentrations at receptor locations for each intersection. All modeling was conducted in compliance with the relevant EPA Guidance.[20] Receptor locations were placed using a similar methodology as the CO hotspot methodology. The analysis calculated maximum 24-hour and annual concentrations. These concentrations were compared to the NAAQS to assess the impact on air quality.

Parking Facility Analysis

Depending on the Action Alternative, the Project would include a naturally ventilated above-ground parking facility or a mechanically ventilated below-ground parking facility, or both. Potential air emissions from vehicles using the facility were estimated using AERMOD and a methodology similar to the one used for the existing garage's expansion in 2004.[21] Parking facility emissions can combine with emissions from traffic on nearby streets. To take this into account, pollutant concentrations were estimated at the near and far sidewalk of the most heavily travelled street adjacent to the parking facility. The emission and dispersion models used in the analysis were updated to reflect the most recently approved EPA models.

The naturally ventilated parking facility and exhaust vents from below-ground parking areas were treated as volume sources. Pollutant emissions from the facility were modeled using MOVES2014. The analysis calculated emission factors for starting vehicles, idling vehicles, and vehicles travelling within the parking facility. The emission factors of parking activity account for both passenger cars and passenger trucks. Vehicles were assumed to have had a "soak time" [22] of at least 12 hours before starting. Additional assumptions included: vehicles would travel 5 miles per hour to and from entrance and exit ramps and parking spots; arriving vehicles would idle for 1 minute at their parking spots while exiting vehicles would idle for 2 minutes; only vehicles exiting the parking facility would have startup emissions; and buses would idle for 2 minutes during passenger pickup and discharge.

Vehicle activity in the parking facility was developed using data on entries and exits from the transportation impact analysis. Receptor locations were set at publicly accessible spots

[19] U.S. Environmental Protection Agency. AERMOD, The American Meteorological Society/Environmental Protection Agency Regulatory Model.

[20] U.S. Environmental Protection Agency. November 2015. *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*. EPA-420-B-15-084.

[21] Union Station Redevelopment Corporation. May 2004. *Union Station Garage Expansion; Final Environmental Study*.

[22] Soak time is the time a vehicle's engine is at rest prior to being started. Emissions are generally higher when a vehicle's soak time is long, so the maximum soak time (at least 12 hours) was assumed for the analysis.

adjacent to the facility. CO concentrations calculated in AERMOD for each alternative were compared to the NAAQS to assess the impact on air quality.

6.4.2.2 Stationary Source Methodology

The stationary source analysis for each Action Alternative considered the potential impacts on existing receptors of the stationary sources of emissions that the Project would create. Potential air quality impacts associated with heating ventilation and air conditioning systems (HVAC) and Project-related combustion equipment were assessed qualitatively.

The design of mechanical systems is highly conceptual at this early stage of planning. As WUS receives heating and cooling from District energy sources, there is little need for HVAC equipment with direct pollutant emissions. The only Project-related stationary source equipment with direct emissions would be emergency generators and cooling towers, which would be a minor source of emissions. Ventilation fans would be used to exhaust air from the conditioned spaces, including the below-ground parking.

Analysis for stationary sources considered the planned location of emergency generator and cooling tower sources for each Action Alternative. Because the fan plants would be ventilating pollutants from mobile sources, emissions from the ventilation fans were accounted for in the microscale analysis of parking facility emissions and in the mesoscale analysis.

6.4.2.3 Mesoscale Methodology

The purpose of mesoscale analysis is to determine a project's indirect impacts on regional air quality. The mesoscale analysis for each alternative considered both roadway and rail emission sources, including diesel locomotives, motor vehicles, and buses. Volumes in each alternative were derived from the transportation analysis presented in Chapter 5, *Transportation,* of this report.

Motor vehicle emission factors were calculated using EPA's MOVES2014. This model calculates emission factors from motor vehicles in a mass per distance format (often grams per mile) for existing and future conditions. It then applies these factors to vehicle-miles traveled (VMT) data to obtain emissions inventories. Tier 3 emission standards, an EPA program that sets new vehicle emissions standards, were factored into the analysis. In a first phase (2014-2018), Tier 3 emission standards regulate the sulfur content of gasoline, heavy-duty engine emissions, and vehicle greenhouse gas (GHG). A second phase (2017-2025) regulates light-duty vehicle GHG. The analysis also accounted for conditions specific to the District, such as the state vehicle registration age distribution and the I/M program. Roadway links were developed based on the traffic network used in the transportation impact analysis. VMT and vehicle delays were calculated using the traffic volumes and network operations from the same analysis.

The mesoscale analysis estimated the change in annual area-wide emissions of VOC, NO_X, CO, and PM that would result from implementing the Action Alternatives. The mesoscale analysis accounted for 2040 mobile source emissions from major roadways in the transportation Local Study Area. Traffic impacts data (volumes, delays, and speeds) for each alternative were used to estimate roadway emissions. Bus activity was included through the link volumes defined in the traffic analysis, including trips to and from the bus facility.

Rail emissions were developed based on the EPA's *Emission Factors for Locomotives* guidance (EPA-420-F-09-025) and applied to projected future rail operations. The analysis considered emissions from diesel locomotives only. Locomotive emissions were considered for operations that would occur in the Project Area and for locomotive dwelling that would occur at WUS. An inventory of horsepower-hours by alternative, operator, locomotive type and emissions tier was obtained from an Amtrak study of locomotive operating conditions in the Local Study Area.[23]

Project-related emissions were compared to the applicable *de minimis* thresholds to assess impacts on air quality.

6.4.2.4 Mobile Source Air Toxics Methodology

The EPA regulates 188 air toxics and hazardous air pollutants.[24] Of these, nine compounds from mobile sources are significant national and regional-scale cancer risk drivers (listed in the 2011 National Air Toxics Assessment).[25] These compounds are: 1,3-butadiene; acetaldehyde; acrolein; benzene; diesel particulate matter (diesel PM); ethylbenzene; formaldehyde; naphthalene; and polycyclic organic matter. The EPA requires controls to dramatically decrease emissions of those nine mobile source air toxics (MSAT) through cleaner fuels and engines.

FHWA has developed a tiered approach for analyzing MSAT in NEPA documents, depending on specific project circumstances. FHWA has identified three levels of analysis:

- No analysis for projects with no potential for meaningful MSAT impacts, or that are exempt under 23 CFR 771.117 or 40 CFR 93.126;
- Qualitative analysis for projects with low potential for MSAT impacts; and
- Quantitative analysis to differentiate alternatives for projects with higher potential for MSAT impacts.

23 Amtrak. 2018. *Washington Union Station Terminal Infrastructure, Diesel Emissions Data Development Methodology*.

24 The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of nine compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/).

25 Environmental Protection Agency. *National Air Toxics Assessment*. Accessed from https://www.epa.gov/national-air-toxics-assessment. Accessed on September 14, 2018.

Most projects are categorized as having low potential for MSAT impacts. They include projects that improve highway, transit, or freight operations without adding substantial new capacity or without creating a new facility that would increase MSAT emissions. All the Action Alternatives have low potential for MSAT impacts. Therefore, impacts are assessed qualitatively.

The qualitative analysis considers the anticipated impacts of the Project on traffic volumes, vehicle mix, and routing of traffic along with associated changes in MSAT emissions based on VMT, vehicle mix, and speed. The analysis also considers future rail activity.

6.4.3 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Because the planned duration of construction exceeds 5 years in all Action Alternatives, a quantitative modeling of potential peak construction year emissions was performed to comply with General Conformity requirements. Each of the four construction phases was reviewed to determine which construction activities have the highest potential for emissions.[26] This review found that the peak construction activities would be those associated with excavation, which typically is the most emission-intensive construction activity.

Excavation activities require the use of numerous pieces of non-road equipment. They include most of the soil disturbance and removal associated with the Project. Two options were analyzed for spoil removal associated with excavation: removal by dump trucks (up to 120 trucks a day) and removal by work trains (two work trains a day). The first scenario yields a conservative, maximum estimate for all Action Alternatives. The second scenario shows by how much using work trains to haul spoil away would reduce emissions. At this time, the removal method is undetermined. The analysis also included other major construction activities such as: support of excavation construction; caisson drilling; pressure slab construction; and overbuild deck construction. While less emission-intensive than excavation, these construction processes also generate a substantial amount of emissions. In all Action Alternatives, construction would proceed in four phases. Peak-activity emissions in each phase were estimated assuming a worst-case scenario where these activities would all take place within a single calendar year.

[26] The quantitative modeling of construction impacts does not include emissions associated with the column removal work, which would be the same in all Action Alternatives. During Phases 1 and 2 of construction, the column removal work would overlap with the excavation and reconstruction of portions of the rail terminal and would contribute additional emissions. However, this work would take place within the historic station building and involve installing temporary supports, removing, and replacing structural elements. These activities are not machine-intensive and would not involve the type of excavation or foundation installation work associated with the reconstruction of the rail terminal. In none of the Action Alternatives are annual emissions in Phases 1 or 2 anticipated to exceed 50 percent of the applicable *de minimis* levels, as documented in this section. Given the small scale of the column removal work, the emissions associated with this work have no potential to result in an exceedance of the *de minimis* in Phase 1 or 2, or during the Intermediate Phase.

The analysis estimated the emissions generated by diesel-powered construction equipment, dust-generating activities, and road vehicles. As appropriate, emission control measures that would minimize potential air quality impacts were also considered. Fugitive dust was considered in accordance with 20 DCMR §605. Emission factors for the various emission sources were determined using a combination of EPA's Non-Road, MOVES2014, and AP-42 models. The estimated emissions were then compared to the *de minimis* thresholds to assess impacts on air quality and compliance with General Conformity requirements.

6.4.3.1 Fugitive Dust

Fugitive dust is at its peak during major earth-moving activities with soil transfers from loaders to trucks or rail gondolas and vehicles traveling on unpaved roads. The amount of dust generated depends on many factors, including the moisture content of the soils, the length of construction activities, the number of construction vehicles, vehicle types, roadway characteristics, wind speed, and the frequency of precipitation. During excavation activities, dust is generated by digging and truck loading activities. During soil removal, dust is generated by heavy construction equipment traveling over unpaved roads and kicking up dust into the atmosphere. Fugitive dust emissions were estimated using the EPA's AP-42 *Compilation of Air Pollutant Emission Factors* model.

6.4.3.2 Construction Equipment

Exhaust emissions associated with construction equipment were predicted based on typically-used equipment for each critical construction activity and the percentage of time (or load factor) that the equipment would be operating. The analysis of construction equipment emissions is dependent on the number of working days for each phase of construction and for each construction process within each phase. **Table 6-3** presents the anticipated quantity, horsepower, and load factor for each piece of equipment that would be used during each major construction activity. The exhaust emissions from the equipment used in each phase of construction were determined using the Non-Road emissions model.

Table 6-3. Construction Equipment

Equipment[1]	Quantity	Horsepower	Load Factor	Construction Phase
Air Compressor	1	150	0.59	Overbuild, Slab, SOE
Backhoe	1	125	0.21	Excavation, SOE
Bulldozer	1	225	0.59	Excavation
Clam Shell Excavator	3	232	0.59	Excavation, SOE
Concrete Pump	1	181	0.59	Overbuild, Slab, SOE
Crane	4	130	0.43	Caisson Drilling, Overbuild, Slab, SOE
Drill Rig	4	250	0.43	Caisson Drilling, SOE

Equipment[1]	Quantity	Horsepower	Load Factor	Construction Phase
Excavator	1	225	0.59	SOE
Front End Loader	2	400	0.21	Excavation, SOE
Generator	1	143	0.59	Overbuild, Slab, SOE
Pile Driving Rig	2	200	0.59	SOE
Sheet Pile Driver	4	240	0.59	SOE
Slurry Pump/Plant	1	300	0.59	SOE
Truck	21	400	0.59	Excavation, SOE
Water Pump	1	100	0.59	SOE
Work Train	2	3000	0.3	Excavation

SOE: Support of excavation
1. The quantity of operations is different for each phase and construction process. The table presents the greatest number of operations that may be happening on site in any single instance.

6.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on air quality. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect, operational and construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions and relative to applicable NAAQS and *de minimis* thresholds. The operational impacts of the Action Alternatives are assessed relative to the No-Action Alternative or relative to applicable NAAQS and *de minimis* thresholds. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

6.5.1 No-Action Alternative

6.5.1.1 Direct Operational Impacts

Direct impacts are those resulting from pollutant emissions at a local scale. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for the No-Action Alternative.

The No-Action Alternative includes various station improvement projects but no major changes that would cause significant amounts of new air pollutant emissions at WUS. In this alternative, the private air rights above the rail terminal would be developed, causing increases in local traffic volumes. Traffic volumes in the Local Study Area and railroad operations at WUS would also increase due to background growth in population and future travel demand. At the same time, there would be changes in vehicular and locomotive emission factors driven by regulation and technology. These changes would result in changes in local pollutant emissions.

Microscale Analysis: CO Hotspot

Relative to existing conditions, in the No-Action Alternative, there would be a minor adverse direct operational impact on air quality from CO emissions. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

Table 6-4 shows modeled CO concentrations in the No-Action Alternative at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

One-hour CO concentrations would range from to 1.9 ppm (0.2 ppm above background) to 2.2 ppm (0.5 ppm above background) while 8-hour concentrations would range from 1.6 ppm (0.1 ppm above background) to 1.8 ppm (0.3 ppm above background). All concentrations would be only slightly above background levels and well below the applicable NAAQS.

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to existing conditions, in the No-Action Alternative, there would be a minor adverse direct operational impact on air quality from $PM_{2.5}$. At all modeled receptor locations, $PM_{2.5}$ concentrations would be below the applicable NAAQS.

$PM_{2.5}$ emissions were modeled for the intersections with the greatest potential for high pollutant concentrations as determined based on bus activity. For the No-Action Alternative, these intersections would be the H Street NE entrance into the existing bus facility and the bus facility exit a little to the east. Receptors at these intersections were divided into two groups: north of H Street and south of H Street. The analysis used traffic data from the No-Action Alternative transportation impact analysis.

Table 6-4. Carbon Monoxide Hotspot Concentrations, No-Action Alternative

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.1	1.8	35	9
	NE	2.1	1.7	35	9
	SW	2.0	1.7	35	9
	SE	2.0	1.7	35	9
	NW	2.2	1.8	35	9
	NE	2.1	1.8	35	9

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and H Street	**SW**	2.1	1.8	35	9
	SE	2.1	1.7	35	9
Union Station Garage and H Street	**NW**	2.1	1.7	35	9
	NE	2.0	1.7	35	9
	SW	2.0	1.7	35	9
	SE	1.9	1.6	35	9
First Street and K Street	**NW**	2.0	1.7	35	9
	NE	1.9	1.7	35	9
	SW	1.9	1.6	35	9
	SE	1.9	1.6	35	9

Table 6-5 shows modeled $PM_{2.5}$ concentrations in the No-Action Alternative for the 24-hour and the annual standards. The estimates include background concentrations of 22 micrograms per cubic meter (μg/m^3) for the 24-hour averaging period and 9.2 μg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

Table 6-5. Particulate Matter 2.5 Hotspot Concentrations, No-Action Alternative

Receptor Grouping	$PM_{2.5}$ Concentrations (μg/m^3)		NAAQS (μg/m^3)	
	24-Hour	Annual	24-Hour	Annual
North of H Street	23.6	9.9	35.0	12.0
South of H Street	23.4	10.0	35.0	12.0

North of H Street, receptors would experience a maximum 24-hour concentration of 23.6 μg/m^3 (1.6 μg/m^3 above background) and a maximum annual concentration of 9.9 μg/m^3 (0.7 μg/m^3 above background). South of H Street, receptors would experience a maximum 24-hour concentration of 23.4 μg/m^3 (1.4 μg/m^3 above background) and a maximum annual concentration of 10.0 μg/m^3 (0.8 μg/m^3 above background).

In both locations, they would be below the applicable NAAQS. While total concentrations would approach the NAAQS (approximately 69 percent of the 24-hour standard and 83 percent of the annual standard), this would mostly be due to background concentrations.

Microscale Analysis: Parking Facility

Relative to existing conditions, in the No-Action Alternative, there would be a minor adverse direct operational impact on air quality from CO near the parking garage. At all

modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

The parking facility analysis for the No-Action Alternative consisted of an evaluation of the existing, naturally ventilated parking garage but with future traffic volumes and operations and the effects of the proposed private air-rights development on the local transportation network and H Street Bridge. CO concentrations were modeled at receptor locations placed on the near and far sidewalks adjacent to the garage at H Street NE. The garage was separated into two volume sources: the bus deck and the short and long term parking levels. Passenger vehicles were assumed to travel an average of 1,500 feet in the garage when departing and 1,750 feet when parking. Buses using the terminal were assumed to travel only on the bus deck, for an average distance of 500 feet.

Table 6-6 shows the maximum CO concentrations at the modeled receptor locations. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period. The maximum CO concentrations were primarily the result of traffic on H Street NE.

For the near sidewalk, modeled CO concentrations would be 2.1 ppm (0.4 ppm above background) for the 1-hour averaging period and 1.7 ppm (0.2 ppm above background) for the 8-hour averaging period. Concentrations at the far sidewalk were slightly lower. At both locations, the modeled concentrations would remain well below the NAAQS.

Table 6-6. Parking Garage Concentrations, No-Action Alternative

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street - Far Sidewalk	2.0	1.7	35	9
H Street - Near Sidewalk	2.1	1.7	35	9

6.5.1.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to existing conditions, in the No-Action Alternative, reductions in emissions of VOC, NO_X, CO, and $PM_{2.5}$ would result in a beneficial indirect operational impact on air quality.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. This section presents the mesoscale air quality analysis for the No-Action Alternative.

The mesoscale analysis considered the changes in VOC, NO_X, CO, and PM emissions from motor vehicle and locomotive anticipated to occur by 2040 using data (volumes, delays, and speeds) from the No-Action Alternative traffic analysis. Locomotive emissions were modeled based on future rail operations and assumed the use of diesel locomotives. The analysis accounted for emissions from locomotive propulsion and idling as well as for generator activity.

Table 6-7 shows the results of the No-Action Alternative mesoscale analysis along with corresponding estimates for existing conditions.

Table 6-7. Mesoscale Inventory, No-Action Alternative

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	33.9	4.1	63.9	4.4	0.9
Locomotive Emissions	0.9	26.5	12.2	0.5	0.5
Total Emissions	34.8	30.6	76.0	4.8	1.3
Existing Conditions Emissions	62.6	73.0	161.0	4.3	2.1

Regional emissions of VOC, NO_X, CO, and $PM_{2.5}$ in the No-Action Alternative would decrease substantially compared to existing conditions. This is attributable to improved regulations and technology in vehicles and locomotives. Only PM_{10} emissions would increase relative to existing conditions due to increases in traffic on local streets and emissions generated from brake-and-tire wear.

6.5.1.3 Construction Impacts

Construction of the projects included in the No-Action Alternative would cause air pollutant emissions. Available information on methods and schedules of construction is insufficient to quantify and characterize impacts on air quality.

The construction of the private air-rights development, the replacement of the H Street Bridge, and the other projects that would be constructed through 2040 in the No-Action Alternative would generate emissions of air criteria pollutants. Primary sources would include construction equipment and heavy machinery exhaust as well as ground disturbing activities. The total annual amount of emissions would depend on the type of equipment and vehicles used as well as on the schedule of each project. This information is not currently available, precluding the development of quantitative estimates.

6.5.2 Alternative A

6.5.2.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative A would result in localized criteria pollutant emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for Alternative A.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative A, there would be a minor adverse direct operational impact on air quality due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-8 shows modeled CO concentrations in Alternative A at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

One-hour CO concentrations would range from 2.0 ppm (0.3 ppm above background) to 2.3 ppm (0.5 ppm above background). Eight-hour concentrations would range from 1.7 ppm (0.2 ppm above background) to 1.9 ppm (0.4 ppm above background). All concentrations would be only slightly above background levels.

Compared to the No-Action Alternative modeled estimates shown in **Table 6-4**, concentrations would see increases of up to 0.2 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would increase by up to 0.1 ppm. All concentrations would remain well below the applicable NAAQS.

Table 6-8. Carbon Monoxide Hotspot Concentrations, Alternative A

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.3	1.9	35	9
	NE	2.2	1.8	35	9
	SW	2.2	1.8	35	9
	SE	2.1	1.7	35	9
North Capitol Street and H Street	NW	2.3	1.8	35	9
	NE	2.2	1.8	35	9
	SW	2.2	1.8	35	9
	SE	2.2	1.8	35	9
Parking Facility and H Street	NW	2.2	1.8	35	9
	NE	2.1	1.7	35	9
	SW	2.1	1.7	35	9
	SE	2.0	1.7	35	9

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative A, there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$ concentrations. At

all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

$PM_{2.5}$ emissions were modeled for the intersections with the greatest potential for high pollutant concentrations as determined based on bus activity. In Alternative A, these intersections would be the H Street NE entrance to and exit from the new bus facility. The analysis used traffic data from the Alternative A transportation impact analysis.

Table 6-9 shows modeled $PM_{2.5}$ concentrations for the 24-hour and annual standards. The estimates include background concentrations of 22 µg/m^3 for the 24-hour averaging period and 9.2 µg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping (north and south of H Street NE).

North of H Street NE, receptors would experience a maximum 24-hour concentration of 23.7 µg/m^3 (1.7 µg/m^3 above background) and a maximum annual concentration of 10.0 µg/m^3 (0.8 µg/m^3 above background). South of H Street, receptors would experience a maximum 24-hour concentration of 23.7 µg/m^3 (1.7 µg/m^3 above background) and a maximum annual concentration of 10.0 µg/m^3 (0.8 µg/m^3 above background).

Compared to the No-Action Alternative estimates shown in **Table 6-5**, there would be a slight increase in the maximum concentrations of 0.1 µg/m^3 for both the 24-hour averaging time and the annual averaging time. In both modeled locations, emission levels would be below the applicable NAAQS. While total concentrations would approach the NAAQS (approximately 68 percent of the 24-hour standard and 83 percent of the annual standard), this would mostly be due to background concentrations.

Table 6-9. Particulate Matter 2.5 Hotspot Concentrations, Alternative A

Receptor Grouping	$PM_{2.5}$ Concentrations (µg/m^3)		NAAQS (µg/m^3)	
	24-Hour	Annual	24-Hour	Annual
North of H Street	23.7	10.0	35.0	12.0
South of H Street	23.7	10.0	35.0	12.0

Microscale Analysis: Parking Facility Analysis

Relative to the No-Action Alternative, in Alternative A, there would be a minor adverse direct operational impact on air quality near the parking facility due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

The parking facility analysis for Alternative A considered the operation of the proposed bus facility and parking facility along with projected future traffic volumes and operations for Alternative A. The bus facility would be located approximately where the existing garage currently stands, and buses would enter and exit through H Street NE. Parking would be provided on six levels above the bus facility. Vehicles would access and exit the parking facility via H Street NE. Emissions from vehicles travelling on H Street NE were included in the analysis.

CO concentrations were evaluated at receptor locations on the near and far sidewalks adjacent to the parking facility on H Street NE. These locations would experience the highest CO concentrations as they are near both the facility and the heavily travelled H Street Bridge. The parking facility was separated into volume sources to represent the bus deck and the parking levels. The average path through the facility was assumed to be 5,475 feet when departing and 5,725 feet when parking. These estimates are based on the planned dimensions of the parking facility and assume an equal distribution of users across the parking levels. Buses using the facility were assumed to travel only on the bus deck, with an average path length of 630 feet into the facility and 630 feet out of it.

Table 6-10 shows the maximum CO concentrations at the modeled receptor locations. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

For the near and far sidewalk, modeled CO concentrations would be 2.2 ppm for the 1-hour averaging period (0.5 ppm above background) and 2.0 ppm for the 8-hour averaging period (0.5 ppm above background).

Table 6-10. Parking Facility Concentrations, Alternative A

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street - Far Sidewalk	2.2	2.0	35	9
H Street - Near Sidewalk	2.2	2.0	35	9

Relative to the No-Action Alternative, emissions would be slightly higher. For the 1-hour averaging time, there would be an increase of 0.2 ppm (far sidewalk) or 0.1 ppm (near sidewalk). For the 8-hour averaging time, the increase would be 0.3 ppm at both locations. Concentrations would remain well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative A would have negligible adverse direct operational impacts on air quality.

The stationary source analysis included a preliminary assessment of the potential location of HVAC equipment and ventilation fans in Alternative A. Fan plants would be used to exhaust air from the interior of WUS. These plants likely would be in three locations across the Project Area. One plant would be located south of H Street NE, on the west side of WUS near the service road at the southern end of the private air-rights development area. Two fan plants would be north of H Street NE, in the east and west corners of the private air-right development area, immediately adjacent to K Street NE. The ventilation fans would be designed to ensure good ambient air quality. They would be at least 30 feet from the nearest operable windows, louvers, or doors.

Emissions from the ventilation fans are incorporated in the mesoscale analysis presented in **Section 6.5.2.2**, *Indirect Operational Impacts*. Emissions originating in the bus facility and parking facility were accounted for in the microscale analysis presented above.

The location of cooling towers under Alternative A would likely be next to the northern end of the Railway Express Agency (REA) Building on the east side of the Project Area. Cooling towers are a minor source of particulate matter emissions. They do not directly emit pollutants through a combustion process. The towers would be placed at least 30 feet from adjacent buildings or on a roof to maintain good ambient air quality.

Finally, emergency generators would be installed next to the cooling towers. The exact number, size, and model of the emergency generators have not yet been determined and would be defined during the final design process. Emergency generators are direct sources of air pollutant emissions from combustion. The operation of emergency generators is limited to 500 hours per year. These generators can only be operated during emergency situations and for periodic testing. The emergency generators would be sized to serve the needs of both WUS and the private air-rights development. Current design criteria indicate that they would have to be located at least 30 feet from adjacent buildings or on a rooftop. The emergency generators would be required to obtain an air quality permit from the District Department of Energy and Environment (DOEE) before installation and operation. During the permitting process, the applicant would be required to demonstrate that the generators would not cause an impact on air quality.

6.5.2.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative A would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative A would be below the General Conformity *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. This section presents the mesoscale air quality analysis for Alternative A.

The mesoscale analysis considered the changes in VOC, NO_X, CO, and PM emissions from motor vehicle and locomotive anticipated to occur by 2040 under Alternative A, using data (volumes, delays, and speeds) from the Alternative A traffic analysis. Locomotive emissions were modeled based on future rail operations and assumed the use of diesel locomotives.

The analysis accounted for emissions from locomotive propulsion and idling as well as for generator activity.

Table 6-11 shows the results of the Alternative A mesoscale analysis along with the corresponding estimates for the No-Action Alternative, for purposes of comparison.

Table 6-11. Mesoscale Inventory, Alternative A

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	37.7	4.7	70.8	4.7	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	39.7	66.1	100.6	5.8	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Total Alternative A Emissions[1]	4.9	35.5	24.6	1.0	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Emissions specifically attributable to the Project in Alternative A. Calculated by subtracting total No-Action Alternative emissions from total Alternative A emissions.

Alternative A would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ all would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms. The emissions of NO_X attributable to Alternative A represent a 116 percent increase relative to No-Action emissions and around a third of the applicable *de minimis* level.

Emissions of CO would also increase substantially: emissions would increase by approximately 32 percent and the emissions attributable to Alternative A represent almost a quarter of the applicable *de minimis* level.

All emissions attributable to Alternative A would remain below the applicable *de minimis* level.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative A may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The amount of MSAT emitted in Alternative A would be proportional to the amount of bus VMT and railroad activity, assuming other variables (such as travel not associated with WUS) remain the same. Most Project-generated motor vehicle traffic would be light-duty vehicles, which are not a substantial source of MSAT. Although in Alternative A the capacity of the new bus facility would be less than in the No-Action Alternative, this would not prevent peak-hour bus activity to increase to accommodate an increased number of passengers. Estimated bus VMT and railroad activity in Alternative A would be higher than in the No-Action Alternative because of the greater activity associated with the expanded WUS.

The increase in bus VMT and rail activity would lead to higher diesel particulate matter emissions (a component of MSAT) near WUS. The higher emissions could be partly offset by two factors: the decrease in regional traffic due to greater use of commuter rail and increased speeds on area highways due to the decrease in commuter traffic.

Only a portion of the increase in railroad activity would be associated with electric locomotives, which do not generate MSAT emissions. Therefore, additional railroad activity would have the effect of increasing diesel emissions near homes, schools, and businesses in WUS's vicinity and there may be areas where ambient concentrations of MSAT would be locally higher in Alternative A than in the No-Action Alternative. The magnitude and duration of these potential impacts cannot be reliably quantified due to incomplete or unavailable information.

On a region-wide basis, EPA's vehicle and fuel regulations, coupled with the progressive replacement over time of older vehicles by newer ones, is anticipated to cause substantial reductions in MSAT emissions over time, resulting in overall lower MSAT levels in 2040. Indeed, EPA's national control programs are projected to reduce annual MSAT emissions by over 90 percent between 2010 and 2050.[27] Local conditions may differ from national assumptions in terms of fleet mix and turnover, VMT growth rates, and local control measures, affecting the actual level of MSAT reduction. However, EPA's projected reductions are so substantial (even after accounting for VMT growth) that MSAT emissions in the Regional Study Area are likely to be lower by 2040.

6.5.2.3 Construction Impacts

Construction of Alternative A would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Construction activities in Alternative A would cause air pollutant emissions in amounts that would vary across the entire construction period, estimated to last approximately 11 years and 5 months. This would include emissions from construction equipment and heavy machinery exhaust; fugitive dust from ground-disturbing activities; and fugitive dust from the operation of construction vehicles on unpaved roadways.

[27] U.S. Department of Transportation, Federal Highway Administration. October 18, 2016. Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Accessed from https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/. Accessed on June 6, 2018.

Excavation, including the loading and transport of excavated soil and other materials would require the use of large diesel-fueled equipment such as excavators and dump trucks. This would make excavation the most emission-intensive part of the construction process. Two scenarios were analyzed for the removal of excavation spoils: one scenario assumed removal only by trucks and the other assumes spoil removal by work trains.

Construction-related air quality impacts were estimated for each of the four construction phases based on emissions associated with excavation; support of excavation construction; caisson drilling; pressure slab construction; and overbuild deck construction. For each phase, the assessment conservatively assumed that these activities would take place simultaneously within one calendar year. This conservative assumption allows for comparison with EPA's *de minimis* criteria and a General Conformity applicability determination.

Table 6-12 shows estimated annual emissions for the All Truck Scenario. **Table 6-13** shows estimated annual emissions for the Work Train Scenario.

Table 6-12. Construction Emissions per Phase, Alternative A (All Truck Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	3.3	24.3	11.1	1.4	0.9
Phase 2	4.8	35.6	16.4	2.2	1.4
Phase 3	3.9	29.6	13.7	1.9	1.2
Phase 4	6.6	50.3	23.3	3.2	2.0
***De Minimis* Criteria**	50	100	100	100	100

Table 6-13. Construction Emissions per Phase, Alternative A (Work Train Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	2.6	27.1	9.7	0.7	0.7
Phase 2	3.5	40.2	14.0	1.1	1.0
Phase 3	2.9	33.6	11.6	0.9	0.8
Phase 4	4.8	57.1	19.8	1.5	1.4
***De Minimis* Criteria**	50	100	100	100	100

Of the four construction phases, Phase 4 would generate the largest amount of emissions for all pollutants. Spoil removal via trucks would produce greater emission levels for all pollutants excluding NO_X, which is a major pollutant produced by locomotives. Otherwise, the greatest amounts of annual emissions would occur during Phase 4 of the All Truck Scenario, with 6.6 tons of VOC, 23.3 tons of CO, 3.2 tons of PM_{10}, and 1.4 tons of $PM_{2.5}$.

During all phases and in both scenarios, emissions of criteria pollutants would remain below the applicable *de minimis* level even with the conservative scheduling assumption used for the analysis.

6.5.2.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative A on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions, but it would remain small. Concentrations would remain below the NAAQS.

At the regional level, as shown in **Table 6-14**, the emissions specifically attributable to Alternative A would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative A would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-14. Mesoscale Inventory Comparison, Alternative A

	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative A	39.7	66.1	100.6	5.8	2.0
Emissions Attributable to Alternative A[1]	4.9	35.5	24.6	1.0	0.7

1. Calculated by subtracting total No-Action Alternative emissions from total Alternative A emissions.

6.5.3 Alternative B

6.5.3.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative B would result in localized criteria pollutants emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for Alternative B.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative B, there would be a minor adverse direct operational impact on air quality due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-15 shows modeled CO concentrations in Alternative B at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

One-hour CO concentrations would range from 2.1 ppm (0.4 ppm above background) to 2.6 ppm (0.9 ppm above background). Eight-hour concentrations would range from 1.7 ppm (0.2 ppm above background) to 1.9 ppm (0.4 ppm above background). All concentrations would be only slightly above background levels.

Compared to the modeled No-Action Alternative estimates shown in **Table 6-4**, emissions would increase by up to 0.5 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would increase by up to 0.2 ppm. All concentrations would remain well below the applicable NAAQS.

Table 6-15. Carbon Monoxide Hotspot Concentrations, Alternative B

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.6	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.5	1.9	35	9
	SE	2.2	1.8	35	9
North Capitol Street and H Street	NW	2.5	1.9	35	9
	NE	2.3	1.9	35	9
	SW	2.5	1.9	35	9
	SE	2.3	1.8	35	9
First Street and K Street	NW	2.3	1.8	35	9
	NE	2.4	1.8	35	9
	SW	2.2	1.7	35	9
	SE	2.1	1.7	35	9

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative B, there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$ concentrations. At all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

The $PM_{2.5}$ microscale analysis for Alternative B was conducted for the same receptor locations as for Alternative A because the bus facility would be in the same location (see **Section 6.5.2.1**, *Direct Operational Impacts*).

Table 6-16 shows modeled $PM_{2.5}$ concentrations for the 24-hour and annual averaging periods in Alternative B. The estimates include background concentrations of 22 µg/m^3 for the 24-hour averaging period and 9.2 µg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

North of H Street NE, receptors would experience a maximum 24-hour concentration of 23.6 µg/m^3 (1.6 µg/m^3 above background) and a maximum annual concentration of 9.9 µg/m^3 (0.7 µg/m^3 above background). South of H Street, receptors would experience similar maximum concentrations.

Compared to the No-Action Alternative estimates shown in **Table 6-5**, there would be a maximum increase of 0.2 µg/m^3 for the 24-hour averaging time and no significant change for the annual averaging time. Emission levels would be below the applicable NAAQS. While total concentrations would approach the NAAQS (approximately 67 percent of the 24-hour standard and 83 percent of the annual standard), this would mostly be due to background concentrations.

Table 6-16. Particulate Matter 2.5 Hotspot Concentrations, Alternative B

Receptor Grouping	$PM_{2.5}$ Concentrations (µg/m^3)		NAAQS (µg/m^3)	
	24-Hour	Annual	24-Hour	Annual
North of H Street	23.6	9.9	35	12.0
South of H Street	23.6	9.9	35	12.0

Microscale Analysis: Parking Facility

Relative to the No-Action Alternative, in Alternative B, there would be a minor adverse direct operational impact on air quality near the parking facility due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

In Alternative B, the new bus facility and new parking facility would be separated. The bus facility would be located approximately where the existing parking garage stands. Buses would enter and exit through H Street NE. Parking would be provided in two below-ground levels underneath the rail terminal. Vehicles would enter and exit via K Street NE. The parking microscale analysis considered both facilities, along with future traffic volumes and operations for Alternative B. Emissions from vehicles travelling along H Street NE, K Street NE, and First Street NE were included in the analysis.

CO concentrations were evaluated at receptor locations on near and far sidewalks on H Street NE and at the intersection of K Street NE with First Street NE. The H Street NE receptors are close to the new bus facility and the below-ground parking facility's southern fan plant. The receptors at K and First Streets NE are close to the parking facility's northern fan plant. The bus facility was modeled as a volume source to represent the bus deck.

Emissions from the parking facility were considered at the two fan locations near the intersection of K and First Street NE and on top of the bus deck.

The average path through the parking facility was estimated to be 1,554 feet when departing and 2,697 feet when parking based on the planned dimensions of the facility and assuming an equal distribution of users across the two parking levels. Buses using the bus facility were assumed to travel only on the bus deck, with an average path length of 630 feet into and out of the facility.

Table 6-17 shows the maximum CO concentrations at the modeled receptor locations in Alternative B. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-17. Parking Facility Concentrations, Alternative B

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street - Far Sidewalk	2.2	1.8	35	9
H Street - Near Sidewalk	2.3	1.9	35	9
K Street and First Street - Far Sidewalk	2.3	1.9	35	9
K Street and First Street - Near Sidewalk	2.5	1.9	35	9

For the H Street NE receptors, the maximum CO concentrations would be 2.3 ppm for the 1-hour averaging period (0.6 ppm above background) and 1.9 ppm for the 8-hour averaging period (0.4 ppm above background) on the near sidewalk. For the receptors at K Street NE and First Street NE intersection, the maximum CO concentrations would be 2.5 ppm for the 1-hour averaging period (0.9 ppm above background) and 1.9 ppm for the 8-hour averaging period on the near sidewalk (0.4 ppm above background).

Relative to the No-Action Alternative, on H Street NE, emissions would be slightly higher. For the 1-hour averaging time, there would be an increase of 0.2 ppm (both sidewalks). For the 8-hour averaging time, the increase would be 0.2 ppm (near sidewalk) or 0.1 ppm (far sidewalk). In all locations, CO concentrations would be well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative B would have negligible adverse direct operational impacts on air quality.

The stationary source analysis presented in **Section 6.5.2.1**, *Direct Operational Impacts,* also applies to Alternative B. The locations of fan plants would be different in Alternative B, but this does not affect the conclusions of the analysis.

The plants would be used to exhaust air from the interior of WUS and the below-ground parking. In Alternative B, the plants would be at four locations across the Project Area. Two fan plants would be south of H Street NE, adjacent to the east and west ends of the bus facility at the southern end of the private air-rights development. Two fan plants would be north of H Street NE, at the east and west corners of the Project Area adjacent to K Street NE.

6.5.3.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative B would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative B would be below the General Conformity *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. The mesoscale air quality analysis for Alternative B was conducted for VOC, NO_X, CO, and PM emissions using vehicle and train traffic data from the Alternative B transportation impact analysis. **Table 6-18** shows the results of the Alternative B mesoscale analysis, along with the corresponding estimates for the No-Action Alternative, for purposes of comparison.

Alternative B would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ all would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms.

The emissions of NO_X attributable to Alternative B represent a 117 percent increase relative to No-Action emissions and more than a third of the applicable *de minimis* level.

Emissions of CO would also increase substantially: emissions would increase by approximately 37 percent and the emissions attributable to Alternative B represent just under 30 percent of the applicable *de minimis* level.

However, all emissions attributable to Alternative B would remain below the applicable *de minimis* level.

Table 6-18. Mesoscale Inventory, Alternative B

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	39.6	4.9	74.6	5.0	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	41.6	66.3	104.4	6.0	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative B Emissions[1]	6.8	35.7	28.4	1.2	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Emissions specifically attributable to the Project under Alternative B. Calculated by subtracting No-Action Alternative total emissions from total Alternative B emissions.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative B may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The MSAT analysis conducted for Alternative A also applies to Alternative B (see **Section 6.5.2.2**, *Indirect Operational Impacts*).

6.5.3.3 Construction Impacts

Construction of Alternative B would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Construction activities in Alternative B would cause air pollutant emissions in amounts that would vary across the entire construction period, estimated to last approximately 14 years and 4 months. The main types and sources of emissions would be as described for Alternative A and emissions were estimated using the same approach, including two scenarios for the removal of excavation spoil (see **Section 6.5.2.3**, *Construction Impacts*).

Table 6-19 shows estimated annual emissions for the All Truck Scenario. **Table 6-20** shows estimated annual emissions for the Work Train Scenario.

Table 6-19. Construction Emissions per Phase, Alternative B (All Truck Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	3.3	24.5	11.2	1.4	0.9
Phase 2	5.9	44.2	20.4	2.5	1.7
Phase 3	5.0	38.2	18.0	2.5	1.5
Phase 4	6.8	52.4	24.7	3.5	2.1
***De Minimis* Criteria**	50	100	100	100	100

Table 6-20. Construction Emissions per Phase, Alternative B (Work Train Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	2.6	27.2	9.8	0.7	0.7
Phase 2	4.7	48.9	18.0	1.3	1.3
Phase 3	3.5	43.8	15.0	1.1	1.1
Phase 4	4.8	60.0	20.7	1.5	1.5
***De Minimis* Criteria**	50	100	100	100	100

Phase 4 would generate the largest amount of emissions for all pollutants. Spoil removal via trucks would produce greater emission levels for all pollutants excluding NO_X, which is a major pollutant produced by locomotives. During Phase 4, annual NO_X emissions in the Work Train Scenario would reach 60 tons. Otherwise, the greatest amounts of annual emissions would occur during Phase 4 of the All Truck Scenario, with 6.8 tons of VOC, 24.7 tons of CO, 3.5 tons of PM_{10}, and 2.1 tons of $PM_{2.5}$.

During all phases and in both scenarios, emissions of criteria pollutants would remain below the applicable de minimis level even with the conservative scheduling assumption used for the analysis.

6.5.3.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative B on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions, but they would remain small. Concentrations would remain below the NAAQS.

At the regional level, as shown in **Table 6-21**, the emissions specifically attributable to Alternative B would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative B would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-21. Mesoscale Inventory Comparison, Alternative B

	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative B	41.6	66.3	104.4	6.0	2.0
Emissions Attributable to Alternative B[1]	6.8	35.7	28.4	1.2	0.7

[1] Calculated by subtracting total No-Action Alternative emissions from total Alternative B emissions.

6.5.4 Alternative C

6.5.4.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative C (either option) would result in localized criteria pollutants emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking garage analysis for Alternative C.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative C (either option), there would be a minor adverse direct operational impact on air quality due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-22 and **Table 6-23** show modeled CO concentrations at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*) in Alternative C with the East and the West Option, respectively. The concentrations shown are the receptor with highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

There would be no significant differences between the two options. One-hour CO concentrations would range from 2.1 ppm (0.4 ppm above background) to 2.6 ppm (0.9 ppm above background). Eight-hour concentrations would range from 1.6 ppm (0.1 ppm above background) to 1.9 ppm (0.4 ppm above background) in both options. All concentrations would be only slightly above background levels.

Compared to the modeled No-Action Alternative estimates shown in **Table 6-4**, concentrations would increase by up to 0.5 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would increase by up to 0.2 ppm. All concentrations would remain well below the applicable NAAQS.

Table 6-22. Carbon Monoxide Hotspot Concentrations, Alternative C East Option

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.6	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.5	1.9	35	9
	SE	2.3	1.8	35	9
North Capitol Street and H Street	NW	2.5	1.9	35	9
	NE	2.3	1.9	35	9
	SW	2.4	1.8	35	9
	SE	2.4	1.8	35	9
First Street and K Street	NW	2.3	1.8	35	9
	NE	2.4	1.8	35	9
	SW	2.2	1.7	35	9
	SE	2.1	1.7	35	9

Table 6-23. Carbon Monoxide Hotspot Concentrations, Alternative C West Option

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.6	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.5	1.9	35	9
	SE	2.2	1.8	35	9
North Capitol Street and H Street	NW	2.5	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.4	1.9	35	9
	SE	2.3	1.8	35	9
Parking Facility and H Street	NW	2.3	1.8	35	9
	NE	2.1	1.7	35	9
	SW	2.2	1.7	35	9
	SE	2.1	1.6	35	9

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative C (either option), there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$ concentrations. At all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

The $PM_{2.5}$ microscale analysis for Alternative C was conducted for receptor locations at the H Street NE entrance to the bus facility and the bus pick-up and drop-off area. **Table 6-24** and **Table 6-25** show modeled concentrations for the 24-hour and annual averaging periods in Alternative C with the East Option and Alternative C with the West Option, respectively. The estimates include background concentrations of 22 μg/m^3 for the 24-hour averaging period and 9.2 μg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

In Alternative C with the East Option, receptors would experience a maximum 24-hour concentration of 25.1 μg/m^3 (3.1 μg/m^3 above background) and a maximum annual concentration of 10.8 μg/m^3 (1.6 μg/m^3 above background).

In Alternative C with the West Option, receptors would experience a maximum 24-hour concentration of 25.0 μg/m^3 (3.0 μg/m^3 above background). The maximum annual concentration would be 10.5 μg/m^3 (1.3 μg/m^3 above background) at the H Street NE area and 10.8 μg/m^3 (1.6 μg/m^3 above background) at the bus pick-up and drop-off area.

Table 6-24. Particulate Matter 2.5 Hotspot Concentrations, Alternative C East Option

Receptor Grouping	$PM_{2.5}$ Concentrations (μg/m^3)		NAAQS (μg/m^3)	
	24-Hour	Annual	24-Hour	Annual
H Street	25.1	10.8	35.0	12.0
Bus Pick-up/drop-off Area	24.7	10.8	35.0	12.0

Table 6-25. Particulate Matter 2.5 Hotspot Concentrations Alternative C West Option

Receptor Grouping	$PM_{2.5}$ Concentrations (μg/m^3)		NAAQS (μg/m^3)	
	24-Hour	Annual	24-Hour	Annual
H Street	24.3	10.5	35.0	12.0
Bus Pick-up/drop-off Area	25.0	10.8	35.0	12.0

Compared to the No-Action Alternative estimates shown in **Table 6-5**, there would be an increase in concentrations of up to 1.5 μg/m^3 for the 24-hour averaging time and up to 0.8 μg/m^3 for the annual averaging time. $PM_{2.5}$ concentrations at all receptor locations would be below the NAAQS. While total concentrations would approach the NAAQS (approximately 71 percent of the 24-hour standard and 90 percent of the annual standard), this would mostly be due to background concentrations.

Microscale Analysis: Parking Facility

Relative to the No-Action Alternative, in Alternative C (either option), there would be a minor adverse direct operational impact on air quality near the parking facility and bus pick-up and drop-off area due to small increases in CO concentrations relative to the No-Action Alternative. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

In Alternative C, the bus facility would be located to the north of the H Street Bridge and it would have three levels of parking above it. Depending on the option, it would stand either to the northeast or the northwest corner of the bridge. Both the bus facility and the parking facility above it would be naturally ventilated. Buses using the facility and drivers using the parking facility would enter and exit via H Street NE. In addition, there would be one level of below-ground parking along the western side of the Project Area. Vehicles would access and exit this facility via K Street NE. Finally, a bus pick-up and drop-off area would be built adjacent to the north side of the train hall.

The parking facility analysis for Alternative C considered the operation of the new bus facility, above-ground parking facility, below-ground parking facility, and bus pick-up and drop-off area, in combination with future traffic volumes and operations for this alternative. Emissions from vehicles travelling on H Street, K Street, First Street and 2nd Street NE were included in the analysis.

CO concentrations in Alternative C were evaluated at receptor locations on both sidewalks on H Street, K Street, First Street, and 2nd Street NE as well as along the bus pick-up and drop-off area loop access road. The receptors at H Street and the bus pick-up and drop-off area are close to the parking facility's southern fan plant. The receptors on K Street and First Street NE are close to the facility's northern fan plant. The receptors on H Street, 2nd Street and K Street NE are close to the above-ground parking facility and the bus facility in the East Option. The receptors on H Street, K Street and First Street NE are close to the above-ground parking facility and bus facility in the West Option.

The new bus facility and above-ground parking facility were modeled as volume sources. Emissions from the below-ground parking were considered at the two western fan locations near the intersection of K Street and First Street NE as well as near the southwest corner of the bus pick-up and drop-off area. Buses traveling on the pick-up and drop-off area loop and idling at the area's slips were modeled using area sources.

The average path through the below-ground parking facility was estimated to be 777 feet when departing and 1,920 feet when parking. In the above-ground facility, the corresponding distances were estimated to be 3,288 feet and 3,826 feet, respectively. These path lengths were estimated based on the planned dimensions of the parking facilities and assuming an equal distribution of users across the parking levels. Buses using the bus facility were assumed to travel only on the bus deck, with an average path length of 366 feet into and out of the facility.

Table 6-26 and **Table 6-27** show the maximum CO concentrations at the receptors at each modeled location for the East Option and the West Option, respectively. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-26. Parking Facility Concentrations, Alternative C East Option

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street	2.3	1.9	35	9
K Street	2.4	1.9	35	9
First Street	2.6	2.0	35	9
2nd Street	2.0	1.7	35	9
Bus Pick-up/Drop-off Area	2.7	2.2	35	9

Table 6-27. Parking Facility Concentrations, Alternative C West Option

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street	2.2	1.8	35	9
K Street	2.4	1.9	35	9
First Street	2.7	2.1	35	9
2nd Street	2.0	1.7	35	9
Bus Pick-up/Drop-off Area	2.7	2.2	35	9

The maximum CO concentrations for both options would occur at the bus pick-up and drop-off area near the traveling buses and the below-ground parking exhaust vent. Concentrations there would reach 2.7 ppm (1.0 ppm above background) for the 1-hour averaging time and 2.2 ppm (0.7 ppm above background) for the 8-hour averaging time. All CO concentrations would remain well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative C (either option) would have negligible adverse direct operational impacts on air quality.

The stationary source analysis presented in **Section 6.5.2.1**, *Direct Operational Impacts,* also applies to Alternative C. The locations of fan plants in Alternative C would be as in Alternative B (see **Section 6.5.3.1**, *Direct Operational Impacts*) but this does not affect the conclusions of the analysis.

6.5.4.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative C (either option) would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative C would be below the *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. The mesoscale air quality analysis for each option of Alternative C was conducted for VOC, NO_X, CO, and PM emissions using vehicle and train traffic data from the Alternative C transportation impact analysis.

Table 6-28 and **Table 6-29** show the results of the Alternative C mesoscale analysis for the East Option and the West Option, respectively. No-Action Alternative estimates are also provided, for purposes of comparison.

Table 6-28. Mesoscale Inventory, Alternative C East Option

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	38.9	4.8	73.7	4.9	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	40.9	66.2	103.5	5.9	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative C East Option Emissions[1]	6.1	35.6	27.5	1.1	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Calculated by subtracting total No-Action Alternative total emissions from total Alternative C, East Option emissions

Table 6-29. Mesoscale Inventory, Alternative C West Option

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	38.8	4.7	72.8	4.9	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	40.8	66.1	102.6	5.9	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative C West Option Emissions[1]	6.0	35.5	26.6	1.1	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Calculated by subtracting total No-Action Alternative total emissions from total Alternative C, West Option emissions

Alternative C with either option would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ all would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms.

In either option, the emissions of NO_X attributable to Alternative C represent a 117 percent increase relative to No-Action Alternative emissions and more than a third of the applicable *de minimis* level.

Emissions of CO would also increase substantially in both options: emissions would increase by approximately 36 percent (East Option) or 35 percent (West Option). Emissions attributable to Alternative C would represent 27 percent of the applicable *de minimis* level.

All emissions attributable to Alternative C in either option would remain below the applicable *de minimis* level.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative C (either option) may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The MSAT analysis conducted for Alternative A also applies to Alternative C (see **Section 6.5.2.2**, *Indirect Operational Impacts*).

6.5.4.3 Construction Impacts

Construction of Alternative C (either option) would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of

criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Construction activities in Alternative C would cause air pollutant emissions in amounts that would vary across the entire construction period, estimated to last approximately 12 years and 3 months. The main types and sources of emissions would be as described for Alternative A and emissions were estimated using the same approach, including two scenarios for the removal of excavation spoil (see **Section 6.5.2.3**, *Construction Impacts*).

Table 6-30 shows estimated annual emissions for the All Truck Scenario. **Table 6-31** shows estimated annual emissions for the Work Train Scenario.

Table 6-30. Construction Emissions per Phase, Alternative C Either Option (All Truck Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	3.1	22.9	10.5	1.4	0.9
Phase 2	5.1	38.3	17.8	2.4	1.5
Phase 3	4.8	37.0	17.3	2.4	1.5
Phase 4	6.3	48.4	22.8	3.3	1.9
***De Minimis* Criteria**	50	100	100	100	100

Table 6-31. Construction Emissions per Phase, Alternative C Either Option (Work Train Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	2.4	25.7	9.0	0.7	0.7
Phase 2	3.7	43.5	15.1	1.1	1.1
Phase 3	3.4	42.3	14.5	1.1	1.0
Phase 4	4.3	55.9	18.9	1.4	1.3
***De Minimis* Criteria**	50	100	100	100	100

In Alternative C as in the other Action Alternatives, Phase 4 would generate the largest amount of emissions for all pollutants. Spoil removal via trucks would produce greater emission levels for all pollutants excluding NO_X, which is a major pollutant produced by locomotives. During Phase 4, annual NO_X emissions in the Work Train Scenario would reach 55.9 tons. Otherwise, the greatest amounts of annual emissions would occur during Phase 4 of the All Truck Scenario, with 6.3 tons of VOC, 22.8 tons of CO, 3.3 tons of PM_{10}, and 1.9 tons of $PM_{2.5}$.

During all phases and in both scenarios, emissions of criteria pollutants would remain below the applicable *de minimis* level even with the conservative scheduling assumption used for the analysis.

6.5.4.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative C (either option) on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions, but they would remain small. Concentrations would remain below the NAAQS.

At the regional level, as **Table 6-32** shows, the emissions specifically attributable to Alternative C would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative C would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-32. Mesoscale Inventory Comparison, Alternative C

Condition	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative C East Option	40.9	66.2	103.5	5.9	2.0
Emissions Attributable to Alternative C East Option[1]	6.1	35.6	27.5	1.1	0.7
Total Emissions in Alternative C West Option	40.8	66.1	102.6	5.9	2.0
Emissions Attributable to Alternative C West Option[1]	6.0	35.5	26.6	1.1	0.7

1. Calculated by subtracting total No-Action Alternative emissions from total Alternative C emissions.

6.5.5 Alternative D

6.5.5.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative D would result in localized criteria pollutants emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for Alternative D.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative D, there would be a minor adverse direct operational impact on air quality due to small increases in CO. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-33 shows modeled CO concentrations in Alternative D at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-33. Carbon Monoxide Hotspot Concentrations, Alternative D

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.4	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.3	1.9	35	9
	SE	2.2	1.8	35	9
North Capitol Street and H Street	NW	2.4	1.8	35	9
	NE	2.3	1.8	35	9
	SW	2.3	1.9	35	9
	SE	2.3	1.8	35	9
First Street and K Street	NW	2.3	1.8	35	9
	NE	2.3	1.7	35	9
	SW	2.1	1.7	35	9
	SE	2.1	1.7	35	9

One-hour CO concentrations in Alternative D would range from 2.1 ppm (0.4 ppm above background) to 2.4 ppm (0.7 ppm above background). Eight-hour concentrations would range from 1.7 ppm (0.2 ppm above background) to 1.9 ppm (0.4 ppm above background). All concentrations would be only slightly above background levels.

Compared to the modeled No-Action Alternative estimates shown in **Table 6-4**, there would be increases of up to 0.4 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would be the same or increase by up to 0.2 ppm. All concentrations would remain well below the applicable NAAQS.

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative D, there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$ concentrations. At

all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

The $PM_{2.5}$ microscale analysis for Alternative D was conducted for receptor groupings on H Street NE and on the roads leading to and from the bus facility adjacent to the train hall. **Table 6-34** shows modeled concentrations for the 24-hour and annual averaging periods. The estimates include background concentrations of 22 µg/m^3 for the 24-hour averaging period and 9.2 µg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

Table 6-34. Particulate Matter 2.5 Hotspot Concentrations, Alternative D

Receptor Grouping	$PM_{2.5}$ Concentrations (µg/m^3)		NAAQS (µg/m^3)	
	24-Hour	Annual	24-Hour	Annual
H Street	24.5	10.6	35.0	12.0
Bus Facility Entrance Road	23.7	10.2	35.0	12.0
Bus Facility Exit Road	23.8	10.2	35.0	12.0

On the bus facility's exit road, receptors would experience a maximum 24-hour concentration of 23.8 µg/m^3 (1.8 µg/m^3 above background) and annual concentration of 10.2 µg/m^3 (1.0 µg/m^3 above background). The highest concentrations would occur on H Street NE, where receptors would experience a maximum 24-hour concentration of 24.5 µg/m^3 (2.5 µg/m^3 above background) and a maximum annual concentration of 10.6 µg/m^3 (1.4 µg/m^3 above background).

Compared to the No-Action Alternative maximum estimates shown in **Table 6-5**, there would be an increase in concentrations on H Street of up to 0.9 µg/m^3 for the 24-hour averaging time and up to 0.6 µg/m^3 for the annual averaging time. In all modeled locations, emission levels would be below the applicable NAAQS. While maximum total concentrations would approach the NAAQS (approximately 70 percent of the 24-hour standard and 88 percent of the annual standard), this would mostly be due to background concentrations.

Microscale Analysis: Parking Facility Analysis

Relative to the No-Action Alternative, in Alternative D, there would be a minor adverse direct operational impact on air quality near the parking facility and bus facility due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

In Alternative D, the bus facility would consist of a loop around the train hall. Buses using the facility would access it via H Street NE. Parking would be provided in a one-level below-ground parking facility along the western side of the Project Area and in a multi-story above-ground parking facility at the northern end of the Project Area. Vehicles would access below-ground parking via K Street NE and above-ground parking via H Street NE.

The parking facility microscale analysis for Alternative D considered the operation of the proposed bus facility, below-ground parking facility, and above-ground parking facility along with future traffic volumes and operations for this alternative. The analysis incorporated the emissions from vehicles traveling on H Street, K Street, First Street, and 2nd Street NE as well as on the access roads to the bus facility and the above-ground parking.

CO concentrations in Alternative D were evaluated at receptor locations placed on H Street, K Street, First Street, 2nd Street NE and the bus facility access roads. These locations would experience the highest CO concentrations as they are near the bus facility, parking facility vents, and heavily travelled streets. H Street and the bus facility roadway receptors are close to the parking facility's southern fan plant and bus facility. Receptors on K Street, First Street and 2nd Street NE are close to the parking facility's northern fan plant and the above-ground parking facility.

The bus facility and above-ground parking facility were modeled as volume sources. Emissions from the below-ground parking facility were considered at the two western fan locations: near the intersection of K Street and First Street NE and near the western end of the bus facility. The average path through the below-ground parking facility was estimated to be 777 feet when departing and 1,531 feet when parking. In the above-ground facility, it would be 2,145 feet when departing and 2,466 feet when parking. These path lengths were estimated based on the planned dimensions of the parking facilities. They assume an equal distribution of users across all parking levels. Buses using the bus facility were assumed to travel an average path length of 876 feet into and out of the facility.

Table 6-35 shows the maximum CO concentrations for each modeled location. All results include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-35. Parking Facility Concentrations, Alternative D

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street	2.3	1.9	35	9
K Street	2.1	1.8	35	9
First Street	2.2	1.8	35	9
2nd Street	2.0	1.7	35	9
Bus Facility Roadways	2.3	2.0	35	9

Maximum CO concentrations in Alternative D would occur along the bus facility's access roadways. These concentrations would be the result of emissions from the facility and the nearby below-ground parking exhaust vent. At this location, the maximum 1-hour CO concentration would reach 2.3 ppm (0.6 ppm above background) and the maximum 8-hour concentration 2.0 ppm (0.5 ppm above background). All concentrations would remain well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative D would have negligible adverse direct operational impacts on air quality.

The stationary source analysis presented in **Section 6.5.2.1**, *Direct Operational Impacts,* also applies to Alternative D. The locations of fan plants in Alternative D would be as in Alternative B (see **Section 6.5.3.1**, *Direct Operational Impacts*) but this does not affect the conclusions of the analysis.

6.5.5.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative D would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative D would be below the General Conformity *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. The mesoscale air quality analysis for Alternative D was conducted for VOC, NO_X, CO, and PM emissions using vehicle and train traffic data from the Alternative D transportation impact analysis.

Table 6-36 shows the results of the mesoscale analysis for Alternative D. No-Action Alternative estimates are also provided, for purposes of comparison.

Table 6-36. Mesoscale Inventory, Alternative D

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	38.3	4.6	72.2	4.9	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	40.3	66.0	102.0	5.9	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative D Emissions[1]	5.5	35.4	25.9	1.1	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Emissions specifically attributable to the Project under Alternative D. Calculated by subtracting total No-Action Alternative emissions from total Alternative D emissions.

Alternative D would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ all would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms.

The emissions of NO_X attributable to Alternative D represent a 116 percent increase relative to No-Action emissions and more than a third of the applicable *de minimis* level.

Emissions of CO would also increase substantially: emissions would increase by approximately 34 percent and the emissions attributable to Alternative D represent more than 25 percent of the applicable *de minimis* level.

All emissions attributable to Alternative D would remain below the applicable *de minimis* level.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative D may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The MSAT analysis conducted for Alternative A also applies to Alternative D (see **Section 6.5.2.2**, *Indirect Operational Impacts*).

6.5.5.3 Construction Impacts

Construction of Alternative D would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Construction activities in Alternative D would cause air pollutant emissions in amounts that would vary across the entire construction period, estimated to last approximately 12 years and 3 months. The main types and sources of emissions would be as described for Alternative A and emissions were estimated using the same approach, including two scenarios for the removal of excavation spoil (see **Section 6.5.2.3**, *Construction Impacts*).

Table 6-37 shows estimated annual emissions for the All Truck Scenario. **Table 6-38** shows estimated annual emissions for the Work Train Scenario.

Table 6-37. Construction Emissions per Phase, Alternative D (All Trucks Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	3.1	22.9	10.5	1.4	0.9
Phase 2	5.1	38.3	17.8	2.4	1.5
Phase 3	4.8	37.0	17.3	2.4	1.5
Phase 4	6.3	48.4	22.8	3.3	1.9
***De Minimis* Criteria**	50	100	100	100	100

Table 6-38. Construction Emissions per Phase, Alternative D (Work Train Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	2.4	25.7	9.0	0.7	0.7
Phase 2	3.7	43.5	15.1	1.1	1.1
Phase 3	3.4	42.3	14.5	1.1	1.0
Phase 4	4.3	55.9	18.9	1.4	1.3
***De Minimis* Criteria**	50	100	100	100	100

In Alternative D as in the other Action Alternatives, Phase 4 would generate the largest amount of emissions for all pollutants. Spoil removal via trucks would produce greater emission levels than removal by work trains for all pollutants except NO_X, which is a major pollutant produced by locomotives. During Phase 4, annual NO_X emissions in the Work Train Scenario would reach 55.9 tons. Otherwise, the greatest amounts of annual emissions would occur during Phase 4 of the All Truck Scenario, with 6.3 tons of VOC, 22.8 tons of CO, 3.3 tons of PM_{10}, and 1.9 tons of $PM_{2.5}$.

6.5.5.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative D on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions but would remain small. Concentrations would remain below the NAAQS.

At the regional level, as shown in **Table 6-39**, the emissions specifically attributable to Alternative D would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative B would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-39. Mesoscale Inventory Comparison, Alternative D

Condition	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative D[1]	40.3	66.0	102.0	5.9	2.0
Emissions Attributable to Alternative D	5.5	35.4	25.9	1.1	0.7

1. Calculated by subtracting total No-Action Alternative emissions from total Alternative D emissions.

6.5.6 Alternative E

6.5.6.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative E would result in localized criteria pollutants emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for Alternative E.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative E, there would be a minor adverse direct operational impact on air quality due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-40 shows modeled CO concentrations for Alternative E at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All results include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-40. Carbon Monoxide Hotspot Concentrations, Alternative E

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.5	1.9	35	9
	NE	2.4	1.9	35	9
	SW	2.4	1.9	35	9
	SE	2.2	1.8	35	9
North Capitol Street and H Street	NW	2.4	1.8	35	9
	NE	2.3	1.8	35	9
	SW	2.3	1.9	35	9
	SE	2.3	1.8	35	9
First Street and K Street	NW	2.3	1.8	35	9
	NE	2.3	1.7	35	9
	SW	2.1	1.7	35	9
	SE	2.1	1.7	35	9

One-hour CO concentrations in Alternative E would range from 2.1 ppm (0.4 ppm above background) to 2.5 ppm (0.8 ppm above background). Eight-hour concentrations would range from 1.7 ppm (0.2 ppm above background) to 1.9 ppm (0.4 ppm above background). All concentrations would be only slightly above background levels.

Compared to the modeled No-Action Alternative estimates shown in **Table 6-4**, there would be increases of up to 0.3 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would increase by up to 0.1 ppm. All concentrations would remain well below the applicable NAAQS.

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative E, there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$. At all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

The microscale $PM_{2.5}$ analysis for Alternative E was conducted for receptor groupings on H Street and on the roads leading to and from the bus facility adjacent to the train hall. **Table 6-41** shows modeled concentrations for the 24-hour and annual averaging periods. The estimates include background concentrations of 22 μg/m^3 for the 24-hour averaging period and 9.2 μg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

On the bus facility's exit road, receptors would experience a maximum 24-hour concentration of 23.8 μg/m^3 (1.8 μg/m^3 above background) and annual concentration of 10.2 μg/m^3 (1.0 μg/m^3 above background). The highest concentrations would occur on H

Street NE, receptors would experience a maximum 24-hour concentration of 24.5 μg/m^3 (2.5μg/m^3 above background) and a maximum annual concentration of 10.6 μg/m^3 (1.4 μg/m^3 above background).

Compared to the No-Action Alternative estimates shown in **Table 6-5**, there would be an increase in concentrations of up to 0.9 μg/m^3 for the 24-hour averaging time and up to 0.6 μg/m^3 for the annual averaging time. In both modeled locations, emission levels would be below the applicable NAAQS. While total concentrations would approach the NAAQS (approximately 70 percent of the 24-hour standard and 88 percent of the annual standard), this would mostly be due to background concentrations.

Table 6-41. Particulate Matter 2.5 Hotspot Concentrations, Alternative E

Receptor Grouping	$PM_{2.5}$ Concentrations (μg/m^3)		NAAQS (μg/m^3)	
	24-Hour	Annual	24-Hour	Annual
H Street	24.5	10.6	35.0	12.0
Bus Facility Entrance Road	23.7	10.2	35.0	12.0
Bus Facility Exit Road	23.8	10.2	35.0	12.0

Microscale Analysis: Parking Facility

Relative to the No-Action Alternative, in Alternative E, there would be a minor adverse direct operational impact on air quality near the parking facility and bus facility due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

In Alternative E, the bus facility would consist of a loop around the train hall. Buses using the facility would access it via H Street NE. Parking would be provided in a two-level below-ground parking facility along the western side of the Project Area. Vehicles would access parking via K Street NE.

The parking facility microscale analysis for Alternative E considered the operation of the proposed bus facility and below-ground parking facility along with future traffic volumes and operations for this alternative. The analysis incorporated the emissions from vehicles travelling on H Street, K Street, and First Street NE as well as on the access roads to the bus facility.

CO concentrations in Alternative E were evaluated at receptor locations placed on the near and far sidewalks on H Street, K Street, and First Street NE as well as the bus facility's access roads. These locations would experience the highest CO concentrations as they are near the bus facility, parking facility vents, and heavily travelled streets. The H Street NE and bus facility roadway receptors are close to the bus facility and parking facility's southern fan plant. Receptors on K Street NE and First Street NE are close to the parking facility's northern fan plant.

The bus facility was modeled as a volume source. Emissions from the below-ground parking facility were considered at the two fan locations near the intersection of K Street NE and First Street NE and near the bus facility. Vehicles using the parking facility were estimated to travel an average path of 1,554 feet when departing and 2,697 feet when parking. These path lengths were estimated based on the planned dimensions of the facility. They assume an equal distribution of users across the two parking levels. Buses using the bus facility were assumed to travel an average length of 876 feet into and out of the bus facility.

Table 6-42 shows the maximum CO concentrations for each modeled location. All results include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

Table 6-42. Parking Facility Concentrations, Alternative E

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
H Street NE	2.3	1.9	35	9
K Street	2.2	1.8	35	9
First Street	2.4	1.9	35	9
Bus Terminal Roadways	2.6	2.2	35	9

Maximum CO concentrations in Alternative E would occur on the bus facility's access roadways. These concentrations would be the result of pollutant emissions from both the bus facility and the below-ground parking exhaust vent. At this location, the maximum 1-hour CO concentration would reach 2.6 ppm (0.9 ppm above background) and the maximum 8-hour concentration 2.2 ppm (0.7 ppm above background). All concentrations would remain well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative E would have negligible adverse direct operational impacts on air quality.

The stationary source analysis presented in **Section 6.5.2.1**, *Direct Operational Impacts,* also applies to Alternative E. The locations of fan plants in Alternative E would be as in Alternative B (see **Section 6.5.3.1**, *Direct Operational Impacts*) but this does not affect the conclusions of the analysis.

6.5.6.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative E would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative E would be below the General Conformity *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. The mesoscale air quality analysis for Alternative E was conducted for VOC, NO_X, CO, and PM emissions using vehicle and train traffic data from the Alternative E transportation impact analysis.

Table 6-43 shows the results of the mesoscale analysis for Alternative E. No-Action Alternative estimates are also provided, for purposes of comparison.

Table 6-43. Mesoscale Inventory, Alternative E

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	38.8	4.7	73.2	5.0	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	40.8	66.1	103.0	6.0	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative E Emissions[1]	6.0	35.5	27.0	1.2	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Emissions specifically attributable to the Project under Alternative E. Calculated by subtracting total No-Action Alternative emissions from total Alternative E emissions.

Alternative E would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ all would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms.

The emissions of NO_X attributable to Alternative E represent a 116 percent increase relative to No-Action emissions and more than a third of the applicable *de minimis* level.

Emissions of CO would also increase substantially: emissions would increase by approximately 35 percent and the emissions attributable to Alternative E represent 27 percent of the applicable *de minimis* level.

All emissions attributable to Alternative E would remain below the applicable *de minimis* level.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative E may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The MSAT analysis conducted for Alternative A also applies to Alternative E (see **Section 6.5.2.2**, *Indirect Operational Impacts*).

6.5.6.3 Construction Impacts

Construction of Alternative E would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Construction activities in Alternative E would cause air pollutant emissions in amounts that would vary across the entire construction period, estimated to last approximately 14 years and 4 months. The main types and sources of emissions would be as described for Alternative A and emissions were estimated using the same approach, including two scenarios for the removal of excavation spoil (see **Section 6.5.2.3**, *Construction Impacts*).

Table 6-44 shows estimated annual emissions for the All Truck Scenario. **Table 6-45** shows estimated annual emissions for the Work Train Scenario.

Table 6-44. Construction Emissions per Phase, Alternative E (All Truck Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	3.3	24.5	11.2	1.4	0.9
Phase 2	5.9	44.2	20.4	2.5	1.7
Phase 3	5.0	38.2	18.0	2.5	1.5
Phase 4	6.8	52.4	24.7	3.5	2.1
***De Minimis* Criteria**	50	100	100	100	100

Table 6-45. Construction Emissions per Phase, Alternative E (Work Train Scenario)

Construction Period	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Phase 1	2.6	27.2	9.8	0.7	0.7
Phase 2	4.7	48.9	18.0	1.3	1.3
Phase 3	3.5	43.8	15.0	1.1	1.1
Phase 4	4.8	60.0	20.7	1.5	1.5
***De Minimis* Criteria**	50	100	100	100	100

Like in the other Action Alternatives, Phase 4 would generate the largest amount of emissions for all pollutants. Spoil removal via trucks would produce greater emission levels for all pollutants excluding NO_X, which is a major pollutant produced by locomotives. During Phase 4, annual NO_X emissions in the Work Train Scenario would reach 60 tons. Otherwise, the greatest amounts of annual emissions would occur during Phase 4 of the All Truck Scenario, with 6.8 tons of VOC, 24.7 tons of CO, 3.5 tons of PM_{10}, and 2.1 tons of $PM_{2.5}$.

During all phases and in both scenarios, emissions of criteria pollutants would remain below the applicable *de minimis* level even with the conservative scheduling assumption used for the analysis.

6.5.6.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative E on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions but would remain small. Concentrations would remain below the NAAQS.

At the regional level, as shown in **Table 6-46**, the emissions specifically attributable to Alternative E would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative E would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-46. Mesoscale Inventory Comparison, Alternative E

Condition	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative E	40.8	66.1	103.0	6.0	2.0
Emissions Attributable to Alternative E[1]	6.0	35.5	27.0	1.2	0.7

1. Calculated by subtracting total No-Action Alternative emissions from total Alternative E emissions.

6.5.7 Alternative A-C (Preferred Alternative)

6.5.7.1 Direct Operational Impacts

Increased vehicular traffic to and from WUS in Alternative A-C would result in localized criteria pollutants emissions. These impacts are assessed through microscale analysis. This section presents the CO and $PM_{2.5}$ hotspot analyses and parking facility analysis for Alternative A-C.

Microscale Analysis: CO Hotspot

Relative to the No-Action Alternative, in Alternative A-C, there would be a minor adverse direct operational impact on air quality due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would remain well below the applicable NAAQS.

Table 6-47 shows modeled CO concentrations in Alternative A-C at the selected intersections (see **Section 6.4.2.1**, *Microscale Methodology*). The concentrations shown are for the receptor with the highest result in each quadrant of the intersection. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

One-hour CO concentrations would range from 2.0 ppm (0.3 ppm above background) to 2.3 ppm (0.6 ppm above background). Eight-hour concentrations would range from 1.7 ppm (0.2 ppm above background) to 1.9 ppm (0.4 ppm above background). All concentrations would be only slightly above background levels.

Compared to the modeled No-Action Alternative estimates shown in **Table 6-4**, emissions would increase by up to 0.1 ppm for the 1-hour averaging time. For the 8-hour averaging time, emissions would increase by up to 0.1 ppm. All concentrations would remain well below the applicable NAAQS.

Table 6-47. Carbon Monoxide Hotspot Concentrations, Alternative A-C

Intersection	Receptor Quadrant	CO Concentrations (ppm)		NAAQS (ppm)	
		1-Hour	8-Hour	1-Hour	8-Hour
North Capitol Street and K Street	NW	2.3	1.9	35	9
	NE	2.2	1.8	35	9
	SW	2.2	1.8	35	9
	SE	2.1	1.7	35	9
North Capitol Street and H Street	NW	2.3	1.8	35	9
	NE	2.2	1.8	35	9
	SW	2.2	1.8	35	9
	SE	2.1	1.7	35	9
North Capitol Street, Massachusetts Avenue and F Street	NW	2.0	1.7	35	9
	NE	2.0	1.7	35	9
	SW	2.1	1.7	35	9
	SE	2.0	1.7	35	9
	W	2.0	1.7	35	9

Microscale Analysis: $PM_{2.5}$ Hotspot

Relative to the No-Action Alternative, in Alternative A-C, there would be a minor adverse direct operational impact on air quality due to small increases in $PM_{2.5}$ concentrations. At all modeled receptor locations, $PM_{2.5}$ concentrations would remain below the applicable NAAQS.

The $PM_{2.5}$ microscale analysis for Alternative A-C was conducted for the same receptor locations as for Alternative A because the bus facility would be in the same general location (see **Section 6.5.2.1**, *Direct Operational Impacts*).

Table 6-48 shows modeled $PM_{2.5}$ concentrations for the 24-hour and annual averaging periods in Alternative B. The estimates include background concentrations of 22 μg/m^3 for the 24-hour averaging period and 9.2 μg/m^3 for the annual averaging period. Maximum concentrations are presented for each receptor grouping.

North of H Street NE, receptors would experience a maximum 24-hour concentration of 23.9 μg/m^3 (1.9 μg/m^3 above background) and a maximum annual concentration of 10.1 μg/m^3 (0.9 μg/m^3 above background). South of H Street, receptors would experience a maximum 24-hour concentration of 23.7 μg/m^3 (1.7 μg/m^3 above background) and a maximum annual concentration of 10.2 μg/m^3 (1.0 μg/m^3 above background).

Compared to the No-Action Alternative estimates shown in **Table 6-5**, there would be an increase in concentrations of 0.3 μg/m^3 for the 24-hour averaging time and 0.2 μg/m^3 for the annual averaging time. In both modeled locations, emission levels would be below the applicable NAAQS. While total concentrations would approach the NAAQS (approximately 68 percent of the 24-hour standard and 85 percent of the annual standard), this would mostly be due to background concentrations.

Table 6-48. Particulate Matter 2.5 Hotspot Concentrations, Alternative A-C

Receptor Grouping	$PM_{2.5}$ Concentrations ($\mu g/m^3$)		NAAQS ($\mu g/m^3$)	
	24-Hour	Annual	24-Hour	Annual
North of H Street	23.9	10.1	35.0	12.0
South of H Street	23.7	10.2	35.0	12.0

Microscale Analysis: Parking Facility

Relative to the No-Action Alternative, in Alternative A-C, there would be a minor adverse direct operational impact on air quality near the parking facility due to small increases in CO concentrations. At all modeled receptor locations, CO concentrations would be well below the applicable NAAQS.

The parking facility analysis for Alternative A-C considered the operation of the proposed bus facility and parking facility along with projected future traffic volumes and operations for this alternative. The bus facility would be located approximately where the existing garage currently stands. Buses would enter via H Street NE; they would exit directly to H Street NE via a dedicated ramp. Parking would be provided on six levels above the bus facility. Vehicles would access and exit the parking facility via H Street (west intersection) and the east-west road running along the length of the train hall. Emissions from vehicles travelling on H Street NE were included in the analysis.

CO concentrations were evaluated at receptor locations on the near and far sidewalks adjacent to the parking facility, north and south of H Street NE. These locations would experience the highest CO concentrations as they are near both the parking facility and the heavily travelled H Street Bridge. The parking facility was separated into volume sources to represent the bus deck and the parking levels. The average path through the facility was assumed to be 4,421 feet when departing and 4,671 feet when parking. These estimates are based on the planned dimensions of the facility and assume an equal distribution of users across the parking levels. Buses using the facility were assumed to travel only on the bus decks, with an average path length of 894 feet into the facility and 894 feet out of it.

Table 6-49 shows the maximum CO concentrations at the modeled receptor locations in Alternative A-C. All concentrations include background concentrations of 1.7 ppm for the 1-hour averaging period and 1.5 ppm for the 8-hour averaging period.

North of H Street NE, modeled CO concentrations would be 2.4 ppm for the 1-hour averaging period (0.7 ppm above background) and 1.9 ppm for the 8-hour averaging period (0.4 ppm above background). Concentrations South of H Street NE would be slightly lower.

Table 6-49. Parking Facility Concentrations, Alternative A-C

Receptor Grouping	CO Concentrations (ppm)		NAAQS (ppm)	
	1-Hour	8-Hour	1-Hour	8-Hour
North of H Street	2.4	1.9	35	9
South of H Street	2.3	1.8	35	9

Relative to the No-Action Alternative, emissions would be slightly higher. For the 1-hour averaging time, there would be an increase of up to 0.3 ppm. For the 8-hour averaging time, there would be an increase of up to 0.2 ppm. Concentrations would remain well below the NAAQS.

Stationary Source Analysis

Relative to the No-Action Alternative, stationary source emissions in Alternative A-C would have negligible adverse direct operational impacts on air quality.

The stationary source analysis presented in **Section 6.5.2.1**, *Direct Operational Impacts,* for Alternative A also applies to Alternative A-C.

6.5.7.2 Indirect Operational Impacts

Mesoscale Analysis

Relative to the No-Action Alternative, Alternative A-C would have moderate adverse indirect operational impacts on air quality due to increased emissions. Emissions of criteria pollutants attributable to Alternative A-C would be below the General Conformity *de minimis* criteria applicable to the District.

Indirect impacts on air quality are a result of pollutant emissions on a regional scale. Such regional emissions are evaluated through mesoscale analysis. The mesoscale air quality analysis for Alternative A-C was conducted for VOC, NO_X, CO, and PM emissions using vehicle and train traffic data from the Alternative A-C transportation impact analysis. **Table 6-50** shows the results of the Alternative A-C mesoscale analysis, along with the corresponding estimates for the No-Action Alternative, for purposes of comparison.

Alternative A-C would have moderate adverse indirect operational impacts on air quality. Emissions of VOC, NO_X, CO, PM_{10}, and $PM_{2.5}$ would increase relative to the No-Action Alternative. NO_X emissions would increase the most in both absolute and relative terms.

The emissions of NO_X attributable to Alternative A-C represent a 116 percent increase relative to No-Action emissions and more than a third of the applicable *de minimis* level. Emissions of CO would increase by approximately 31 percent and the emissions attributable to Alternative A-C represent almost 24 percent of the applicable *de minimis* level.

However, all emissions attributable to Alternative A-C would remain below the applicable *de minimis* level.

Table 6-50. Mesoscale Inventory, Alternative A-C

Source	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
Motor Vehicle Emissions	37.4	4.6	70.1	4.8	1.0
Locomotive Emissions	2.0	61.4	29.8	1.0	1.0
Subtotal	39.4	66.0	99.9	5.8	2.0
No-Action Emissions	34.8	30.6	76.0	4.8	1.3
Alternative A-C Emissions[1]	4.6	35.4	23.9	1.0	0.7
***De Minimis* Criteria**	50	100	100	100	100

1. Emissions specifically attributable to the Project under Alternative A-C. Calculated by subtracting No-Action Alternative total emissions from total Alternative A-C emissions.

Mobile Source Air Toxics Analysis

Relative to the No-Action Alternative, Alternative A-C may result in localized, higher levels of MSAT emissions in the Local Study Area. Information to quantitatively assess these impacts is not available. Based on existing information, they are anticipated to be minor.

The MSAT analysis conducted for Alternative A also applies to Alternative A-C (see **Section 6.5.2.2**, *Indirect Operational Impacts*).

6.5.7.3 Construction Impacts

Construction of Alternative A-C would have moderate adverse impacts on air quality due to increased annual emissions during all phases of construction. Emissions of criteria pollutants would be below the General Conformity *de minimis* criteria applicable to the District.

Depth of excavation, most emission-intensive construction activities, and schedule in Alternative A-C would be the same as in Alternative A. Air quality impacts would be the same. These impacts are described in **Section 6.5.2.3**, *Construction Impacts*.

6.5.7.4 Comparison to Existing Conditions

At the local level, the impacts of Alternative A-C on air quality relative to existing conditions would generally be the same as relative to the No-Action Alternative. Increases in pollutant concentrations would be proportionally slightly greater relative to existing conditions, but they would remain small. Concentrations would remain below the NAAQS.

At the regional level, as shown in **Table 6-51**, the emissions specifically attributable to Alternative A-C would not change but total emissions would be less or the same as in existing conditions for all pollutants except PM_{10}. This is because total emissions in Alternative A-C would incorporate the reduction in emissions anticipated to occur by 2040 from improved regulations and technology for vehicles and locomotives.

Table 6-51. Mesoscale Inventory Comparison, Alternative A-C

	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	**Tons/Year**	**Tons/Year**	**Tons/Year**	**Tons/Year**
Total Emissions under Existing Conditions	62.6	73.0	161.0	4.3	2.1
Total Emissions in No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Emissions in Alternative A-C	39.4	66.0	99.9	5.8	2.0
Emissions Attributable to Alternative A-C[1]	4.6	35.4	23.8	1.0	0.7

[1] Calculated by subtracting total No-Action Alternative emissions from total Alternative A-C emissions.

6.6 Comparison of Alternatives

Table 6-52 shows a comparison of all the alternatives. All Action Alternatives would cause impacts on air quality because all would generate operational and construction-related air pollutant emissions that would not occur in the No-Action Alternative.

Table 6-52. Comparison of Alternatives

Type of Impact	Analysis	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
Direct Operational	Microscale CO	Minor Adverse Impact	Minor Adverse Impact					
	Microscale PM2.5	Minor Adverse Impact	Minor Adverse Impact					
	Microscale Parking	Minor Adverse Impact	Minor Adverse Impact					
	Stationary Source	N/A	Negligible Adverse Impact					
Indirect Operational	Mesoscale	Beneficial Impact	Moderate Adverse Impact					
	MSAT	N/A	Minor Adverse Impact					
Construction		N/A	Moderate Adverse Impact					

Based on the analyses presented in this section, the amount of new emissions attributable to each Action Alternative would be similar, though they would vary only across a narrow range as can be seen in **Table 6-53** through **Table 6-55**. As a result, the impact intensities relative to the No-Action Alternative would be the same for all Action Alternatives. All Action Alternatives would have:

- Minor adverse direct operational impacts on local air quality due to small, localized increases of CO and $PM_{2.5}$ concentrations from mobile sources (motor vehicles and trains). Total concentrations would remain well below the NAAQS at all locations.
- Moderate adverse indirect operational impacts on regional air quality because the Action Alternatives would increase annual NO_X emissions by 116 to 117 percent relative to the No-Action Alternative and represent more than a third of the applicable *de minimis* level. Additionally, annual CO emissions would increase by approximately 31 to 37 percent relative to the No-Action Alternative and represent from 24 to 28 percent of the *de minimis* level. Annual emissions of all criteria pollutants would remain below the *de minimis* levels, however, and all Action Alternatives would meet General Conformity requirements.
- Moderate construction-related impacts due to estimated annual emissions of NO_X representing up to approximately 60 percent of the applicable *de minimis* level and annual emission of CO representing from approximately 20 to 25 percent of the *de minimis* level for this pollutant. Annual emissions of all criteria pollutants would

remain below the *de minimis* levels, however, and all Action Alternatives would meet General Conformity requirements.

The No-Action Alternative would have:

- A minor adverse direct operational impact on air quality from CO and $PM_{2.5}$ emissions. Emissions of both pollutants would be well below the applicable NAAQS.
- A beneficial indirect operational impact on air quality due to reductions in emissions of VOC, NO_X, CO, and $PM_{2.5}$.
- Undetermined construction-related impacts.

Table 6-53. Comparison of Maximum Microscale Concentrations

Alternative	CO Hotspot Analysis (ppm)		$PM_{2.5}$ Hotspot Analysis ($\mu g/m^3$)		Parking Facility Analysis (ppm)	
	1-Hour	8-Hour	24-Hour	Annual	1-Hour	8-Hour
No-Action Alternative	2.2	1.8	23.6	10.0	2.1	1.7
Alternative A	2.3	1.9	23.7	10.0	2.2	2.0
Alternative B	2.6	1.9	23.6	9.9	2.5	1.9
Alternative C East Option	2.6	1.9	25.1	10.8	2.7	2.2
Alternative C West Option	2.6	1.9	25.0	10.8	2.7	2.2
Alternative D	2.4	1.9	24.5	10.6	2.3	2.0
Alternative E	2.5	1.9	24.5	10.6	2.6	2.2
Alternative A-C	2.3	1.9	23.9	10.2	2.4	1.9
NAAQS	35	9	35	12	35	9

Table 6-54. Comparison of Mesoscale Emissions

Alternative	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year
No-Action Alternative	34.8	30.6	76.0	4.8	1.3
Total Alternative A	39.7	66.1	100.6	5.8	2.0
Attributable to Alternative A	4.9	35.7	24.6	0.9	0.7
Alternative B	41.6	66.3	104.4	6.0	2.0
Attributable to Alternative B	6.8	35.7	28.4	1.2	0.7
Alternative C East Option	40.9	66.2	103.5	5.9	2.0
Attributable to Alternative C East Option	6.1	35.6	27.5	1.1	0.7
Alternative C West Option	40.8	66.1	102.6	5.9	2.0
Attributable to Alternative C West Option	6.0	35.5	26.6	1.1	0.7
Alternative D	40.3	66.0	102.0	5.9	2.0
Attributable to Alternative D	5.5	35.4	25.9	1.1	0.7
Alternative E	40.8	66.1	103.0	6.0	2.0
Attributable to Alternative E	6.0	35.5	27.0	1.2	0.7
Alternative A-C	39.4	66.0	99.9	5.8	2.0
Attributable to Alternative A-C	4.6	35.4	23.8	1.0	0.7
***De Minimis* Criteria**	50	100	100	100	100

Table 6-55. Construction Emissions Analysis Comparison

Alternative	Phase	Estimated Construction Emissions (Truck Removal / Train Removal)				
		VOC (Tons/Year)	NO_X (Tons/Year)	CO (Tons/Year)	PM_{10} (Tons/Year)	$PM_{2.5}$ (Tons/Year)
Alternative A	Phase 1	3.3 / 2.6	24.3 / 27.1	11.1 / 9.7	1.4 / 0.7	0.9 / 0.7
	Phase 2	4.8 / 3.5	35.6 / 40.2	16.4 / 14.0	2.2 / 1.1	1.4 / 1.0
	Phase 3	3.9 / 2.9	29.6 / 33.6	13.7 / 11.6	1.9 / 0.9	1.2 / 0.8
	Phase 4	6.6 / 4.8	50.3 / 57.1	23.3 / 19.8	3.2 / 1.5	2.0 / 1.4
Alternative B	Phase 1	3.3 / 2.6	24.5 / 27.2	11.2 / 9.8	1.4 / 0.7	0.9 / 0.7
	Phase 2	5.9 / 4.7	44.2 / 48.9	20.4 / 18.0	2.5 / 1.3	1.7 / 1.3
	Phase 3	5.0 / 3.5	38.2 / 43.8	18.0 / 15.0	2.5 / 1.1	1.5 / 1.1
	Phase 4	6.8 / 4.8	52.4 / 60.0	24.7 / 20.7	3.5 / 1.5	2.1 / 1.5
Alternative C (either option)	Phase 1	3.1 / 2.4	22.9 / 25.7	10.5 / 9.0	1.4 / 0.7	0.9 / 0.7
	Phase 2	5.1 / 3.7	38.3 / 43.5	17.8 / 15.1	2.4 / 1.1	1.5 / 1.1
	Phase 3	4.8 / 3.4	37.0 / 42.3	17.3 / 14.5	2.4 / 1.1	1.5 / 1.0
	Phase 4	6.3 / 4.3	48.4 / 55.9	22.8 / 18.9	3.3 / 1.4	1.9 / 1.3
Alternative D	Phase 1	3.1 / 2.4	22.9 / 25.7	10.5 / 9.0	1.4 / 0.7	0.9 / 0.7
	Phase 2	5.1 / 3.7	38.3 / 43.5	17.8 / 15.1	2.4 / 1.1	1.5 / 1.1
	Phase 3	4.8 / 3.4	37.0 / 42.3	17.3 / 14.5	2.4 / 1.1	1.5 / 1.0
	Phase 4	6.3 / 4.3	48.4 / 55.9	22.8 / 18.9	3.3 / 1.4	1.9 / 1.3
Alternative E	Phase 1	3.3 / 2.6	24.5 / 27.2	11.2 / 9.8	1.4 / 0.7	0.9 / 0.7
	Phase 2	5.9 / 4.7	44.2 / 48.9	20.4 / 18.0	2.5 / 1.3	1.7 / 1.3
	Phase 3	5.0 / 3.5	38.2 / 43.8	18.0 / 15.0	2.5 / 1.1	1.5 / 1.1
	Phase 4	6.8 / 4.8	52.4 / 60.0	24.7 / 20.7	3.5 / 1.5	2.1 / 1.5
Alternative A-C	Phase 1	3.3 / 2.6	24.3 / 27.1	11.1 / 9.7	1.4 / 0.7	0.9 / 0.7
	Phase 2	4.8 / 3.5	35.6 / 40.2	16.4 / 14.0	2.2 / 1.1	1.4 / 1.0
	Phase 3	3.9 / 2.9	29.6 / 33.6	13.7 / 11.6	1.9 / 0.9	1.2 / 0.8
	Phase 4	6.6 / 4.8	50.3 / 57.1	23.3 / 19.8	3.2 / 1.5	2.0 / 1.4
***De Minimis* Criteria**		50	100	100	100	100

6.7 Avoidance, Minimization, and Mitigation Evaluation

6.7.1 Operational Impacts

None of the Action Alternatives would result in major adverse operational impacts. To avoid or minimize less than major adverse impacts on local air quality, the Project Proponents would ensure that Project design places ventilation fans at least 30 feet from the nearest operable windows, louvers, or doors. Emergency generators would be at least 30 feet from the nearest building or on a rooftop. Rail operators would impose restrictions on diesel locomotive idling to minimize MSAT emissions.

6.7.2 Construction Impacts

Even with conservative scheduling assumptions placing the most emission-intensive activities within one calendar year for each construction phase, construction-related emissions would not exceed the applicable de minimis criteria under any of the Action Alternatives. Although no major adverse impacts are anticipated during construction, measures would be taken to reduce pollutant emissions. Such measures, to be implemented by the construction contractor, would include but are not limited to:

- Dust suppression; idling restrictions; use of Ultra Low Sulfur Diesel (ULSD) fuel; proper maintenance of all motor vehicles, machinery, and equipment; and fitting of equipment with mufflers or other regulatory-required emissions control devices would be used.
- Compliance with the District's anti-idling law (20 DCMR 900) during all construction phases. This regulation limits non-road engine idling to three minutes. Idling restriction signs would be placed on the premises to remind drivers and construction personnel of the applicable regulations. Drivers and equipment operators would be trained accordingly.
- Fitting all diesel-fuel construction equipment with after-engine emission controls. The construction contractor would also be required to use ULSD fuel for all off-road construction vehicles as an additional measure to reduce air emissions. Any non-road diesel equipment would have to be rated 50 horsepower or greater to meet EPA's Tier 4 emission limits or be retrofitted with appropriate emission reduction equipment. Emission reduction equipment could include EPA-verified or California Air Resource Board-verified diesel oxidation catalysts or diesel particulate filters.
- Implementing measures to protect local residents, visitors, passengers, and passers-by from off-site exposure to dust and debris in accordance with 20 DCMR 605. Appropriate methods of dust control would be determined according to the surfaces concerned (roadways or disturbed areas) and include, as applicable: application of water during ground-disturbing activities; stone surfacing of construction roads; seeding of areas of exposed or stock-piled soils; wheel washing; and regular

sweeping of paved roadways. Recycling construction waste and demolition materials may also reduce dust emissions.

- During construction in or immediately adjacent to the historic station building (demolition of the Claytor Concourse, column removal), put airtight walls or partitions in place around the construction areas, as needed to eliminate the risk of train engine exhaust fumes or dust drifting into the indoor areas accessible to the public or station employees.

6.8 Permits and Regulatory Compliance

In any of the Action Alternatives considered, the Project would cause no exceedances of the applicable NAAQS and emissions inventories would remain below the applicable *de minimis* thresholds. Therefore, the Project would be in compliance with applicable regulations and General Conformity Rule requirements.

7 Greenhouse Gas Emissions and Resilience

7.1 Overview

This section addresses the potential impacts on greenhouse gas (GHG) emissions and resilience of the No-Action and Action Alternatives. GHGs trap heat in the atmosphere and can affect air quality and climate change. Major GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases (such as hydrofluorocarbons and perfluorocarbons). The primary pollutant of concern from sources related to human activity is CO_2, which is the most abundant and influential GHG.

If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies potential permitting and regulatory compliance requirements.

7.2 Regulatory Context and Guidance

Federal policies, regulations, and guidance that pertain to GHG and resilience that are relevant to the Project include:

- Executive Order (EO) 13783, Promoting Energy Independence and Economic Growth;
- EO 13677, Climate Resilient International Development;
- EO 13834, Efficient Federal Operations;
- Environmental Protection Agency (EPA) *Greenhouse Gas Endangerment Finding*;[1] and

[1] U.S. Environmental Protection Agency. December 15, 2009. *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act (74 F.R. 66495).* Accessed from https://www.epa.gov/sites/production/files/2016-08/documents/federal_register-epa-hq-oar-2009-0171-dec.15-09.pdf. Accessed June 8, 2017.

- EPA and U.S. Department of Transportation *Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards* (2011).[2,3]

District of Columbia (District) policies, regulations and guidance that pertain to GHG and resilience include:

- *Sustainable DC Plan*;[4] and
- *Climate Ready DC*.[5]
- *Resilient DC. A strategy to Thrive in the Face of Change*. [6]

7.3 Study Area

The Local Study Area consists of the Project Area and the surrounding area within one-half mile. The Local Study Area only applies to the resilience impact analysis (**Figure 7-1)**. Concerns about GHG emissions are primarily related to their impact on climate change, a regional and global phenomenon. The state of dispersion science is not sufficiently advanced to usefully consider GHG emission impacts at a microscale level. Therefore, a Local Study Area was not defined for GHG and the study area for GHGs is regional only. The Regional Study Area encompasses the jurisdictions of the Metropolitan Washington Council of Governments (MWCOG) (**Figure 7-2**).[7]

2 U.S. Environmental Protection Agency, U.S Department of Transportation. May 7, 2010. *Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards* (75 F.R. 25324). Accessed from https://www.gpo.gov/fdsys/pkg/FR-2010-05-07/pdf/2010-8159.pdf. Accessed on June 8, 2017.

3 U.S. Environmental Protection Agency, U.S Department of Transportation. October 15, 2012. *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards* (77 F.R. 62624). Accessed from https://www.gpo.gov/fdsys/pkg/FR-2012-10-15/pdf/2012-21972.pdf. Accessed on June 8, 2017.

4 Department of Energy and Environment, District Office of Planning, and Office of the Mayor. 2016. *The Sustainable DC Plan.* Accessed from http://www.sustainabledc.org/wp-content/uploads/2017/03/SDC_Plan_2016_compressed2.pdf. Accessed on June 8, 2017.

5 Department of Energy and Environment. November 2016. *Climate Ready DC Plan.* Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/CRDC-Report-FINAL-Web.pdf. Accessed on June 8, 2017.

6 Issued in April 2019. Available at: https://resilient.dc.gov/. Accessed on August 20, 2019.

7 The member jurisdictions of the Metropolitan Washington Council of Governments are the District of Columbia; Charles, Frederick, Montgomery, and Prince George's Counties in Maryland; the Cities of Bladensburg, Bowie, College Park, Frederick, Gaithersburg, Greenbelt, Hyattsville, Laurel, Rockville, and Takoma Park in Maryland; Arlington, Fairfax, Loudoun, and Prince William Counties in Virginia; and the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park in Virginia.

Figure 7-1. Resilience Local Study Area

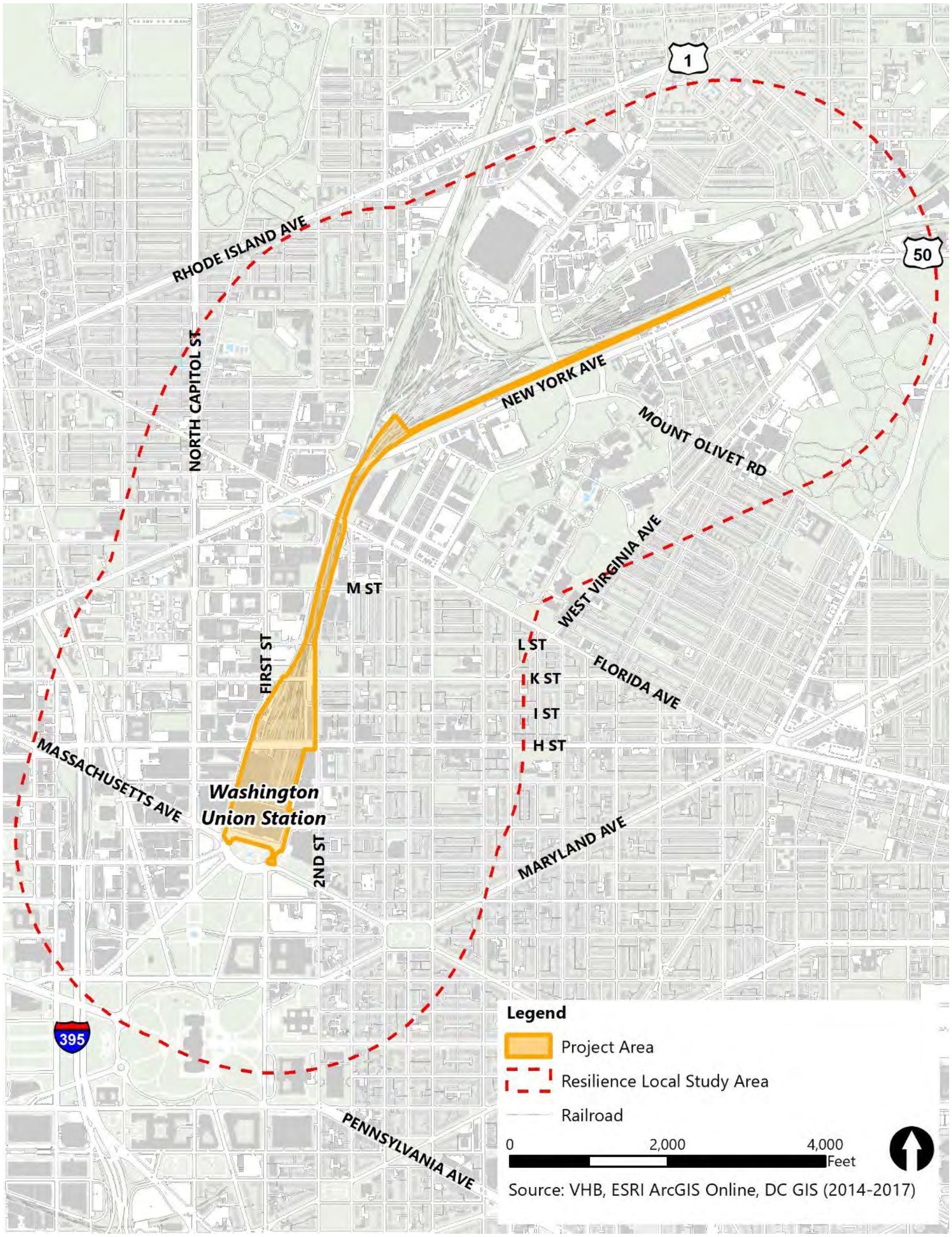

Figure 7-2. GHG Emissions and Resilience Regional Study Area

7.4 Methodology

Section 7 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) presents the general approach used to assess GHG and resilience impacts. The following sections explain how the methodology was applied to assess these impacts.

7.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is completed in the planning horizon year of 2040. The primary GHG associated with the operation of WUS is CO_2 from mobile and stationary sources. Therefore, the operational impact analysis consisted of an estimation of the CO_2 emissions associated with each alternative.

To provide context and a measure of the intensity of anticipated operational impacts, estimated emissions were compared to the District's CO_2-equivalent (CO_2e) emissions inventory for 2017 and to the District's emission target for 2032, which is 50 percent of the 2006 emissions.8 The District's total CO2e emissions inventory for 2017 were approximately 7.3 million metric tons. The 2032 emission target is approximately 5.05 million metric tons.

For the purposes of the analysis, impacts from changes in CO_2 emissions would be negligible if annual emissions would equal to or less than 1 percent of the 2017 emission inventory and 2032 emission target amount; minor if they would be equal to or less than 1 percent of the 2017 emission inventory and between 1 and 2 percent of the 2032 emission target amount; moderate if they would be between 1 and 2 percent of both; and major if they would be more than 2 percent of either.

7.4.1.1 Stationary Source Emissions

The methodology for the assessment of CO_2 emissions from stationary sources was built on the methodology used to estimate energy impacts, presented in **Section 8**, *Energy Resources,* by converting estimated energy use into CO_2 emissions. Conversion factors for the consumption of electricity and natural gas were obtained from the U.S. Energy Information Administration (EIA). Conversion factors for the consumption of steam and chilled water were based on guidance from the EPA and published efficiencies of the Capitol Power Plant.

Emissions of CO_2 that would occur in the Project Area were considered direct impacts. Only emissions from natural gas use at the private air-rights development would have direct stationary source impacts. Emissions from the consumption of energy produced away from the Project Area are considered indirect impacts. These include emissions associated with

[8] Department of Energy and Environment (DDOE). *2006-2017 Greenhouse Gas Inventory*. Accessed from: https://doee.dc.gov/service/greenhouse-gas-inventories. Accessed on August 20, 2019. The District set emission reduction target for 2032 and 2050. The target for 2032 was used for this analysis as being closer to the Project's planning horizon year.

electricity consumption at both WUS and the private air-rights development as well as those associated with cooling (chilled water) and heating (steam) at WUS.

7.4.1.2 Mobile Source Emissions

The mobile source analysis considered roadway and rail traffic emissions. Annual CO_2 emissions were evaluated at the mesoscale level for the same diesel locomotive, motor vehicle, and bus operations considered in the air quality impact analysis.

Motor vehicle and bus emission factors were calculated using EPA's MOVES2014. This model calculates emission factors from motor vehicles in a mass per distance format (often grams per mile) for existing and future conditions. It then applies them to Vehicle Miles Traveled (VMT) data to obtain emissions inventories. The emission calculations took into account Tier 3 emission standards, an EPA program that sets new vehicle emissions standards. In a first phase (2014-2018), Tier 3 emission standards regulate the sulfur content of gasoline, heavy-duty engine emissions, and GHG. A second phase (2017--2025) regulates light-duty vehicle GHG. The analysis also accounted for conditions specific to the District, such as the state vehicle registration age distribution and the Inspection and Maintenance (I/M) program. VMT were calculated using the traffic volumes and network operations from the transportation impact analysis. Annual emissions inventories were developed for atmospheric CO_2, which is the primary GHG emitted by motor vehicles.

Locomotive emissions were based on future rail operations and anticipated train consists. [9] Emissions were developed based on the EPA guidance *Emission Factors for Locomotives* (EPA-420-F-09-025) and applied to the projected future railroad operations. Locomotive CO_2 emissions were considered within the extent of the Project Area only. The analysis involved an inventory of horsepower-hours by alternative, operator, locomotive type and emissions tier.[10]

7.4.1.3 Resilience

Potential impacts pertaining to resilience were assessed qualitatively for the Project and immediately adjacent infrastructure. The analysis also considered consistency with *Resilient DC. A strategy to Thrive in the Face of Change.* [11]

7.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Analysis of construction impacts involved the

[9] A train consist is a lineup or sequence of railroad cars and locomotives forming a unit.

[10] Amtrak. 2018. W*ashington Union Station Terminal Infrastructure; Diesel Emissions Data Development Methodology*.

[11] Issued in April 2019. Available at: https://resilient.dc.gov/. Accessed on August 20, 2019.

quantitative modeling of potential CO_2 emissions during the peak construction year for each phase, when emissions would be at their greatest.[12] The peak construction activities that would be the most emissions intensive are those involving excavation. The analysis also factored in other major construction activities such as support of excavation, caisson drilling, pressure slab construction and overbuild deck construction. While less emission-intensive than the excavation process, these construction processes also contribute emissions. Two options were analyzed for spoil removal associated with excavation: removal by dump trucks and removal by work trains.

Emissions from the peak activities under each phase of construction were estimated using the conservative assumption that these activities would take place for the entire year. The analysis took into account emissions generated by on- and off-site diesel-powered construction equipment and vehicles. The analysis considered phasing schedules, location, and activities occurring throughout the construction period. Emission factors for each source were determined using a combination of EPA's Non-Road and MOVES2014 as appropriate.[13] Emissions associated with construction equipment were predicted based on typically-used equipment for critical construction activities and the percentage of time (load factor) that the equipment would be operating. The analysis of construction equipment CO_2 emissions is dependent on the number of working days for each phase of construction and for each construction process within each phase. The quantity, horsepower, and load factor for each piece of equipment used for the CO_2 emission estimates were the same as those use for the air quality impact analysis (see **Section 6.4.3**, *Construction Impacts*, **Table 6-3**). CO_2 emissions from the equipment used in each phase on construction were determined using the Non-Road emissions model.

7.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on GHG emissions and resilience. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect, operational and construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed

[12] The quantitative modeling of construction impacts does not include emissions associated with the column removal work, which would be the same in all Action Alternatives. During Phases 1 and 2 of construction, the column removal work would overlap with the excavation and reconstruction of portions of the rail terminal and would contribute additional GHG emissions. However, these emissions would be negligible because the work would take place within the historic station building and involve installing temporary supports, removing, and replacing structural elements; such activities are not machine-intensive and would not involve the type of emission-intensive excavation or foundation installation work associated with the reconstruction of the rail terminal.

[13] U.S. Environmental Protection Agency NONROAD2008 Emissions model. Released in April 2009. Accessed from https://www.epa.gov/moves/nonroad2008a-installation-and-updates.

relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

7.5.1 No-Action Alternative

7.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would result in a negligible adverse direct operational impact on CO_2 emissions due to new stationary sources of emissions in the Project Area.

The No-Action Alternative does not include any changes to WUS that would cause CO_2 emissions at the station to vary significantly from existing conditions. New stationary source emissions would be introduced by the construction of the private air-rights development. The exact type of mechanical and combustion equipment that would be operated at the private air-rights development is not known. For the purposes of the analysis, the development's total energy use was separated into electricity and natural gas usage based on prototypical models developed by the U.S. Department of Energy (DOE).[14] Emission from natural gas boilers would occur on site and would be direct operational impacts.

As explained in **Section 8.5.1.1**, *Direct Operational Impacts*, of this report, the total estimated annual energy use of the private air-rights development would be approximately 263,766,000 kilo British thermal units (kBTUs).[15] Based on the DOE's prototypical models, it can be estimated that natural gas consumption would account for approximately 60,666,230 kBTUs. Using the EIA's conversion factor of 117 pounds of CO_2 per 1,000 kBTUs of natural gas energy,[16] the private air-rights development would emit approximately 3,220 metric tons per year of CO_2.

This would represent approximately 0.04 percent of the District's total 2017 GHG emissions (7.3 million metric tons of CO_2e) and 0.06 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

7.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would result in a minor adverse indirect operational impact on CO_2 emissions due to new stationary and mobile sources of emissions.

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14 U.S. Department of Energy. *Commercial Prototype Building Models Climate Zone 4A*. Accessed from https://www.energycodes.gov/development/commercial/prototype_models. Accessed on April 3, 2018.

15 A kBTUs is 1,000 BTUs. A BTU is "a measure of the heat content of fuels or energy sources." Specifically, "it is the quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit)".

16 U.S. Energy Information Administration. *Carbon Dioxide Emissions Coefficients.* Accessed from https://www.eia.gov/environment/emissions/co2_vol_mass.php. Accessed on April 3, 2018.

Table 7-1 summarizes the total of indirect annual emissions of CO_2 from stationary and mobile sources associated with the No-Action Alternative. Total emissions would be approximately 76,568 metric tons, representing about 1.05 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 1.52 percent of its 2032 emission target (5.05 million metric tons of CO_2e). The following sections describe the stationary and mobile source emissions in more detail.

Table 7-1. Total Indirect CO_2 Emissions, No-Action Alternative

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources: (Private Air-rights Development)	32,833	0.45	0.65
Stationary Sources: (WUS)	12,274	0.17	0.24
Mobile Sources	31,461	0.43	0.62
Total	76,568	1.05	1.52

Stationary Source Analysis

The station improvement projects included in the No-Action Alternative would not substantially affect energy usage. Electricity, steam, and chilled water consumption at WUS, and the associated CO_2 emissions would remain in the same range as the existing ones.

On average, WUS (including the parking garage) consumes approximately 1,260 megawatt hours (MWh) [17] of electricity each billing cycle. With nine billing cycles per year, this amounts to approximately 11,340 MWh annually. Using the 2017 factor for CO_2 emissions from electricity generation in the District (1,216 pounds/MWh),[18] this would cause emissions of approximately 6,255 metric tons of CO_2 per year.

WUS also consumes approximately 13,265,000 tons of chilled water for cooling and 18,993,000 kBTUs of steam for heating. Using the emissions factors for emissions from electricity generation and natural gas energy, respectively, this equates to approximately 5,011 metric tons of CO_2 for chilling and 1,008 metric tons for heating, for a total of approximately of 7,012 metric tons.

17 A MWh is equal to 1,000 Kilowatts of electricity used continuously for 1 hour. A megawatt is a unit for measuring power.

18 U.S. Energy Information Administration. *States Electricity Profiles.* Accessed from https://www.eia.gov/electricity/state/districtofcolumbia/. Accessed on February 17, 2019.

Finally, the private air-rights development would consume approximately an estimated 203,109,768 kBTUs of electrical energy, equivalent to 59,526 MWh and generating approximately 32,833 metric tons of CO_2.

Total indirect stationary source CO_2 emissions in the No-Action Alternative are summarized in **Table 7-2**. Total annual CO_2 emissions would amount to approximately 45,107 metric tons. This would represent approximately 0.62 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.89 percent of its emission target (5.05 million metric tons of CO_2e).

Table 7-2. Indirect Stationary Source CO_2 Emissions, No-Action Alternative

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
WUS and Garage		
Electricity	11,340 MWh	6,255
Chilled Water	9,085 MWh	5,011
Steam	18,993 MMBTU	1,008
Subtotal WUS		12,274
Private Air-Rights Development	59,526 MWh	32,833
Total	-	45,107

Mobile Source Analysis

Table 7-3 shows the mesoscale inventory of CO_2 emissions from mobile sources in the No-Action Alternative. Motor vehicle estimates were developed based on data from the No-Action Alternative traffic impact analysis. Locomotive emissions were estimated based on planned operations of diesel locomotives in the Project Area, including locomotive propulsion, idling, and generator activity as well as anticipated train consists and movements.

Combined, annual mobile source CO_2 emissions would amount to approximately 31,461 metric tons. This would represent 0.43 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.62 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Table 7--3. Indirect Mobile Source CO_2 Emissions, No-Action Alternative

Source	CO_2 Emissions (Metric Tons)
Motor Vehicle Emissions	27,235
Locomotive Emissions	4,226
Total Emissions	31,461

Total Direct and Indirect CO_2 Emissions

Relative to existing conditions, combining direct and indirect impacts, the No-Action Alternative would result in moderate adverse direct and indirect operational impacts on CO_2 emissions due to new mobile and stationary sources of emissions.

Table 7-4 shows the total of direct and indirect annual emissions of CO_2 from stationary and mobile sources associated with the No-Action Alternative. Total emissions would be approximately 79,788 metric tons, representing 1.09 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 1.58 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Table 7-4. Total CO_2 Emissions, No-Action Alternative

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Direct Stationary Sources (Private Air-rights Development)	3,220	0.04	0.06
Indirect Stationary Sources (Private Air-rights Development)	32,833	0.45	0.65
Indirect Stationary Sources (WUS)	12,274	0.17	0.24
Mobile Sources	31,461	0.43	0.62
Total Emissions	**79,788**	**1.09**	**1.58**

Resilience

Relative to existing conditions, the No-Action Alternative would have a moderate adverse impact on resilience at WUS. Climate change impacts would likely increase resiliency challenges while WUS infrastructure remains mostly unchanged.

In the No-Action Alternative, no major upgrades or retrofitting of the station's infrastructure that would provide the opportunity to improve its resilience would occur. This would be an adverse impact because, as climate change related weather events become more numerous and challenging, WUS's current infrastructure may become less and less able to withstand them, potentially leading to disruptions in service and a deterioration of passenger and visitor experience. The No-Action Alternative would not fully support the transportation objectives of *Resilient DC*, which calls for greater integration, capacity, and frequency of regional transit systems at Union Station. [19]

[19] *Resilient DC. A Strategy to Thrive in the Face of Change*, page 73 (emphasis added). Accessed from https://resilient.dc.gov/. Accessed on August 20, 2019.

The adverse impact would be moderate because the most significant effects of climate change are likely to occur later than 2040 and the No-Action Alternative would not preclude later upgrades or modifications intended to improve resiliency. The No-Action Alternative would also not preclude some increase in capacity and frequency of transit services at Union Station, though only to a limited extent.

As noted in the *Climate Ready DC Plan*, average temperature in the District is projected to continue rising over the coming decades, with hot days and heatwaves expected to occur more frequently. Extreme precipitation events are also expected to occur more frequently and intensely by mid- and end of the century. The District will become more vulnerable to storm surge flooding from coastal storms and hurricanes.

As a result, by 2040, WUS may experience increased temperatures, increased frequency and duration of heat waves, and increased frequency and intensity of precipitation and extreme storm events. A summary list of the various issues the station may have is provided in **Table 7-5**. Areas around WUS would experience similar challenges.

Due to its location, WUS is not likely to be directly affected by sea level rise and increased storm surge risks. The elevation of the Local Study Area ranges from approximately 50 feet near Columbus Plaza to near 100 feet at the northern end of the Project Area.

Table 7-5. Potential Impacts of Climate Change

Potential Impacts	
Increasing temperatures and frequency and duration of heat waves	Power outages due to larger demand for cooling during hot days. Increased internal temperatures of buildings if ventilation is not adequate. Increased stress on transmission lines, rail tracks, and critical electrical equipment. Expanded joints or buckled rail tracks. Increased risk of regional brownouts or blackouts, which may result in interruption or delay of service. Increased risk of heat exposure and heat-related illness to construction workers, terminal employees, and passengers. Improved safety and train services due to fewer cold days. Reduced environmental impacts (from salt and chemicals) and costs from less need for snow and ice removal.

Potential Impacts	
Increasing frequency and intensity of precipitation and extreme storm events	Damages to facilities, disruption of operations and services due to flooding and standing water.
	Flood risks near the Project due to overwhelmed stormwater/drainage systems that would impact access to the Project Site.
	Damage to train and electrical equipment due to electrical voltage spikes during severe storms.
	Fallen trees and debris (from high wind, ice storms, and other severe storm events), resulting in damaged rail infrastructure and terminal building.
	Safety risk for outdoor workers and passengers.
	Limitation of outdoor operations and maintenance services.

7.5.1.3 Construction Impacts

Construction of the projects included in the No-Action Alternative would cause CO_2 emissions. Available information on methods and schedules of construction is insufficient to quantify and characterize impacts.

The construction of the private air-rights development, the replacement of the H Street Bridge, and the other projects that would be constructed through 2040 in the No-Action Alternative would generate emissions of CO_2. Primary sources would include construction equipment and heavy machinery exhaust. The total annual amount of emissions would depend on the type of equipment and vehicles used as well as the schedule of each project. This information is not currently available, precluding the development of quantitative estimates.

7.5.2 Alternative A

7.5.2.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative A would result in no direct operational impact on CO_2 emissions.

WUS is not a substantial source of direct (on-site) stationary source emissions of CO_2, as it receives electricity, chilled water, and steam from sources outside of the Project Area. At this point in design, it is anticipated that WUS would continue to receive energy from these outside sources. All CO_2 impacts would be indirect.

7.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-6 shows the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative A. Total emissions would be approximately 17,371 metric tons, representing approximately 0.24 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.34 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would be approximately a 22 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-6. Total CO_2 Emissions, Alternative A

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,331	0.07	0.11
Mobile Sources	11,442	0.16	0.23
Federal Air-rights Development	597	0.01	0.01
Total Alternative A Emissions	**17,370**	**0.24**	**0.34**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative A increase relative to No-Action Alternative	22%	-	-

Stationary Source Analysis

Stationary source CO_2 emissions in Alternative A were estimated based on the anticipated increase in energy consumption associated with the additional space requiring lighting, cooling, and heating that the Project would construct. As explained in **Section 8.5.2.1**, *Direct Operational Impacts*, of this report, in Alternative A*,* the expanded station would use an additional 37,517,700 kBTUs per year of energy.

Based on the proportion of each energy source used at WUS in existing conditions, 52 percent of this energy would be electrical; 30 percent chilled water; and 18 percent steam. After conversion to MWh (for electricity and chilled water) and application of the emission factors explained in **Section 7.5.1.1**, *Direct Operational Impacts,* and **Section 7.5.1.2**, *Indirect Operational Impacts,* additional CO_2 emissions generated by Alternative A were estimated as shown in **Table 7-7**.

Alternative A would generate an additional 5,331 metric tons of stationary source CO_2 emissions. This would be an increase of 12 percent over the No-Action Alternative. It would represent approximately 0.07 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.11 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Table 7-7. Indirect Stationary Source CO_2 Emissions, Alternative A

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	5,718 MWh	3,154
Chilled Water	3,299 MWh	1,819
Steam	6,753,186 kBTUs	358
Total Alternative A		**5,331**

Potential Federal Air-rights Development

As explained in **Section 8.5.2.2**, *Indirect Operational Impacts*, the potential development of the remaining Federal air rights above the new bus and parking facility as additional parking space would add approximately 3,690,408 kBTUs to WUS's energy consumption. It can be assumed that this energy would be entirely electricity. On this basis, the potential Federal air-rights development would generate 597 metric tons of CO_2. This would represent approximately 0.01 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and of its 2032 emission target (5.05 million metric tons of CO_2e).

Mobile Source Analysis

In Alternative A, vehicular and rail traffic would increase relative to the No-Action Alternative. This would generate additional CO_2 emissions on the regional level. A mesoscale analysis was conducted in accordance with the methodology described in **Section 7.4.1.2**, *Mobile Source Emissions*. Motor vehicle estimates were developed based on data from the Alternative A traffic impact analysis. Locomotive emissions were estimated based on planned operations of diesel locomotives in the Project Area in Alternative A, including locomotive propulsion, idling, and generator activity as well as anticipated train consists and movements. **Table 7-8** shows the results of the analysis.

Table 7-8. Indirect Mobile Source CO_2 Emissions, Alternative A

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative A Emissions:	
Motor Vehicle Emissions	32,542
Locomotive Emissions	10,361
Subtotal Emissions	42,903
Alternative A: Project Related Emissions[1]	11,442

1. Emissions specifically attributable to the Project in Alternative A. Calculated by subtracting No-Action Alternative emissions from Alternative A emissions.

Relative to the No-Action Alternative, Alternative A would generate 11,442 additional metric tons of mobile source CO_2. It would be a 36 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.16 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.23 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative A would have a beneficial impact on WUS's resilience.[20]

As explained in **Section 7.5.1.2**, *Indirect Operational Impacts*, *Resilience,* climate change impacts are likely to increase resiliency challenges at WUS. Alternative A would have the potential to result in a beneficial impact to the extent that it would provide an opportunity to improve the station's resilience. Features or measures designed to increase the resiliency of WUS could be incorporated into the design and operation of the proposed expansion to minimize the potential impacts of extreme weather events. Examples of potential resilience-enhancing measures are listed in Section **7.7.1.2**, *Resilience*. Station expansion in Alternative A would also support the transportation objectives of *Resilient DC*, which calls for greater integration, capacity, and frequency of regional transit systems at Union Station. [21]

[20] This beneficial impact is not assigned an intensity as it would largely depend on the as-yet undefined resiliency features that would be included in the Project's final design.

[21] *Resilient DC. A Strategy to Thrive in the Face of Change*. Accessed from https://resilient.dc.gov/. Accessed on August 20, 2019.

7.5.2.3 Construction Impacts

Construction of Alternative A would result in negligible adverse impacts on CO_2 emissions.

Construction of Alternative A would generate CO_2 emissions from construction equipment and heavy machinery exhaust. Excavation, including the loading, transportation and disposal of surplus soil and other materials, would require the use of large diesel-fueled equipment (such as excavators and dump trailers). This would be the most CO_2 intensive process. Support of excavation, caisson drilling, pressure slab and overbuild deck construction would also generate substantial amounts of CO_2.

For each construction phase, the analysis conservatively assumed that these emission-intensive processes would occur simultaneously within one calendar year. The analysis considered two scenarios for excavation spoil disposal: removal by trucks or removal by work trains. The results of the analysis are shown in **Table 7-9**.

Table 7-9. Construction CO_2 Emissions (Metric Tons), Alternative A

Scenario	Phase 1	Phase 2	Phase 3	Phase 4
All Truck Removal	9,201	13,195	10,289	18,289
Work Train Removal	6,438	8,495	6,709	11,342

The greatest amount of emissions would occur during Phase 4 in both scenarios. Emissions in the All Truck Scenario would be greater than in the Work Train Scenario in all phases. The greatest amount of annual emissions would be 18,289 metric tons, which would occur in Phase 4 of the All Truck Scenario. This would represent 0.25 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.36 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

7.5.2.4 Comparison to Existing Conditions

Alternative A would result in a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. For instance, with only WUS as a source, stationary source emissions in Alternative A would increase by 44 percent relative to existing conditions (47 percent with the potential Federal air-rights development), instead of 11 percent relative to the No-Action Alternative (13 percent with the potential Federal air-rights development).

However, the total amount of CO_2 emissions Alternative A would generate, their size relative to overall District emissions, and their potential effect on climate change would be the same regardless of the baseline.

7.5.3 Alternative B

7.5.3.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative B would result in no direct operational impact on CO_2 emissions.

Like in the other Action Alternatives, there would be no direct impacts because WUS is not a significant source of on-site stationary source CO_2 emissions. All impacts would be indirect.

7.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-10 shows the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative B. Total emissions would be approximately 26,453 metric tons, amounting to approximately 0.36 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.53 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would represent approximately a 33 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-10. Total CO_2 Emissions, Alternative B

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,995	0.08	0.12
Mobile Sources	12,019	0.16	0.24
Federal Air-rights Development	8,439	0.12	0.17
Total Alternative B Emissions	**26,453**	**0.36**	**0.52**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative B increase relative to No-Action Alternative	33%	-	-

Stationary Source Analysis

Table 7-11 shows the estimated stationary source emissions associated with Alternative B. These estimates were developed using WUS's estimated energy use in this alternative presented in **Section 8.5.3.1**, *Direct Operational Impacts*, of this report. As explained there, Alternative B would cause WUS to use an additional 42,180,870 kBTUs of energy. Corresponding CO_2 emissions were developed as explained for Alternative A (**Section 7.5.2.2**, *Indirect Operational Impacts, Stationary Source Analysis*).

Table 7-11. Indirect Stationary Source CO_2 Emissions, Alternative B

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	6,428 MWh	3,546
Chilled Water	3,709 MWh	2,046
Steam	7,592,557 kBTUs	403
Total Alternative B		**5,995**

Alternative B would generate an additional 5,995 metric tons of stationary source CO_2 emissions. This would be an increase of 13 percent over the No-Action Alternative. It would represent approximately 0.08 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.12 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Potential Federal Air-rights Development

As explained in **Section 8.5.3.2**, *Indirect Operational Impacts*, of this report, the potential development of the remaining Federal air rights above the new bus facility as additional office space would add approximately 61,742,366 kBTUs to WUS's energy consumption. Using similar assumptions as used for the private air-rights development (see **Section 7.5.1.1**, *Direct Operational Impacts*) it can be assumed that this energy would be partly from natural gas and electricity. On this basis, the potential Federal air-rights development would generate 8,439 metric tons of CO_2 annually. This would represent approximately 0.12 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.17 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Mobile Source Analysis

Table 7-12 shows the results of the mesoscale CO_2 emission analysis conducted for Alternative B in accordance with the methodology described in **Section 7.4.1.2**, *Mobile Source Emissions*. Motor vehicle estimates were developed based on data from the Alternative B traffic impact analysis.

Table 7-12. Indirect Mobile Source CO_2 Emissions, Alternative B

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative B Emissions:	
Motor Vehicle Emissions	33,119
Locomotive Emissions	10,361
Subtotal Emissions	43,480
Alternative B: Project Related Emissions[1]	12,019

1. Emissions specifically attributable to the Project in Alternative B. Calculated by subtracting No-Action Alternative emissions from Alternative B emissions.

Relative to the No-Action Alternative, Alternative B would generate 12,019 additional metric tons of mobile source CO_2. This would be a 38 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.16 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.24 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative B would have a beneficial impact on WUS's resilience. [22]

The impacts of Alternative B on WUS's resilience would be the same as those of Alternative A (see **Section 7.5.3.2**, *Indirect Operational Impacts, Resilience*).

7.5.3.3 Construction Impacts

Construction of Alternative B would result in negligible adverse impacts on CO_2 emissions.

Alternative B's construction-related CO_2 emissions were estimated using the same approach as for Alternative A (see **Section 7.5.2.3**, C*onstruction Impacts*). the results are shown in **Table 7-13**.

[22] This beneficial impact is not assigned an intensity as it would depend on the as-yet undefined resiliency features that would be included in the Project's final design.

Table 7-13. Construction CO_2 Emissions (Metric Tons), Alternative B

Scenario	Phase 1	Phase 2	Phase 3	Phase 4
All Truck Removal	9,267	16,765	13,700	18,736
Work Train Removal	6,505	12,020	8,028	10,975

As with all Action Alternatives, the greatest amount of emissions would occur during Phase 4 In both scenarios and emissions in the All Truck Scenario would be greater than in the Work Train Scenario in all phases. The greatest amount of annual emissions would be 18,736 metric tons, which would occur in Phase 4 of the All Truck Scenario. It would represent 0.26 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.36 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

7.5.3.4 Comparison to Existing Conditions

Alternative B would result in a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. For instance, with only WUS as a source, stationary source emissions in Alternative B would increase by 49 percent relative to existing conditions (113 percent if the potential Federal air-rights development is included) instead of 13 percent relative to the No-Action Alternative (31 percent with the potential Federal air-rights development).

However, the total amount of CO_2 emissions Alternative B would generate, their size relative to overall District emissions, and their potential effect on climate change would be the same regardless of the baseline.

7.5.4 Alternative C

7.5.4.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative C (either option) would result in no direct operational impact on CO_2 emissions.

Like in the other Action Alternatives, there would be no direct impacts because WUS is not a significant source of on-site stationary source CO_2 emissions. All impacts would be indirect.

7.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-14 and **Table 7-15** show the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative C with the East Option and Alternative C with the West Option, respectively. The difference between the two options would be negligible. Total emissions would be 24,845 (East Option) or 24,681 (West Option) metric tons, amounting to approximately 0.34 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.49 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would represent approximately a 31 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-14. Total CO_2 Emissions, Alternative C East Option

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,376	0.07	0.11
Mobile Sources	10,707	0.15	0.21
Federal Air-Rights Development	8,762	0.12	0.17
Total Alternative C East Option Emissions	**24,845**	**0.34**	**0.49**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative C East Option increase relative to No-Action Alternative	31%	-	-

Table 7-15. Total CO_2 Emissions, Alternative C West Option

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,345	0.07	0.11
Mobile Sources	10,574	0.14	0.21
Federal Air-rights Development	8,762	0.12	0.17
Total Alternative C West Option Emissions	**24,681**	**0.34**	**0.49**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative C West Option increase relative to No-Action Alternative	31%	-	-

Stationary Source Analysis

Table 7-16 and **Table 7-17** show the estimated stationary source emissions associated with Alternative C, East Option, and Alternative C, West Option, respectively. These estimates were developed using WUS's estimated energy use in this alternative presented in **Section 8.5.4.1**, *Direct Operational Impacts*, of this report. As explained there, Alternative C with the East Option would cause WUS to use an additional 37,834,170 kBTUs of energy. The corresponding number for Alternative C with the West Option would be 37,614,720 kBTUs. CO_2 emissions associated with these energy use estimates were developed as explained for Alternative A (**Section 7.5.2.2**, *Indirect Operational Impacts, Stationary Source Analysis*).

Table 7-16. Indirect Stationary Source CO_2 Emissions, Alternative C East Option

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	5,766 MWh	3,180
Chilled Water	3,326 MWh	1,835
Steam	6,810,151 kBTUs	361
Total Alternative C East Option		**5,376**

Table 7-17. Indirect Stationary Source CO_2 Emissions, Alternative C West Option

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	5,732 MWh	3,162
Chilled Water	3,307 MWh	1,824
Steam	6,770,650 kBTUs	359
Total Alternative C West Option		**5,345**

The difference between the East and West Options would be insignificant. Alternative C with the East Option would generate an additional 5,376 metric tons of stationary source CO_2 emissions; with the West Option, it would generate an additional 5,345 metric tons. In both cases, this would be an increase of approximately 12 percent over the No-Action Alternative. It would represent approximately 0.07 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.11 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Potential Federal Air-rights Development

As explained in **Section 8.5.4.2**, *Indirect Operational Impacts*, in Alternative C (either option), the potential development as additional office space of the Federal air rights above the existing parking garage's location would add approximately 64,109,980 kBTUs to WUS's energy consumption. Using similar assumptions as used for the private air-rights development (see **Section 7.5.1.1**, *Direct Operational Impacts*) it can be assumed that this energy would be partly from natural gas and electricity. On this basis, the potential Federal air-rights development would generate annually 8,762 metric tons of CO_2. This would represent approximately 0.12 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.17 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Mobile Source Analysis

Table 7-18 and **Table 7-19** show the results of the mesoscale CO_2 emission analysis conducted for Alternative C with the East Option and Alternative C with the West Option, respectively. The analysis was performed in accordance with the methodology described in **Section 7.4.1.2,** *Mobile Source Emissions.* Motor vehicle estimates were developed based on data from the Alternative C traffic impact analysis.

Table 7-18. Indirect Mobile Source CO_2 Emissions, Alternative C East Option

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative C East Emissions:	
Motor Vehicle Emissions	31,807
Locomotive Emissions	10,361
Subtotal Emissions	42,168
Alternative C East: Project Related Emissions[1]	10,707

1. Emissions specifically attributable to the Project in Alternative C East Option. Calculated by subtracting No-Action Alternative emissions from Alternative C East Option emissions.

Table 7-19. Indirect Mobile Source CO_2 Emissions, Alternative C West Option

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative C West Emissions:	
Motor Vehicle Emissions	31,674
Locomotive Emissions	10,361
Subtotal Emissions	42,035
Alternative C West: Project Related Emissions[1]	10,574

1. Emissions specifically attributable to the Project in Alternative C West Option. Calculated by subtracting No-Action Alternative emissions from Alternative C West Option emissions.

Relative to the No-Action Alternative, Alternative C with the East Option would generate 10,707 additional metric tons of mobile source CO_2. This would be a 34 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.15 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.21 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Alternative C with the West Option would generate 10,574 additional metric tons of mobile source CO_2. This would be a 34 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.14 percent of the District's total 2017 emissions (7.3

million metric tons of CO_2e) and approximately 0.21 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative C (either option) would have a beneficial impact on WUS's resilience. [23]

The impacts of Alternative C on WUS's resilience would be the same as those of Alternative A (see **Section 7.5.2.2**, *Indirect Operational Impacts, Resilience*).

7.5.4.3 Construction Impacts

Construction of Alternative C with either option would result in negligible adverse impacts on CO_2 emissions.

Alternative C's construction-related CO_2 emissions were estimated using the same approach as for Alternative A (see **Section 7.5.2.3**, *Construction Impacts*). Results are shown in **Table 7-20**.

Table 7-20. Construction CO_2 Emissions (Metric Tons), Alternative C

Scenario	Phase 1	Phase 2	Phase 3	Phase 4
All Truck Removal	8,722	14,028	13,272	17,260
Work Train Removal	5,959	8,702	7,820	9,680

As with the other Action Alternatives, the greatest amount of emissions would occur during Phase 4 in both scenarios, and emissions in the All Truck Scenario would be greater than in the Work Train Scenario in all phases. The greatest amount of annual emissions would be 17,260 metric tons, which would occur in Phase 4 of the All Truck Scenario. It would represent 0.24 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.34 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

7.5.4.4 Comparison to Existing Conditions

Like the other Action Alternatives, Alternative C with either option would result in a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. For instance, with only WUS as a source, stationary source emissions in Alternative C would increase by 44 percent relative to existing conditions (115 percent if

[23] This beneficial impact is not assigned an intensity as it would depend on the as-yet undefined resiliency features that would be included in the Project's final design.

the potential Federal air-rights development is included) instead of 12 percent relative to the No-Action Alternative (31 percent with the potential Federal air-rights development).

However, the total amount of CO_2 emissions Alternative C would generate, their size relative to overall District emissions, and their potential effect on climate change would be the same regardless of the baseline.

7.5.5 Alternative D

7.5.5.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative D would result in no direct operational impact on CO_2 emissions.

Like in the other Action Alternatives, there would be no direct impacts in Alternative D. This is because WUS is not a significant source of on-site stationary source CO_2 emissions. All impacts would be indirect.

7.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-21 shows the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative D. Total emissions would be approximately 21,070 metric tons, amounting to 0.29 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.42 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would be approximately a 26 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-21. Total CO_2 Emissions, Alternative D

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,409	0.07	0.11
Mobile Sources	9,332	0.13	0.18
Federal Air-rights Development	6,329	0.09	0.13
Total Alternative D Emissions	**21,070**	**0.29**	**0.42**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative D increase relative to No-Action Alternative	26%	-	-

Stationary Source Analysis

Table 7-22 shows the estimated stationary source emissions associated with Alternative D. These estimates were developed using WUS's estimated energy use in this alternative presented in **Section 8.5.5.1**, *Direct Operational Impacts*, of this report. As explained there, Alternative D would cause WUS to use an additional 38,058,466 kBTUs of energy. Corresponding CO_2 emissions were developed as explained for Alternative A (**Section 7.5.2.2**, *Indirect Operational Impacts, Stationary Source Analysis*).

Table 7-22. Indirect Stationary Source CO_2 Emissions, Alternative D

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	5,800 MWh	3,199
Chilled Water	3,346 MWh	1,846
Steam	6,850,524 kBTUs	364
Total Alternative D		**5,409**

Alternative D would generate an additional 5,409 metric tons of stationary source CO_2 emissions. This would be an increase of 12 percent over the No-Action Alternative. It would represent approximately 0.07 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.11 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Potential Federal Air-Rights Development

As explained in **Section 8.5.5.2**, *Indirect Operational Impacts,* in Alternative D, the potential development as additional office space of the Federal air rights above the existing parking garage's location would add approximately 46,305,765 kBTUs to WUS's energy consumption.

Using similar assumptions as used for the private air-rights development (see **Section 7.5.1.1**, *Direct Operational Impacts*) it can be assumed that this energy would be partly from natural gas and electricity. On this basis, the potential Federal air-rights development would generate annually 6,329 metric tons of CO_2. This would represent approximately 0.09 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and of 0.13 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Mobile Source Analysis

Table 7-23 shows the results of the mesoscale CO_2 emission analysis conducted for Alternative D in accordance with the methodology described in **Section 7.4.1.2**, *Mobile Source Emissions*. Motor vehicle estimates were developed based on data from the Alternative D traffic impact analysis.

Table 7-23. Indirect Mobile Source CO_2 Emissions, Alternative D

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative D West Emissions:	
Motor Vehicle Emissions	30,432
Locomotive Emissions	10,361
Subtotal Emissions	40,793
Alternative D: Project Related Emissions[1]	9,332

1. Emissions specifically attributable to the Project in Alternative D. Calculated by subtracting No-Action Alternative emissions from Alternative D emissions.

Relative to the No-Action Alternative, Alternative D would generate 9,332 additional metric tons of mobile source CO_2. This would be a 30 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.13 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.18 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative D would have a beneficial impact on resilience relative to the No-Action Alternative. [24]

[24] This beneficial impact is not assigned an intensity as it would depend on the as-yet undefined resiliency features that would be included in the Project's final design.

The impacts of Alternative D on WUS's resilience would be the same as those of Alternative A (see **Section 7.5.3.2**, *Indirect Operational Impacts, Resilience*).

7.5.5.3 Construction Impacts

Construction of Alternative D would result in negligible adverse impacts on CO_2 emissions.

Alternative D's construction-related CO_2 emissions would be the same as those of Alternative C. This is because both alternatives would involve a similar amount of excavation work over a similar schedule (see **Section 7.5.4.3**, *Construction Impacts*).

7.5.5.4 Comparison to Existing Conditions

Like the other Action Alternatives, Alternative D would generate a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. For instance, with only WUS as a source, stationary source emissions in Alternative D would increase by 44 percent relative to existing conditions (96 percent if the potential Federal air-rights development is included) instead of 12 percent relative to the No-Action Alternative (26 percent with the potential Federal air-rights development).

However, the total amount of CO_2 emissions Alternative D would generate, their size relative to overall District emissions, and their potential effect on climate change would be the same regardless of the baseline.

7.5.6 Alternative E

7.5.6.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative E would result in no direct operational impact on CO_2 emissions.

Like in the other Action Alternatives, there would be no direct impacts in Alternative E. This is because WUS is not a significant source of on-site stationary source CO_2 emissions. All impacts would be indirect.

7.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-24 shows the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative E. Total emissions would be approximately 22,887 metric tons, amounting to approximately 0.31 percent of the District's total 2017 emissions (7.3

million metric tons of CO_2e) and 0.45 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would represent approximately a 29 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-24. Total CO_2 Emissions, Alternative E

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,856	0.08	0.12
Mobile Sources	10,702	0.15	0.21
Federal Air-rights Development	6,329	0.09	0.13
Total Alternative E Emissions	**22,887**	**0.31**	**0.45**
Total Emissions No-Action Alternative	79,778	1.09	1.57
Alternative E increase relative to No-Action Alternative	29%	-	-

Stationary Source Analysis

Table 7-25 shows the estimated stationary source emissions associated with Alternative E. These estimates were developed using WUS's estimated energy use in this alternative presented in **Section 8.5.6.1**, *Direct Operational Impacts*. As explained there, Alternative E would cause WUS to use an additional 41,210,140 kBTUs of energy. Corresponding CO_2 emissions were developed as explained for Alternative A (**Section 7.5.2.2**, *Indirect Operational Impacts, Stationary Source Analysis*).

Table 7-25. Indirect Stationary Source CO_2 Emissions, Alternative E

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	6,280 MWh	3,464
Chilled Water	3,623 MWh	1,998
Steam	7,417,825 kBTUs	394
Total Alternative E		**5,856**

Alternative E would generate an additional 5,856 metric tons of stationary source CO_2 emissions. This would be an increase of 13 percent over the No-Action Alternative. It would represent approximately 0.08 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.12 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Potential Federal Air-rights Development

The size of the potential Federal air-rights development in Alternative E would be the same as in Alternative D. It would consume the same amount of energy, resulting in the same amount of CO_2 emissions: 6,329 metric tons (see **Section 7.5.5.2**, *Indirect Operational Impacts, Potential Federal Air-rights Development*).

Mobile Source Analysis

Table 7-26 shows the results of the mesoscale CO_2 emission analysis conducted for Alternative E in accordance with the methodology described in **Section 7.4.1.2**, *Mobile Source Emissions*. Motor vehicle estimates were developed based on data from the Alternative E traffic impact analysis.

Table 7-26. Indirect Mobile Source CO_2 Emissions, Alternative E

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative E Emissions:	
Motor Vehicle Emissions	31,802
Locomotive Emissions	10,361
Subtotal Emissions	42,163
Alternative E: Project Related Emissions[1]	10,702

1. Emissions specifically attributable to the Project in Alternative E. Calculated by subtracting No-Action Alternative emissions from Alternative E emissions.

Relative to the No-Action Alternative, Alternative E would generate 10,702 additional metric tons of mobile source CO_2. This would be a 34 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.15 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.21 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative E would have a beneficial impact on WUS's resilience. [25]

[25] This beneficial impact is not assigned an intensity as it would depend on the as-yet undefined resiliency features that would be included in the Project's final design.

The impacts of Alternative E on WUS's resilience would be the same as those of Alternative A (see **Section 7.5.3.2**, *Indirect Operational Impacts, Resilience*).

7.5.6.3 Construction Impacts

Construction of Alternative E would result in negligible adverse impacts on CO_2 emissions.

Alternative E's construction-related CO_2 emissions would be the same as those of Alternative B. This is because both alternatives would involve a similar amount of excavation work over a similar schedule (see **Section 7.5.3.3**, *Construction Impacts*).

7.5.6.4 Comparison to Existing Conditions

Like the other Action Alternatives, Alternative E would generate a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. With only WUS as a source, stationary source emissions in Alternative E would increase by 47 percent relative to existing conditions (99 percent if the potential Federal air-rights development is included) instead of 13 percent relative to the No-Action Alternative (27 percent with the potential Federal air-rights development).

7.5.7 Alternative A-C (Preferred Alternative)

7.5.7.1 Direct Operational Impacts

Stationary Source Analysis

Relative to the No-Action Alternative, Alternative A-C would result in no direct operational impact on CO_2 emissions.

Like the other Action Alternatives, Alternative A-C would have no direct impacts because WUS is not a significant source of on-site stationary source CO_2 emissions. All impacts would be indirect.

7.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would result in negligible adverse indirect operational impacts on CO_2 emissions from mobile and stationary sources.

Table 7-27 shows the total indirect annual emissions of CO_2 from stationary and mobile sources attributable to Alternative A-C. Total emissions would be approximately 18,506 metric tons, amounting to approximately 0.25 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.37 percent of its 2032 emission target (5.05 million metric tons of CO_2e). This would represent approximately a 23 percent increase over emissions in the No-Action Alternative. The following sections describe the stationary and mobile source emissions in more detail.

Table 7-27. Total CO_2 Emissions, Alternative A-C

Source	CO_2 Emissions (Metric Tons)	Percentage of 2017 Total Inventory	Percentage of 2032 Target
Stationary Sources	5,220	0.07	0.10
Mobile Sources	9,791	0.13	0.19
Federal Air-rights Development	3,495	0.05	0.07
Total Alternative A-C Emissions	**18,506**	**0.25**	**0.37**
Total Emissions No-Action Alternative	79,788	1.09	1.57
Alternative A-C increase relative to No-Action Alternative	23%	-	-

Stationary Source Analysis

Table 7-28 shows the estimated stationary source emissions associated with Alternative A-C. These estimates were developed using WUS's estimated energy use in this alternative presented in **Section 8.5.7.1**, *Direct Operational Impacts*, of this report. As explained there, Alternative A-C would cause WUS to use approximately 36,735,090 additional kBTUs of energy. Corresponding CO_2 emissions were developed as explained for Alternative A (**Section 7.5.2.2**, *Indirect Operational Impacts, Stationary Source Analysis*).

Table 7-28. Indirect Stationary Source CO_2 Emissions, Alternative A-C

Component	Energy Consumption	CO_2 Emissions (Metric Tons)
Electricity	5,598 MWh	3,088
Chilled Water	3,230 MWh	1,781
Steam	6,612,316 kBTUs	351
Total Alternative A-C		**5,220**

Alternative A-C would generate an additional 5,220 metric tons of stationary source CO_2 emissions. This would be an increase of 12 percent over the No-Action Alternative. It would represent approximately 0.07 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.10 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Potential Federal Air-rights Development

As explained in **Section 8.5.7.2**, *Indirect Operational Impacts*, of this report, in Alternative A-C, the potential development of the remaining Federal air rights as additional office space would add approximately 25,574,000 kBTUs to WUS's energy consumption. Using similar assumptions as used for the private air-rights development (see **Section 7.5.1.1**, *Direct Operational Impacts*) it can be assumed that this energy would be partly from natural gas and electricity. On this basis, the potential Federal air-rights development would generate around 3,495 metric tons of CO_2 annually. This would represent approximately 0.05 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and 0.07 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Mobile Source Analysis

Table 7-29 shows the results of the mesoscale CO_2 emission analysis conducted for Alternative A-C in accordance with the methodology described in **Section 7.4.1.2**, *Mobile Source Emissions*. Motor vehicle estimates were developed based on data from the Alternative A-C traffic impact analysis.

Table 7-29. Indirect Mobile Source CO_2 Emissions, Alternative A-C

Source	CO_2 Emissions (Metric Tons)
No-Action Alternative Emissions	31,461
Alternative A-C Emissions:	
Motor Vehicle Emissions	30,891
Locomotive Emissions	10,361
Subtotal Emissions	41,252
Alternative A-C: Project Related Emissions[1]	9,791

1. Emissions specifically attributable to the Project in Alternative A-C. Calculated by subtracting No-Action Alternative emissions from Alternative A-C emissions.

Relative to the No-Action Alternative, Alternative A-C would generate 9,791 additional metric tons of mobile source CO_2. This would be a 31 percent increase over No-Action Alternative emissions. It would be equivalent to approximately 0.13 percent of the District's total 2017 emissions (7.3 million metric tons of CO_2e) and approximately 0.19 percent of its 2032 emission target (5.05 million metric tons of CO_2e).

Resilience

Relative to the No-Action Alternative, Alternative A-C would have a beneficial impact on WUS's resilience. [26]

The impacts of Alternative A-C on WUS's resilience would be the same as those of Alternative A (see **Section 7.5.3.2**, *Indirect Operational Impacts, Resilience*).

7.5.7.3 Construction Impacts

Construction of Alternative A-C would result in negligible adverse impacts on CO_2 emissions.

Depth of excavation, most emission-intensive construction activities, and schedule in Alternative A-C would be the same as in Alternative A. Associated CO_2 impacts would be the same. These impacts are described in **Section 7.5.2.3**, *Construction Impacts*.

7.5.7.4 Comparison to Existing Conditions

Alternative A-C would result in a greater proportional increase in CO_2 emissions relative to existing conditions than relative to the No-Action Alternative. This is because the No-Action Alternative baseline incorporates the emissions from the private air-rights development as well as those from increased vehicular traffic and train service. For instance, with only WUS as a source, stationary source emissions in Alternative A-C would increase by 43 percent relative to existing conditions (71 percent if the potential Federal air-rights development is included) instead of 11.5 percent relative to the No-Action Alternative (19 percent with the potential Federal air-rights development).

However, the total amount of CO_2 emissions Alternative A-C would generate, their size relative to overall District emissions, and their potential effect on climate change would be the same regardless of the baseline.

7.6 Comparison of Alternatives

Table 7-30 summarizes the impacts of the alternatives. **Table 7-31** through **Table 7-34** show estimated CO_2 emissions for each alternative. All Action Alternatives would generate emissions that would not occur in the No-Action Alternative. Operational emissions would result from the energy needs of the expanded station and associated street and rail traffic while construction emissions would result from the operation of equipment and vehicles throughout the construction period. Based on the estimates presented in this section, Alternatives A and A-C would generate the smallest amount of CO2 emissions and

[26] This beneficial impact is not assigned an intensity as it would depend on the as-yet undefined resiliency features that would be included in the Project's final design.

Alternatives B and E the largest. In the context of total emissions in the District, emissions would be proportionately very small regardless of the Action Alternative. As a result, the impact intensities relative to the No-Action Alternative would be the same for all Action Alternatives

All Action Alternatives would have:

- No direct operational impacts because no Action Alternative would create significant sources of CO_2 emissions in the Project Area.
- Negligible indirect operational impacts, as CO_2 emissions from energy consumption or vehicular and rail traffic would be small, amounting 1 percent or less of both the District's 2017 CO_2e emissions and its 2032 emission target in all Action Alternatives.
- Negligible construction impacts, as the highest level of annual emissions (during Phase 4 if only trucks are used to remove excavation spoils) would amount to 1 percent or less of both the District's 2017 CO_2e emissions and its 2032 emission target in all Action Alternatives.
- Beneficial impacts on WUS's resilience, as all Action Alternatives would provide the opportunity to improve WUS's ability to better withstand the effects of climate change through design decisions.

The CO_2 emissions generated by all Action Alternatives would also be well below those generated by the No-Action Alternative. This is because the No-Action Alternative includes the development of the private air rights above the rail terminal, which would generate a substantial increase in energy demand, and subsequent CO_2 emissions.

Table 7-30. Comparison of Alternatives

Impact Category	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
GHG	Direct Operational	Negligible Adverse Impacts	No Impacts					
	Indirect Operational	Minor Adverse Impacts	Negligible Adverse Impacts					
	Combined Direct and Indirect	Moderate Adverse Impacts	Negligible Adverse Impacts					
	Construction	Undetermined	Negligible Adverse Impacts					
Resilience		Moderate Adverse Impacts	Beneficial Impacts					

Table 7-31. Total Operational CO_2 Emissions Summary

Alternative	Total CO_2 Emissions (Metric Tons/Year)
No-Action Alternative	79,778
Alternative A	17,370
Alternative B	26,453
Alternative C East Option	24,845
Alternative C West Option	24,681
Alternative D	21,070
Alternative E	22,887
Alternative A-C	18,506
District Total (2017)	7,300,000

Table 7-32. Total Operational Stationary Source CO_2 Emissions Summary

Alternative	Total CO_2 Emissions (Metric Tons/Year)
No-Action Alternative	45,107
Alternative A	5,331
Alternative A with Potential Federal Air-Rights Development	5,928
Alternative B	5,994
Alternative B with Potential Federal Air-Rights Development	14,433
Alternative C East Option	5,376
Alternative C East Option with Potential Federal Air-Rights Development	14,138
Alternative C West Option	5,345
Alternative C West Option with Potential Federal Air-Rights Development	14,107
Alternative D	5,409
Alternative D with Potential Federal Air-Rights Development	11,738
Alternative E	5,856
Alternative E with Potential Federal Air-Rights Development	12,185
Alternative A-C	5,220
Alternative A-C with Potential Federal Air-Rights Development	8,715

Table 7-33. Total Operational Mobile Source CO_2 Emissions Summary

Scenario	Total CO_2 Emissions (Metric Tons/Year)
Alternative A	11,442
Alternative B	12,019
Alternative C East Option	10,707
Alternative C West Option	10,574
Alternative D	9,332
Alternative E	10,702
Alternative A-C	9,791

Table 7-34. Construction CO_2 Emissions Summary (All Truck Scenario / Work Train Scenario)

Alternative	Phase	CO_2 Emissions (Metric Tons/Year)
Alternative A	**Phase 1**	9,201 / 6,438
	Phase 2	13,195 / 8,495
	Phase 3	10,289 / 6,709
	Phase 4	18,289 / 11,342
Alternative B	**Phase 1**	9,267 /6,505
	Phase 2	16,765 / 12,020
	Phase 3	13,700 / 8,028
	Phase 4	18,736 / 10,975
Alternative C (either option)	**Phase 1**	8,722 / 5,959
	Phase 2	14,028 / 8,702
	Phase 3	13,272 / 7,820
	Phase 4	17,260 / 9,680
Alternative D	**Phase 1**	8,722 / 5,959
	Phase 2	14,028 / 8,702
	Phase 3	13,272 / 7,820
	Phase 4	17,260 / 9,680
Alternative E	**Phase 1**	9,267 /6,505
	Phase 2	16,765 / 12,020
	Phase 3	13,700 / 8,028
	Phase 4	18,736 / 10,975
Alternative A-C	**Phase 1**	9,201 / 6,438
	Phase 2	13,195 / 8,495
	Phase 3	10,289 / 6,709
	Phase 4	18,289 / 11,342

7.7 Avoidance, Minimization, and Mitigation Evaluation

7.7.1 Operational Impacts

7.7.1.1 GHG Emissions

As anticipated adverse GHG impacts would be negligible, no mitigation is needed. The most effective means to reduce stationary source GHG emissions is to reduce energy consumption. **Section 8**, *Energy Resources* discusses potential energy conservation measures that could be implemented as part of the Project. Such measures would also reduce indirect GHG emissions.

7.7.1.2 Resilience

Strategies being considered by FRA to enhance WUS's resilience include the adoption of the following measures by the Project Proponents:

- Monitoring and incorporating into the Project design and technology to minimize buckled railroad tracks.
- Increasing power supply redundancy and backup generation.
- Reducing dependency on centralized power by installing renewable energy systems at WUS.
- Designing shelter facilities to provide shading and natural ventilation for passenger comfort and safety.
- Incorporating water conservation and green infrastructure features (See **Section 3.7**, *Avoidance, Minimization, and Mitigation Evaluation*)
- Considering reflective roofs or green roofs to reduce urban heat island effect.
- Considering appropriate glazing for the train hall to control solar heat by season.
- Although the Project Area is located outside of the floodplain:
  - Considering raising electrical components above ground level to protect from flash flood events during extreme storm events.
  - Considering building materials that can withstand inundation, or installing flood barriers at openings of below-grade structures that may become vulnerable to flooding
  - Considering dry and wet floodproofing measures for proposed below-grade parking areas.

7.7.2 Construction Impacts

Although only negligible GHG emissions are anticipated to result from the construction of the Project under any of the Action Alternatives, measures could be taken to minimize these emissions. Such measures would be the same as described in **Section 6.7**, *Avoidance, Minimization, and Mitigation Evaluation* for other air pollutant emissions.

7.8 Permits and Regulatory Compliance

There are no permits pertaining to GHG emissions or resilience. During construction, the contractors would have to comply with the District's anti-idling regulations, as applicable.

8 Energy Resources

8.1 Overview

This section addresses the potential impacts of the No-Action and Action Alternatives on the use of energy resources. The analysis focuses on the amount of energy that would be consumed by WUS and other land uses within the Study Area in the various alternatives. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies relevant permitting and regulatory compliance requirements.

8.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to energy resources include:

- Sections of 42 United States Code (USC) (energy conservation, decreased dependence on foreign oil, use of alternative fuels, and increased efficiency in energy use);[1]
- Executive Order (EO) 13834 Efficient Federal Operations;[2]
- Energy Independence and Security Act of 2007;[3]

District policies, regulations, and guidance that may pertain to energy resources include:

- The DC Energy Conservation Code (ECC);[4]
- The Green Building Act of 2006;[5]

[1] 42 USC *The Public Health and Welfare*. Accessed from http://uscode.house.gov/browse/prelim@title42&edition=prelim. Accessed on November 21, 2017.

[2] EO 13834 *Regarding Efficient Federal Operations*. Accessed from https://www.epa.gov/fgc/executive-order-13834-regarding-efficient-federal-operations. Accessed on August 26, 2018.

[3] *Summary of the Energy Independence and Security Act*. Accessed from https://www.epa.gov/laws-regulations/summary-energy-independence-and-security-act. Accessed on December 18, 2017.

[4] Washington D.C. Department of Consumer and Regulatory Affairs. *2013 District of Columbia Green Construction Code*. Accessed from https://codes.iccsafe.org/content/document/920. Accessed on April 3, 2020.

[5] *Green Building Act of 2006*. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Green_Building_Act_of_2006_B16-515.pdf. Accessed on April 3, 2020.

- The Clean and Affordable Energy Act of 2008;[6]

8.3 Study Area

The Local Study Area is the portion of the Project Area extending from the front of WUS up to K Street (**Figure 8-1)**. The Regional Study Area includes the District.

8.4 Methodology

Section 8 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the general approach used to assess the impacts of the No-Action and Action Alternatives on energy. A summary is below.

8.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The assessment of operational impacts on energy resources was based on an estimation of WUS's anticipated energy use for lighting, heating, and cooling. This energy use is measured in kilo British thermal units (kBTUs). [7,] Estimates of energy use were developed by multiplying the square footage of the facilities included in the No-Action and the Action Alternatives by estimated Energy Use Intensity (EUI) measures provided by the U.S. Federal Government's Energy Star Program to determine electricity and fuel use. [8]

6 *Clean and Affordable Energy Act of 2008*. Accessed from http://dcclims1.dccouncil.us/images/00001/20080819161530.pdf. Accessed on April 3, 2020.

7 A kBTU is one thousand BTU. A BTU is "a measure of the heat content of fuels or energy sources." Specifically, it is the quantity of heat required to raise the temperature of one pound of liquid water by 1-degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit).

8 Energy Star Portfolio Manager. March 2016. *Technical Reference. U.S. Energy Use Intensity by Property Type*.

Figure 8-1. Energy Local Study Area

EUI is expressed as energy per square foot per year. It is calculated by dividing the total energy consumed by a building in one year by the total gross floor area of the building. There are different EUIs for different types of building spaces. The impact analysis used the EUIs best applicable to the facilities included in each alternative. To provide a measure against which to assess the intensity of the resulting impacts, they were compared to the total amount of energy consumed in the District in 2017, which was 168 billion kBTUs.[9]

8.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction of the Project would require the operation of equipment powered by diesel fuel such as trucks, earth moving equipment, cranes, air compressors, and forklifts. Additionally, electrical equipment and battery-operated tools would need to be charged on-site. Since construction of the Project would last from approximately 11 years 5 months to approximately 14 years 4 months depending on the Action Alternative, construction would use a substantial amount of energy.

The energy use related to the construction of each Action Alternative is difficult to quantify. In a 2011 conference paper titled *Estimating Energy Consumption During Construction of Buildings: A Contractor's Perspective*, the authors noted that:

> "Presently, there are plenty of research works assessing the energy consumption and environmental impacts of buildings, but few encompass construction process in complete life cycle. Some studies have included the construction phase; however, this was limited to various stages of material extraction, production, and transportation and did not include on-site construction processes. The industry's energy consumption during construction is not well understood because of its fragmentized nature and involvement of many parties during construction phase. That is why, at the time of design and even before construction starts, it is hard to predict the energy required and its impact at the construction phase."[10]

Therefore, in this report, energy use from construction is assessed qualitatively.

[9] U.S. Energy Information Administration. *District of Columbia Energy Profile*. https://www.eia.gov/state/print.php?sid=DC. Accessed on August 21, 2019.

[10] Shrivastava, Sandeep et al. 2018. *Estimating energy consumption during construction of buildings: a contractor's perspective*. Available from: https://www.researchgate.net/publication/273693109_Estimating_energy_consumption_during_construction_of_buildings_a_contractor's_perspective . Accessed on April 2, 2020.

8.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on energy resources. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

8.5.1 No-Action Alternative

8.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would have a minor adverse direct operational impact on energy resources.

In the No-Action Alternative, energy consumption at WUS would remain approximately the same as under existing conditions because the station would not undergo any major physical expansion. Existing consumption is approximately 103.5 million kBTUs. It may decrease between now and 2040 due to the greater energy-efficiency of upgraded heat, ventilation, and air conditioning systems; lighting fixtures; and other equipment.

Therefore, the primary source of additional energy consumption in the Project Area would be the private air-rights development. **Table 8-1** shows an estimated annual energy use in kBTUs developed using the Energy Star site EUIs approach described in **Section 8.4.1**, *Operational Impacts*. Altogether, the private air-rights development would consume approximately 264 million kBTUs per year, or an average of 70.5 kBTUs per square foot per year.

Table 8-1. Estimated Annual Energy Use of Private Air-Rights Development

Private Air-Rights Development Space	Square Footage[1]	Energy Star Site EUI[2] kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Office	2,160,000	67.3	145,368,000
Retail	120,000	93.7	11,244,000
Hotel	410,000	73.4	30,094,000
Residential	1,050,000	73.4	77,070,000
Total	3,740,000	-	263,776,000

1. Akridge. 2016. Burnham Place Feasible Maximum Program Estimates Applicable to Station Expansion Project No-Build Option. Letter from Akridge to FRA dated May 31, 2016.
2. Values derived from Energy Star Portfolio Manager. March 2016. *Technical Reference. U.S. Energy Use Intensity by Property Type*.

This impact would be minor for the following reasons. The estimated additional energy consumption in the No-Action Alternative represents only a small fraction (around 0.16 percent) of the District's total energy consumption in 2017, which was 168 billion kBTUs. It is unlikely to create capacity issues or to require the development of a dedicated energy source (such as a new power plant) by 2040.

The additional electrical load from the private air-rights development may require a new substation.[11,12] The new substation is likely to increase the electrical load on the local distribution system and could result in other necessary upgrades to ensure stable and reliable delivery of electricity to local customers.

8.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no indirect operational impacts on energy resources.

The No-Action Alternative would not affect energy consumption away from the Project Area.

8.5.1.3 Construction Impacts

Construction of the projects included in the No-Action Alternative would result in minor adverse impacts on energy resources.

In the No-Action Alternative, the Project would not be constructed and there would be no energy-related impacts. The construction of other projects in the Local Study Area through 2040 would consume varying amounts of energy depending on the scale and duration of the construction activities. While it is not possible to develop a quantitative estimate, this consumption would be a minor adverse impact for the following reasons.

The projects included in the No-Action Alternative are of a type and size that are not unusual in a large city like the District. Even the largest one – the development of the private air-rights – is similar to the recent development of the air rights above Interstate 95, a short distance from WUS. While the construction of such projects requires large amounts of energy, mostly in the form of diesel fuel for construction vehicles and equipment, the demand they generate is not such that it can create shortages or capacity issues for energy suppliers. Additionally, the projects would be implemented at different times and on different schedules, spreading the associated energy consumption over up to two decades. For these reasons, impacts would be minor.

[11] A substation is a set of equipment that reduces the high voltage of electrical power transmission to levels suitable for supply to consumers.

[12] Shalom Baranes Associates. 2015. *Washington Union Station: Concept Feasibility Review Report (Draft).* BuroHappold Engineers, Hensel Phelps.

8.5.2 Alternative A

8.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A would have a minor adverse direct operational impact on energy resources.

In Alternative A, relative to the No-Action Alternative, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-2** provides an order-of-magnitude estimate of the increase in energy consumption that would result. The resulting impact would be minor for the reasons explained below.

Table 8-2. Estimated Change in Annual Energy Use, Alternative A

Alternative Element	Additional Square Footage	EUI[1] kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	72,000	93.7	6,746,400
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	180,000	45.3	8,154,000
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	- 453,600	11.4	- 5,171,040
Total	255,200	-	37,517,700

1. Values derived from Energy Star Portfolio Manager. Technical Reference. U.S. Energy Use Intensity by Property Type, March 2016 and Parking and the ENERGY STAR Score in the United States and Canada, August 2018.

Alternative A would result in an increase in energy consumption of approximately 37.5 million kBTUs a year. This would be 10 percent of Project Area consumption in the No-Action Alternative but would amount to only approximately 0.02 percent of the District's total energy consumption in 2017, which was 168 billion kBTUs. As such, it is not likely to create capacity issues or to require the development of a dedicated energy source (such as a new power plant).

Based on a review of energy bills for WUS in 2014 and 2015, approximately 52 percent of the energy used at the station comes from electricity. Therefore, it is likely that the majority of the increased energy consumption in Alternative A would be in the form of electrical power. Increased electricity demand may require upgrades to the local distribution and transmission systems.[13] However, they are not likely to be beyond what it commonly required by large-scale development projects in the District.

13 The potentially affected systems are protected as Critical Energy Infrastructure Information (CEII). Only the owning utility has access to this information and would need to conduct the appropriate to measure how the Project could affect them prior. Such analysis, and follow-on actions, would be conducted during the later stages of Project design.

8.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would have a negligible adverse indirect operational impact on energy resources.

The potential development of the Federal air rights into additional parking space would result in a further increase in energy consumption at WUS. **Table 8-3** provides an estimate. Additional energy consumption from the parking space would represent approximately 10 percent over the increase that would directly result from the Project. It would represent approximately 0.002 percent of the District's total energy consumption in 2017. As such, the resulting impact would be negligible.

Table 8-3. Estimated Annual Energy Use of Federal Air-rights Development, Alternative A

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Parking Space	323,720	11.4	3,690,408

8.5.2.3 Construction Impacts

Construction of Alternative A would result in minor adverse impacts on energy resources.

Construction of Alternative A would consume large amounts of energy, mostly in the form of diesel fuel used for construction vehicles and equipment. As explained in **Section 8.4.2**, *Construction Impacts*, it is difficult to develop a quantitative estimate. However, impacts can be anticipated to be minor based on the following considerations. Large-scale construction projects such as the Project are common in large urban areas like the District. While they require large amounts of energy, they do not create shortages or create capacity issues for suppliers or distributors. Construction of Alternative A would take place over 11 years and 5 months. Therefore, the demand for energy would be distributed over time, reducing the impact on source and distribution.

8.5.2.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A would result in an estimated increase in energy consumption representing 40 percent of the existing WUS consumption. This would be a proportionately greater increase than relative to the No-Action Alternative (see **Table 8-4**). The total amount of additional energy would remain the same. As explained above, it would amount to a minor adverse impact.

Table 8-4. Comparison of Alternative A Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative A Impact (KBTUs)	Alternative A Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative A Impact Relative to No-Action Alternative
103,500,000	41,208,108	40%	263,776,000	367,276,000	11%

8.5.3 Alternative B

8.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a minor adverse direct operational impact on energy resources.

In Alternative B as in the other Action Alternatives, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-5** provides an order-of-magnitude estimate of the increase in energy consumption that would result from Alternative B.

Table 8-5. Estimated Change in Annual Energy Use, Alternative B

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	72,000	93.7	6,746,400
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	180,000	45.3	8,154,000
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	- 44,550	11.4	-507,870
Total	664,250	-	42,180,870

Alternative B would result in an increase in energy consumption of approximately 42.2 million kBTUs a year. For the same reasons as for Alternative A (see **Section 8.5.2.1**, *Direct Operational Impacts*), this would represent a minor adverse impact. It would be 11.5 percent of Project Area consumption in the No-Action Alternative but would amount to only approximately 0.03 percent of the District’s total energy consumption in 2017 (168 billion kBTUs).

8.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a minor adverse indirect operational impact on energy resources.

The potential development of the Federal air rights into office space would result in a further increase in energy consumption at WUS. **Table 8-6** provides an estimate. The impact would be minor. Additional energy consumption from the office space would represent an increment of 146 percent over the increase that would result directly from the Project but only approximately 0.04 percent of the District's total energy consumption in 2017.

Table 8-6. Estimated Annual Energy Use of Federal Air-rights Development, Alternative B

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Office Space	917,420	67.3	61,742,366

8.5.3.3 Construction Impacts

Construction of Alternative B would result in minor adverse impacts on energy resources.

Construction of Alternative B, like that of Alternative A and the other Action Alternatives, would consume large amounts of energy, mostly in the form of diesel fuel used for construction vehicles and equipment. Construction of Alternative B would take place over approximately 14 years and 4 months. While the longer duration would result in greater total energy consumption, annual consumption would likely be within the same range as for Alternative A. For the same reasons as explained in **Section 8.5.2.3**, *Construction Impacts*, the resulting impacts on energy resources would be minor.

8.5.3.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative B would result in an estimated increase in energy consumption that would double the existing WUS consumption. This would be a proportionately greater increase relative to the No-Action Alternative (see **Table 8-7**). The total amount of additional energy would remain the same, however. As explained above, it would amount to a minor adverse impact.

Table 8-7. Comparison of Alternative B Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative B Impact (KBTUs)	Alternative B Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative B Impact Relative to No-Action Alternative
103,500,000	103,923,236	100%	263,776,000	367,276,000	28%

8.5.4 Alternative C

8.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have a minor adverse direct operational impact on energy resources.

In Alternative C, as in the other Action Alternatives, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-8** and **Table 8-9** provide order-of-magnitude estimates of the increase for both options of Alternative C. The difference between the two options would be negligible.

Table 8-8. Estimated Change in Annual Energy Use, Alternative C East Option

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	72,000	93.7	6,746,400
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	115,000	45.3	5,209,500
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	-167,550	11.4	-1,910,070
Total	476,192		37,834,170

Table 8-9. Estimated Change in Annual Energy Use, Alternative C West Option

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	72,000	93.7	6,746,400
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	115,000	45.3	5,209,500
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	-186,800	11.4	-2,129,520
Total	457,000		37,614,720

Alternative C would result in an increase in energy consumption of approximately 37.6 to 37.8 million kBTUs a year. For the same reasons as for Alternative A (see **Section 8.5.2.1**, *Direct Operational Impacts*), this would be a minor adverse impact. It would be 10 percent of Project Area consumption in the No-Action Alternative but would amount to approximately 0.02 percent of the District's total energy consumption in 2017 (168 billion kBTUs).

8.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have a minor adverse indirect operational impact on energy consumption in the Project Area.

The potential development of the Federal air rights into office space would result in a further increase in energy consumption at WUS. **Table 8-10** provides an order-of-magnitude estimate. The impact would be minor. Additional energy consumption from the office space would represent an increment of 170 percent over the increase that would result directly from the Project, but it would represent only approximately 0.04 percent of the District's total energy consumption in 2017.

Table 8-10. Estimated Annual Energy Use of Federal Air-rights Development, Alternative C

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Office Space	952,600	67.3	64,109,980

8.5.4.3 Construction Impacts

Construction of Alternative C (either option) would result in minor adverse impacts on energy resources.

Construction of Alternative C, like that of Alternative A and the other Action Alternatives, would consume large amounts of energy, mostly in the form of diesel fuel used for construction vehicles and equipment. Construction of Alternative C would take place over approximately 12 years and 3 months. While the longer duration would result in greater total energy consumption, annual consumption would likely be within the same range as for Alternative A. For the same reasons as explained in **Section 8.5.2.3**, *Construction Impacts*, the resulting impacts on energy resources would be minor.

8.5.4.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative C would result in an estimated increase in energy consumption representing approximately 98 percent of the existing WUS consumption. This would be a proportionately greater increase than relative to the No-Action Alternative (see **Table 8-11**). The total amount of additional energy would remain the same, however. As explained above, it would amount to a minor adverse impact.

Table 8-11. Comparison of Alternative C Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative C Impact (KBTUs)	Alternative C Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative C Impact Relative to No-Action Alternative
103,500,000	101,944,150	98%	263,776,000	367,276,000	28%

8.5.5 Alternative D

8.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a minor adverse direct operational impact on energy resources.

In Alternative D as in the other Action Alternatives, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-12** provides an order-of-magnitude estimate of the increase in energy consumption that would result from Alternative D.

Table 8-12. Estimated Change in Annual Energy Use, Alternative D

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	100,000	93.7	9,370,000
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	100,000	45.3	4,530,000
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	-318,410	11.4	-3,629,874
Total	338,390	-	38,058,466

Alternative D would result in an increase in energy consumption of approximately 38 million kBTUs a year. This would be 10.4 percent of Project Area consumption in the No-Action Alternative. For the same reasons as for Alternative A (see **Section 8.5.2.1**, *Direct Operational Impacts*), it would be a minor impact, as it would amount to only approximately 0.02 percent of the District's total energy consumption in 2017 (168 billion kBTUs).

8.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a minor adverse indirect operational impact on energy resources.

The potential development of the Federal air rights into office space would result in a further increase in energy consumption at WUS. **Table 8-13** provides an order-of-magnitude estimate. Additional energy consumption from the office space would represent an increment of 122 percent over the increase that would result directly from the Project. The impact would be minor, as it would represent approximately 0.03 percent of the District's total energy consumption in 2017.

Table 8-13. Estimated Annual Energy Use of Federal Air-rights Development, Alternative D

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Office Space	688,050	67.3	46,305,765

8.5.5.3 Construction Impacts

Construction of Alternative D would result in minor adverse impacts on energy resources.

The construction impacts of Alternative D would be the same as those of Alternative C as both alternatives would have the same depth of excavation and take the same amount of time to construct (see **Section 8.5.4.3**, *Construction Impacts*).

8.5.5.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative D would result in an estimated increase in energy consumption representing approximately 82 percent of the existing WUS consumption. This would be a proportionately greater increase relative to the No-Action Alternative (see **Table 8-14**). The total amount of additional energy would remain the same, however. It would amount to a minor adverse impact.

Table 8-14. Comparison of Alternative D Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative D Impact (KBTUs)	Alternative D Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative D Impact Relative to No-Action Alternative
103,500,000	84,364,231	82%	263,776,000	367,276,000	23%

8.5.6 Alternative E

8.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative E would have a minor adverse direct operational impact on energy resources.

In Alternative E, as in the other Action Alternatives, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-15** provides an order-of-magnitude estimate of the increase in energy consumption that would result from Alternative E.

Table 8-15. Estimated Change in Annual Energy Use, Alternative E

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	100,000	93.7	9,370,000
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	100,000	45.3	4,530,000
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	-41,916	11.4	-478,200
Total	614,884	-	41,210,140

Alternative E would result in an increase in energy consumption of approximately 41 million kBTUs a year. This would be 11 percent of Project Area consumption in the No-Action Alternative. For the same reasons as for Alternative A (see **Section 8.5.2.1**, *Direct Operational Impacts*), this would represent a minor adverse impact. It would amount to approximately 0.02 percent of the District's total energy consumption in 2017 (168 billion kBTUs).

8.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would have a minor adverse indirect operational impact on energy resources.

The indirect impacts of Alternative E would be the same as those of Alternative D. This is because the potential Federal air-rights development would be the same in both alternatives (see **Section 8.5.5.2**, *Indirect Operational Impacts*).

8.5.6.3 Construction Impacts

Construction of Alternative E would result in minor adverse impacts on energy resources.

The construction impacts of Alternative E would be the same as those of Alternative B because both alternatives would have the same depth of excavation and take the same amount of time to construct (see **Section 8.5.3.3**, *Construction Impacts*).

8.5.6.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative E would result in an estimated increase in energy consumption representing approximately 85 percent of the existing WUS consumption. This would be a proportionately greater increase relative to the No-Action Alternative (see **Table 8-16**). The total amount of additional energy would remain the same, however. As explained above, it would amount to a minor adverse impact.

Table 8-16. Comparison of Alternative E Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative E Impact (KBTUs)	Alternative E Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative E Impact Relative to No-Action Alternative
103,500,000	87,515,905	85%	263,776,000	367,276,000	24%

8.5.7 Alternative A-C (Preferred Alternative)

8.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse direct operational impact on energy resources.

In Alternative A-C as in the other Action Alternatives, the expanded WUS would consume additional energy to operate the new station elements. **Table 8-17** provides an order-of-magnitude estimate of the increase in energy consumption that would result from Alternative A-C.

Table 8-17. Estimated Change in Annual Energy Use, Alternative A-C

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Retail	72,000	93.7	6,746,400
Additional Amtrak Support Space	211,800	78.8	16,689,840
Train Hall	113,500	45.3	5,141,550
Additional Concourse Space	245,000	45.3	11,098,500
Reduction in Parking/Bus Space	- 258,000	11.4	-2,941,200
Total	383,300	-	36,735,090

Alternative A-C would result in an increase in energy consumption of approximately 36.7 million kBTUs a year. For the same reasons as for Alternative A (see **Section 8.5.2.1**, *Direct Operational Impacts*), this would represent a minor adverse impact. It would be 10 percent of Project Area consumption in the No-Action Alternative but would amount to only approximately 0.02 percent of the District's total energy consumption in 2017 (168 billion kBTUs).

8.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse indirect operational impact on energy resources.

The potential development of the Federal air rights into office space in Alternative A-C would result in a further increase in energy consumption at WUS. **Table 8-18** provides an estimate. The impact would be minor. Additional energy consumption from the office space would represent an increment of 70 percent over the increase that would result directly from the Project but only approximately 0.015 percent of the District's total energy consumption in 2017.

Table 8-18. Estimated Annual Energy Use of Federal Air-rights Development, Alternative A-C

Alternative Element	Additional Square Footage	EUI kBTUs/Square Foot/Year	Estimated Annual Facility Use (kBTUs)
Additional Office Space	380,000	67.3	25,574,000

8.5.7.3 Construction Impacts

Construction of Alternative A-C would result in minor adverse impacts on energy resources.

Construction of Alternative A-C, like that of Alternative A and the other Action Alternatives, would consume large amounts of energy, mostly in the form of diesel fuel used for construction vehicles and equipment. Construction of Alternative A-C would take place over approximately 11 years and 5 months, like construction of Alternative A. For the same reasons as explained in **Section 8.5.2.3**, *Construction Impacts*, the resulting impacts on energy resources would be minor.

8.5.7.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would result in an estimated increase in energy consumption that would double the existing WUS consumption. This would be a proportionately greater increase relative to the No-Action Alternative (see **Table 8-19**). The total amount of additional energy would remain the same, however. As explained above, it would amount to a minor adverse impact.

Table 8-19. Comparison of Alternative A-C Energy Impacts to Existing Conditions

Existing Conditions (KBTUs)	Alternative A-C Impact (KBTUs)	Alternative A-C Impact Relative to Existing Conditions	Additional Consumption No-Action Alternative (KBTUs)	Total No-Action Alternative (KBTUs)	Alternative A-C Impact Relative to No-Action Alternative
103,500,000	62,309,090	60%	263,776,000	367,276,000	17%

8.6 Comparison of Alternatives

Table 8-20 summarizes the impacts of all alternatives. **Table 8-21** shows the estimated direct and indirect energy impacts for each.

All Action Alternatives would result in lesser impacts than the No-Action Alternative because of the size of the private air-right development. Among the Action Alternatives, direct impacts would be of the same order of magnitude, with Alternative A-C at the lower end of the narrow range and Alternative B at the higher end.

The range would increase when factoring in the indirect impacts from the potential Federal air-rights development, with the impacts of Alternative A substantially less than those of the other Action Alternatives. This is because of the smaller size and energy needs of the Federal air-rights development in this alternative. Alternatives B and C would have the greatest combined impacts. For all alternatives, the estimated impacts of the potential Federal air-rights development would be a very small fraction of the District's energy consumption in 2017. As such, they are not likely to generate supply or capacity issues and are considered negligible or minor.

Construction of the alternatives would also consume energy. While it is difficult to quantify this impact, it would generally be proportional to the size of the development and the duration of the construction. On this basis, Alternatives A and A-C would have the smallest total impact and Alternatives B and E the greatest one. In general, these impacts, once annualized, can be expected to be in the range of what is typical of large construction projects in urban areas.

Table 8-20. Comparison of Alternatives

Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
Direct Operational	Minor adverse impacts						
Indirect Operational	No Impacts	Negligible adverse impacts	Minor adverse impacts				
Construction	Minor adverse impacts						

Table 8-21. Comparison of Estimated Energy Impacts by Alternative (KBTUs per Year)

	No-Action Alternative	Alternative A	Alternative B	Alternative C (East Option)	Alternative C (West Option)	Alternative D	Alternative E	Alternative A-C
WUS Expansion	-	37,517,700	42,180,870	37,834,170	37,614,720	38,058,466	41,210,140	36,735,090
Private Air-Rights Development	263,776,000	-	-	-	-	-	-	-
Potential Federal Air-Rights Development	-	3,690,408	61,742,366	64,109,980	64,109,980	46,305,765	46,305,765	25,574,000
Total	263,776,000	41,208,108	103,923,236	101,944,150	101,724,700	84,364,231	87,515,905	62,309,000

8.7 Avoidance, Minimization and Mitigation Evaluation

The following avoidance, minimization, and mitigation measures are being considered by FRA to minimize energy impacts as much as possible:

- The Project Proponents would incorporate cost-effective energy efficiency technologies into the Project design. Numerous simple efficiency upgrades on systems such as lighting, refrigeration, water and space heating and cooling, windows, doors, and building insulation, would result in major energy savings at reasonable costs with short payback periods. Newer technologies would save additional energy by adjusting energy consumption to the needs of the people using the space. These include, but are not limited to, programmable and learning thermostats; energy management systems that react to utility price signals and energy demand in the region; and light motion sensors and dimmers.
- USRC would develop a Tenant Manual. The retail space in WUS is leased to a single entity (Ashkenazy Acquisition Corporation, operating as Union Station Investco), which subleases the individual spaces to tenants. A Tenant Manual would be prepared for that single entity and any future entities that may control the new retail space created by the Project, designed to help them fit-out and operate their spaces with sustainable and energy efficient designs and operating practices that reduce overall energy demand. USRC would identify, within that Manual, potential strategies to ensure that energy reduction is achieved. These strategies may include, but are not limited to: identifying core and shell features that allow tenant choices in energy-related fit-out (for example, chilled water distribution capabilities, individual electric metering, the energy management systems, and other building features); and requiring or encouraging tenants to adopt appropriate sustainable design, energy efficiency, water use, and water pollution control commitments to the extent feasible as part of their respective lease agreements.

8.8 Permits and Regulatory Compliance

The Project would need to submit Green Determination Requests to the District Department of Consumer and Regulatory Affairs to determine the applicability of green and energy laws and regulations in the Green Building Design Process.

The Green Building Division regulates construction in the District that falls under the regulations of the Green Building Act, Green Construction Code and Energy Conservation Code. The Division is responsible for plan reviews, building inspections, and certificate of occupancy review. When filing a Green Determination Request, the project owner is seeking to determine which green building codes and laws are applicable to the project. The laws and codes that could apply include:

- 2013 DC Building Code.[14]
- Green Building Act (GBA). Establishes high-performance green building standards for public and private construction projects. If a project falls within the scope of the GBA, and associated regulations, compliance with the GBA would also satisfy compliance with the 2013 Green Construction Code.[15]
- 2013 DC Green Construction Code (GCC) consists of the 2012 International Green Construction Code as amended by the District of Columbia 2013 Green Construction Code Supplement (12 DCMR K). Developers must review section 101.4.9 of the 2013 DC Building Code to determine the applicability of GCC to their project.[16]
- 2013 DC ECC consists of the 2012 International Energy Conservation Code as amended by the District of Columbia 2013 Energy Conservation Code Supplement (12 DCMR I).[17]
- The ECC applies broadly to all residential and commercial buildings, the building sites, and associated systems and equipment and regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. Developers must review section 101.4.7 of the 2013 DC Building Code to determine applicability of the ECC to their project.[18]
- Green Area Ratio (GAR) - Part of the Zoning Regulations, the GAR is administered by the District Department of Energy and Environment.[19]

The potential Federal air-rights development would have to comply with the U.S. Department of Energy's Federal Energy Management Program (FEMP)[20] standards for energy efficiency in federal buildings as required under the Energy Conservation and Production Act

[14] 2013 District of Columbia Building Code. Accessed from https://codes.iccsafe.org/public/document/details/toc/922. Accessed on June 20, 2018.

[15] District of Columbia Official Code. *2013 District of Columbia Building Code. Green Building Act*. Division I, Title 6, Chapter 14A, § 6-1451.01 — 6-1451.11.

[16] *District of Columbia Green Construction Code*. 2013. Accessed from https://doee.dc.gov/publication/districts-green-construction-code. Accessed on January 22, 2019.

[17] District of Columbia Energy Conservation Code. Accessed from https://codes.iccsafe.org/category/District%20of%20Columbia?year[]=Current+Adoption&page=1. Accessed on January 22, 2019.

[18] District of Columbia Official Code. *2013 District of Columbia Energy Code. Energy Conservation Code*. Chapter 4 – Commercial Energy Efficiency. Accessed from https://codes.iccsafe.org/public/document/details/toc/921. Accessed on June 20, 2018.

[19] District Department of Energy and Environment. *Green Area Ratio*. Accessed from https://doee.dc.gov/service/green-area-ratio-overview. Accessed on January 22, 2109.

[20] EERE Federal Energy Management Program. Accessed from https://www.energy.gov/eere/femp/federal-energy-management-program. Accessed on June 20, 2018.

(ECPA)[21]. The current commercial standards are ANSI/ASHRAE/IES Standard 90.1-2013[22]. The purpose of FEMP is to work with stakeholders to enable federal agencies to meet energy-related goals, identify affordable solutions, facilitate public-private partnerships, and identify and leverage government best practices.

A number of laws apply to new construction or modernization of federal buildings,[23] including:

- 42 USC 6835(a)(1), Agency Procedures. The head of each Federal agency is required to adopt procedures necessary to assure that new Federal buildings meet or exceed the Federal building energy standards established under 42 USC § 6834.
- 42 USC 6834(a)(3)(A), Energy Efficiency. If life cycle cost-effective, new Federal buildings must be designed to achieve ASHRAE 90.1 energy consumption levels and 30 percent below such levels. The version of ASHRAE 90.1 that Federal agencies must use depends on when design for construction begins.
- 42 USC 6835(b), Expenditure of Federal Funds. The head of a Federal agency may expend Federal funds for the construction of a new Federal building only if the building meets or exceeds the Federal building energy standards established under 42 USC § 6834.
- 42 USC 6834(a)(3)(D)(i)(I)-(II), Fossil Fuel Reduction. New Federal buildings and major renovations of existing buildings are to reduce fossil fuel-generated energy consumption by 55 percent in fiscal year (FY) 2010, 65 percent in FY 2015, 80 percent in FY 2020, 90 percent in FY 2025, and 100 percent in FY 2030, compared to a FY 2003 baseline.
- 42 USC 8254(b)(1), Life Cycle Cost Methods and Procedures. The design of new Federal buildings shall be made using life cycle cost methods and procedures established under 42 USC 8254(a).
- 42 USC 8253(e), Metering Requirements. Agencies are required to install metering and advanced metering devices in Federal buildings in accordance with U.S. Department of Energy metering guidelines.
- 42 USC 6834(a)(3)(A)(iii), Solar Hot Water. If life cycle cost-effective, 30 percent of hot water demand in new Federal buildings undergoing major renovations must be met with solar hot water.

[21] U.S. Public Law 94-385. *Energy Conservation and Production Act*. Accessed from https://legcounsel.house.gov/Comps/Energy%20Conservation%20And%20Production%20Act.pdf. Accessed on June 20, 2018.

[22] EERE. *Building Energy Codes Program. ANSI/ASHRAE/IES Standard 90.1-2013*. Accessed from https://www.energycodes.gov/training-courses/ansiashraeies-standard-901-2013. Accessed on June 20, 2018.

[23] EERE. *Federal Energy Management Program. Building Energy Use. New Construction or Modernization*. Accessed from https://www4.eere.energy.gov/femp/requirements/guidelines_filtering. Accessed on April 3, 2020.

- 42 USC 6834(a)(3)(D)(i)(III), Sustainable Design Principles. New Federal buildings and major renovations of existing buildings are to apply sustainable design principles to the siting, design, and construction of such buildings.

9 Land Use, Land Planning, and Property

9.1 Overview

This section addresses the potential impacts of the No-Action and Action Alternatives on land use and zoning, private property, and applicable local and regional plans and policies. If applicable, it also recommends measures to avoid, minimize, or mitigate potential adverse impacts and it identifies relevant permitting and regulatory compliance requirements.

9.2 Regulatory Context

The following Federal regulations provide the regulatory context for the land use and zoning environmental consequences analysis:

- The Federal Railroad Administration's (FRA's) *Procedures for Considering Environmental Impacts* (64 Federal Register [FR] 28545, May 26, 1999; 78 FR 2713, January 14, 2013); [1]
- The Council on Environmental Quality's (CEQ's) *Implementing Regulations for the National Environmental Policy Act* (40 Code of Federal Regulations [CFR] 1500-1508);[2]
- The Uniform Act (Uniform Relocation Assistance and Real Property Acquisition Properties Act); [3] and
- The National Capital Planning Act of 1952.[4]

[1] FRA. *Procedures for Considering Environmental Impacts*. Accessed from https://www.fra.dot.gov/eLib/Details/L02710. Accessed on March 30, 2018.

[2] 42 CFR 1500-1508. *CEQ Implementing Regulations.* Accessed from https://www.ecfr.gov/cgi-bin/text-idx?SID=30655823cf5f0dcb1c5ee59d01883b89&mc=true&tpl=/ecfrbrowse/Title40/40chapterV.tpl. Accessed on March 30, 2018.

[3] U.S. Department of Transportation, Federal Highway Administration. 2005. *Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally-Assisted Programs* (49 CFR 24). Accessed from https://www.gpo.gov/fdsys/pkg/FR-2005-01-04/pdf/05-6.pdf. Accessed on July 20, 2017.

[4] National Capital Planning Act of 1952. Public Law 82-592. Accessed from https://www.gpo.gov/fdsys/pkg/STATUTE-66/pdf/STATUTE-66-Pg781.pdf. Accessed on December 12, 2017.

The following Federal and District local and regional plans are relevant to the Project and the impact analysis:

- **National Capital Planning Commission (NCPC), Comprehensive Plan for the National Capital – Federal Elements, and the Council of the District of Columbia (DC Council), Comprehensive Plan for the National Capital – District Elements.** The *Comprehensive Plan for the National Capital* is a document that guides future planning and development within the District. It includes the *Federal Elements*, prepared by NCPC, which focuses on planning for the Federal facilities and Federal interests in the region; and the *District Elements*, prepared by the District, which serves as the District's master plan.[5] *The Comprehensive Plan for The National Capital Transportation Element* calls for WUS to become an "intermodal center" for the city. It also calls for WUS to increase and expand its multimodal capacities and connectivity and to improve key facilities.
- ***Mount Vernon Triangle Action Agenda***. The District produced the *Mount Vernon Triangle Action Agenda* to govern the approach to land use development in this neighborhood.[6] The *Mount Vernon Triangle Action Agenda* calls for the enhancement of retail, hotel, recreation, nonprofit, and cultural uses along lively street corridors. **Figure 9-1** shows the area addressed by this plan.
- ***NoMA Vision Plan and Development Strategy***. NoMA stands for North of Massachusetts Avenue. The District developed the *NoMA Vision Plan and Development Strategy* to guide the development of this neighborhood.[7] The *NoMA Vision Plan and Development Strategy* calls for the pursuit of "a balanced approach to transportation, creating a pedestrian-friendly neighborhood with improved transit accessibility. The long-term future of NoMA is dependent on transportation and utility infrastructure demands keeping pace with proposed development. This plan signals the need for multi-agency coordination and a holistic approach to transportation and infrastructure investment that addresses future needs with the most sustainable environmental practices." See **Figure 9-1** for the area addressed by the plan.

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[5] National Capital Planning Commission. 2016. *Comprehensive Plan for the National Capitol – Federal Elements.* Accessed from https://www.ncpc.gov/compplan/. Accessed on March 13, 2020;
District of Columbia. Amended 2011. *Comprehensive Plan.* Accessed from https://planning.dc.gov/page/comprehensive-plan. Accessed on March 13, 2020.

[6] District of Columbia Office of Planning. 2003. *Mount Vernon Triangle Action Agenda.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/Mount%20Vernon%20Triangle%20Action%20Agenda.pdf. Accessed on March 13, 2020.

[7] District of Columbia Office of Planning. 2006. *NoMA Vision Plan and Development Strategy.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/Section%25201-%2520Introduction.pdf. Accessed on March 13, 2020.

- ***Northwest One Redevelopment Plan***. Northwest One is comprised of residential neighborhoods on the west side of North Capitol Street that are largely made up of low-income housing provided by public and private entities. In 2005, the District established a plan for the area.[8] The *Northwest One Redevelopment Plan* makes recommendations to create a vibrant, mixed-income community with a new public school, recreation center, playing fields and parks, health clinic and neighborhood library. The plan also calls for the reconfiguration of some streets, including "extending" K Street to link the neighborhood to those east and west of it to increase connectivity and safety and alleviate congestion. **Figure 9-1** shows the area addressed by this plan.
- ***H Street NE Strategic Development Plan***. The H Street Corridor is a rapidly changing area with a re-emerging commercial core along the street. In 2003, the District developed a plan for the area.[9] The *H Street NE Strategic Development Plan* calls for the strengthening of the connection between WUS and the H Street corridor, activation of the streetscape on the H Street Bridge, increased commercial office space, and for the area to serve as a multi-modal center.

9.3 Study Area

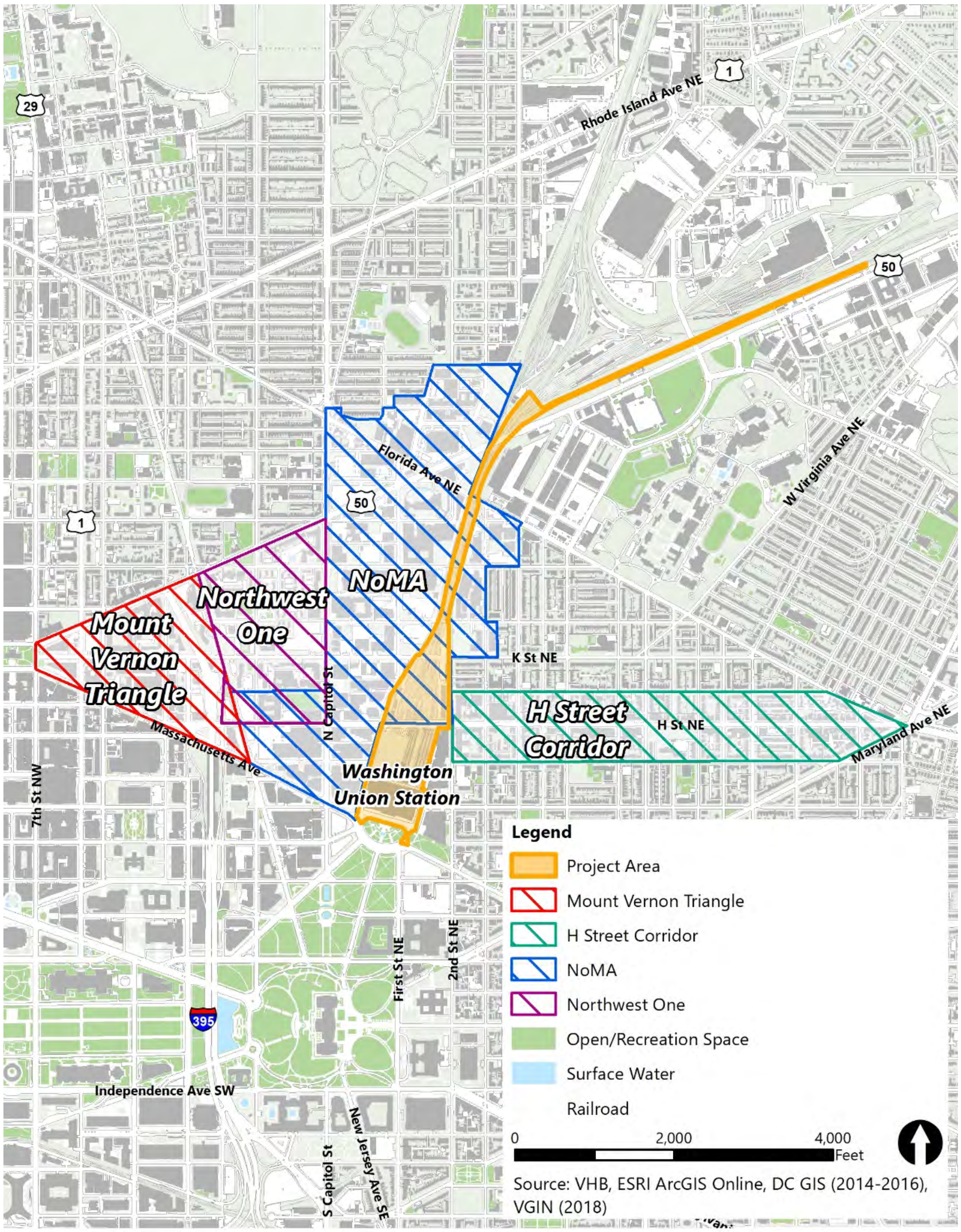
The Local Study Area is the Project Area and the zoning districts within one-half mile of the Project Area. North of K Street, where the Project consists solely of track modifications, the Local Study Area is the track area and the zoning districts within one-quarter mile of the Project Area. **Figure 9-2** shows the Local Study Area.

The Regional Study Area includes the neighborhoods adjacent to the Project Area. The outer limits of the Regional Study Area are the limits of the Atlas District/H Street Corridor, Capitol Hill, the Monumental Core, NoMA, and Mount Vernon Triangle neighborhoods. This Regional Study Area represents the broader land use context of the Project. **Figure 9-2** shows the Regional Study Area.

8 District of Columbia Office of Planning. 2006. *Northwest One Redevelopment Plan.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/NorthwestOneFinal.pdf. Accessed on March 13, 2020.

9 District of Columbia Office of Planning. 2004. *H Street NE Strategic Development Plan.* Accessed from https://planning.dc.gov/publication/h-street-corridor-revitalization-main-page. Accessed on March 13, 2020.

Figure 9-1. Small Area Plan Areas



WASHINGTON UNION STATION STATION EXPANSION

Figure 9-2. Land Use, Land Planning, and Property Local and Regional Study Area

9.4 Methodology

Section 9 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on land use, land planning, and property. A summary is below.

9.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The operational impacts of each alternative on local land uses, land use controls, property ownership, and local and regional planning were considered in accordance with FRA Environmental Procedures.[10]

Federal property is not subject to local zoning. Federal development in the District is subject to review and approval by the National Capital Planning Commission (NCPC) as the zoning authority for Federal land. FRA has determined that it is reasonably foreseeable that the Federal air-rights area would be rezoned to match to District's Union Station North (USN) zoning designation that applies to the adjacent private air rights. Development consistent with USN zoning was assumed for the Federal air rights (**Figure 9-3**).[11]

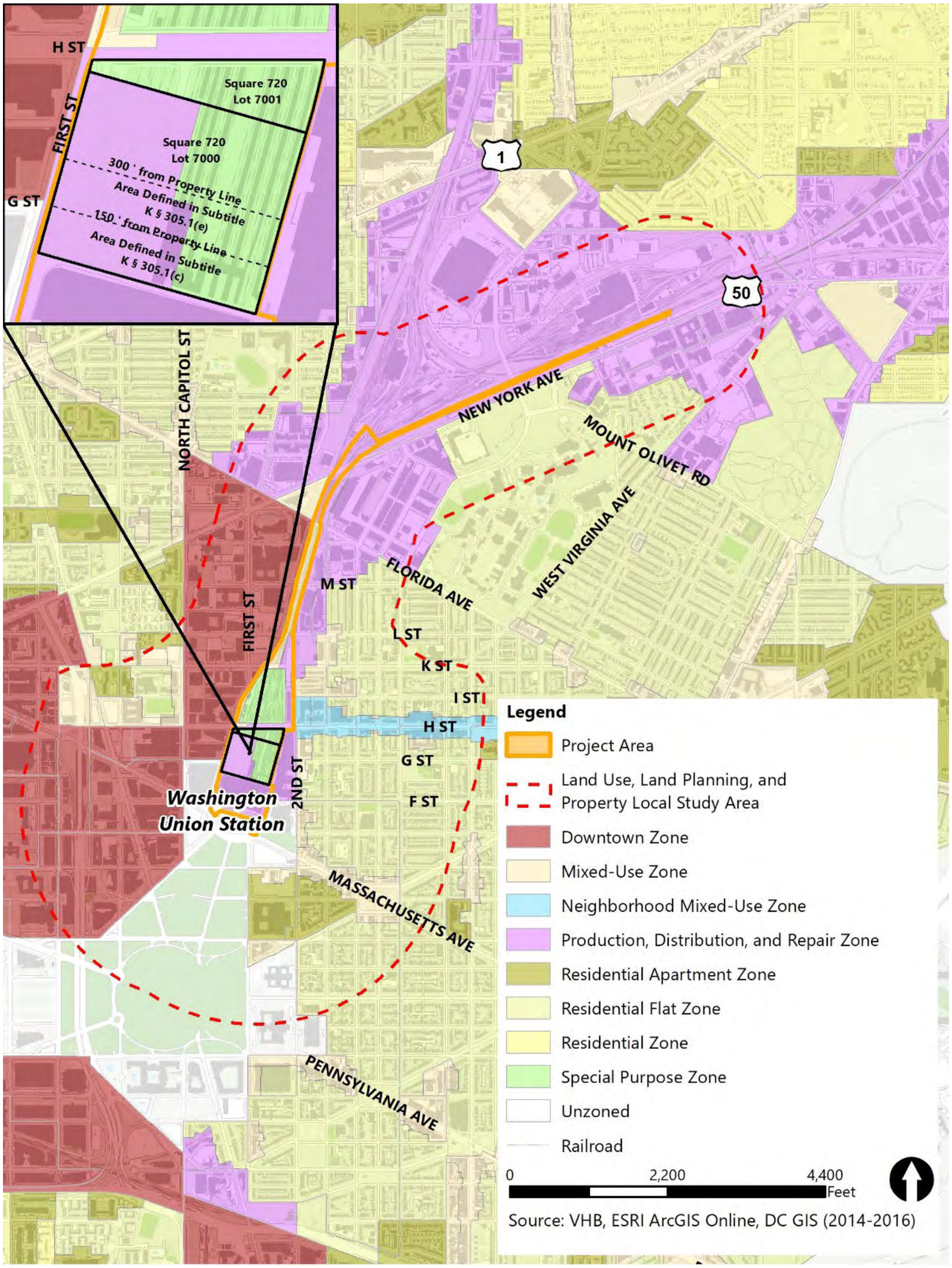
Impacts within the Project Area to property ownership were assessed by estimating the area of private air rights that project elements would occupy. The alternatives' impacts on local and regional plans were determined by considering the consistency of alternative with the goals of the plans.

Potential indirect impacts such as induced development, changes in development patterns, or increased rates of development or redevelopment outside the Project Area were addressed qualitatively. Indirect impacts resulting from the potential development of the Federal air rights in the Project Area were determined based on assumed uses (parking or office).

[10] FRA *Procedures for Considering Environmental Impacts.* Accessed from https://www.fra.dot.gov/eLib/Details/L02710. Accessed on March 30, 2018.

[11] The current Production, Distribution, Repair (PDR)-3 zone limits overall building height to 90 feet above existing grade; does not allow residential uses; and would be unlikely to support a consistent pattern of development on either side of the historic station building. The USN zoning designation allows development to a maximum height of up to 130 feet above the crest of the H Street Bridge with a 20 foot height step down to 110 feet within 300 feet of the historic station building and another 20 foot height step down to 90 feet within 150 feet of it. Prior to 2016, the area was zoned C-M-3 with the same restrictions as PDR-3. This zoning had been in place since 1958: "C-M-3 permits development of high bulk commercial and light manufacturing uses to a maximum FAR of 6.0, and a maximum height of ninety (90) feet with standards of external effects and new residential prohibited. A rear yard of not less than twelve (12) feet shall be provided for each structure located in an Industrial District. No side yard shall be required on a lot in an Industrial District, except where a side lot line of the lot abuts a Residence District. Such side yard shall be no less than eight (8) feet."

Figure 9-3. USN Zoning Designation Applied to PDR-3 Parcels (2040)



9.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. In this section, impacts from construction were evaluated by considering whether construction activities would cause inconsistencies with or modifications or delays to existing or planned land uses and developments in the Local Study Area distinct from potential operational impacts.

9.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on land use, land planning, and property. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

9.5.1 No-Action Alternative

9.5.1.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to existing conditions, the No-Action Alternative would have a major beneficial direct operational impact on land use and development. It would have no direct operational impacts on zoning.

The projects included in the No-Action Alternative would be consistent with existing zoning. The various station and track improvements in this alternative would be consistent with PDR-3 zoning. The private air-rights development would be within what the USN zoning district allows. There would be no need for a zoning amendment.

The various projects included in the No-Action Alternative would moderately enhance WUS as a multi-modal transportation hub. Additionally, the private air-rights development would result in denser and more varied land uses within the Project Area. This would be a major beneficial impact on land use as it would create a new mixed-use development consistent with zoning and land use plans that would bridge the gap created by the existing rail terminal in the local urban fabric. The District of Columbia Office of Planning (DCOP) *Existing Land Use*

Map depicts this area as a "Transport, Communications, Utilities" use.[12] However, zoning for the area has been amended and the change in land use above the rail terminal would be consistent with the new zoning. The DCOP Future Land Use Map accounts for the development and designates the area over the railroad tracks as a combination of "High Density Commercial, Federal, and High Density Residential."[13] The underlying "Transport, Communications, Utilities" uses associated with WUS would remain in place. The No-Action Alternative is consistent with the Future Land Use Map.

In spite of the beneficial impact on land use in the Project Area, the No-Action Alternative would see a marked deterioration of WUS user experience. The number of visitors and travelers would increase substantially. While the improvement projects included in the No-Action Alternative, such as the Concourse Modernization Project, would contribute to improving circulation conditions, they would not be sufficient to prevent ever worse congestion in the station, especially during peak periods. Overcrowding would exacerbate those existing short-comings the No-Action Alternative would leave unaddressed (for instance narrow platforms not capable of accommodating level boarding), making boarding and alighting from trains more difficult for all passengers. While the historic station building would continue to be the center and heart of the station, congested conditions would keep many visitors and travelers from fully appreciating and enjoying its grand architecture.

Property Ownership, Land Acquisitions, and Displacements

Relative to existing conditions, the No-Action Alternative would have no direct operational impacts pertaining to property ownership, land acquisitions, or displacements.

With one exception, the projects in the No Action Alternative would entirely occur within areas already owned or controlled by the respective project proponents. The exception is the private air-rights development. North of the H Street Bridge and south of the bridge above the stub-end tracks, the lower limit (vertical datum) of the private air rights stands at elevation 80 feet. South of the H Street Bridge, there would be insufficient vertical space to accommodate the full depth of a structural deck as proposed by the private air-rights developer without encroaching into Federal property. [14] A similar encroachment would occur within Amtrak property north of the H Street Bridge. Therefore, construction of this portion of the private air-rights deck would require property agreements with the Federal government and Amtrak. Within the portion of the private air rights where the vertical

12 District of Columbia Office of Planning. 2006. *Existing Land Use, Map Tile 11.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/map_11.pdf. Accessed on March 13, 2020.

13 District of Columbia Office of Planning. 2006. *Existing Land Use, Map Tile 11.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/FutureLandUse7.pdf. Accessed on March 13, 2020.

14 Akridge. November 15, 2017. *Burnham Place and Washington Union Station. Concept Level Podium Structural Systems for 30'x55' Column Grid Areas*.

datum is at 70 feet (southeast of the H Street Bridge above the run-through tracks), there would be sufficient vertical space to construct the private structural deck and associated systems within the private air rights.

Consistency with Local and Regional Plans

Relative to existing conditions, the No-Action Alternative would have minor adverse direct operational impacts on most local and regional plans, as shown in Table 9-1.

Table 9-1. Impacts of the No-Action Alternative on Local and Regional Plans

Local or Regional Plan	Impacts
Comprehensive Plan for The National Capital	Minor adverse impact: The No-Action Alternative would not be fully consistent with the goals of the *Comprehensive Plan for the National Capital Transportation Element*, which calls for WUS to increase and expand its multimodal capacities and connectivity.
H Street NE Strategic Development Plan	Minor adverse impact: The No-Action Alternative would not be fully consistent with the goals of the *H Street NE Strategic Development Plan*, which calls for the strengthening of the connection between WUS and the H Street corridor and for the area to serve as a multi-modal center.
NoMA Vision Plan and Development Strategy	Minor adverse impact: The No-Action Alternative would not be fully consistent with the goals of the *NoMA Vision Plan and Development Strategy*, which calls for improved transit accessibility and vehicular circulation.
Northwest One Redevelopment Plan	Minor adverse impact: The No-Action Alternative would not support the goals of the *Northwest One Redevelopment Plan*, which calls for reconstructing the grid pattern of streets in the area, including using public space design on K Street consistent with the design developed for the Mount Vernon Triangle District to better connect the Northwest One neighborhood with its neighbors to the east and west.
Mount Vernon Triangle Action Agenda	No impact: The No-Action Alternative would be generally consistent with the *Mount Vernon Triangle Action Agenda* but the elements of the No-Action Alternative are outside the plan's area.

The No-Action Alternative would have a minor adverse impact on the *Comprehensive Plan for The National Capital's Transportation Element*. The plan calls for WUS to become a "intermodal center" for the city. It also calls for WUS to increase and expand its multimodal capacities and connectivity and to improve key facilities. Without the expansion and modernization included in the Project, the No-Action Alternative would not fully meet the goals of the plan's transportation elements. The adverse impact would be minor because

WUS would continue to operate as an intermodal center and the No-Action Alternative would not preclude future expansion consistent with the plan.

The No-Action Alternative would have a minor adverse impact on the *H Street NE Strategic Development Plan*. The plan calls for the strengthening of the connection between WUS and the H Street Corridor; activation of the streetscape on the H Street Bridge; and increased commercial office space. The plan also calls for the area to serve as a multi-modal center. The projects included in the No-Action Alternative would generally be consistent with these recommendations. However, without a connection between the station and H Street NE, and without the optimization of multi-modal transit included in the Project, the No-Action Alternative would not realize the full potential of the plan. The adverse impact would be minor because several projects in the No-Action Alternative would support some aspects of the plan and it would not preclude the plan's full implementation later.

The No-Action Alternative would have a minor adverse impact on the *NoMA Vision Plan and Development Strategy*. This plan calls for the pursuit of "a balanced approach to transportation, creating a pedestrian-friendly neighborhood with improved transit accessibility and vehicular circulation…The long-term future of NoMA is dependent on transportation and utility infrastructure demands keeping pace with proposed development. This plan signals the need for multi-agency coordination and a holistic approach to transportation and infrastructure investment that addresses future needs with the most sustainable environmental practices."[15] Without the station expansion provided by the Project, the No-Action Alternative would not fully realize the potential of the *NoMA Vision Plan and Development Strategy.* The adverse impact would be minor because the alternative would not preclude the full realization of the plan at a later date.

The No-Action Alternative would not advance the goals of the *Northwest One Redevelopment Plan*. The plan calls for the reconfiguration of some streets, including "extending" K Street through consistent public space design to link the Northwest One neighborhood to the areas east and west of it, increase connectivity and safety, and alleviate congestion. The No-Action Alternative would not reconfigure the streets that connect the Northwest One neighborhood to surrounding areas. This would be a minor adverse impact because this alternative would not preclude the realization of the plan's other goals.

The *Mount Vernon Triangle Action Agenda* calls for the enhancement of retail, hotel, recreation, nonprofit, and cultural uses along lively street corridors. While the projects included in the No-Action Alternative, particularly the private air-rights development, would be generally consistent with these goals, they are located outside the plan's area with no direct impact on the plan's goals.

[15] District of Columbia Office of Planning. 2006. *NoMA Vision Plan and Development Strategy.* Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/Section%25201-%2520Introduction.pdf. Accessed on March 13, 2020.

9.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The development of the private air rights within the Project Area may encourage or accelerate further medium- or high-density development in the H Street Corridor, currently comprised of a high-activity street (H Street NE) surrounded by residential rowhouse neighborhoods, as well as throughout Capitol Hill. Land use patterns in the other neighborhoods within the Local and Regional Study Areas, such as Mount Vernon Triangle and NoMA, are already characterized by the development of medium- and high-density properties. Everywhere, zoning regulations and applicable plans would continue to guide the density and character of potential future developments. This would avoid the development of incompatible land uses and ensure that neighborhoods evolve in accordance with the District’s vision for their respective futures.

9.5.1.3 Construction Impacts

Construction activities in the No-Action Alternative would result in minor adverse impacts on land use and no impacts on zoning or development; property ownership, land acquisitions, and displacement; or local and regional plans.

In the No-Action Alternative, the Project would not be constructed and would have no construction impacts. Construction of the projects included in the No-Action Alternative would result in minor adverse impacts on land use. The largest of these projects - the private air-rights development, the replacement of the H Street Bridge, and VRE Midday Storage Replacement Facility - would take place within the footprint of the rail terminal and have the potential to affect the terminal’s operations. Amtrak must authorize work in the rail terminal. The permitting process would ensure that any impacts to rail operations are minimized.

While construction activities and staging areas would likely remain within the respective footprints of the projects, the noise, pollution, or transportation disruptions typically associated with construction activities in a dense urban environment would affect adjacent land uses. These impacts, which would be typical of medium to large construction projects, are not likely to create durable incompatibilities that would prevent adjacent facilities and buildings from continuing to operate or force them to relocate.

9.5.2 Alternative A

9.5.2.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative A would have no direct operational impact on zoning. It would have a major beneficial direct operational impact on land use and development.

Alternative A would have no adverse impact on zoning. Federal property is not subject to local zoning and Federal development in the District is subject to review and approval by NCPC as the zoning authority. As explained in **Section 9.4.1**, *Operational Impacts*, it can reasonably be assumed that development within the Federal air rights would be conducted consistent with the requirements of the USN zoning designation applying to the adjacent private air rights. Alternative A includes a train hall that would be approximately 42 feet in height above the crest of the H Street Bridge elevation, consistent with PDR-3 zoning. It also includes a bus facility and parking above it that would be about 91 feet above the H Street Bridge. Although this height would not be compatible with the existing PDR-3 zoning, it would be compatible with the USN zoning designation. USN designation allows for greater heights, between 90 and 130 feet above the crest of the H Street Bridge, depending on the distance to the historic station building.[16]

Alternative A would have a major beneficial impact on land use by enhancing multi-modal transportation uses and connectivity within the Project Area and providing a more accessible, up-to-date multi-modal facility capable of accommodating more passengers and more train and bus service than in the No-Action Alternative. It would make efficient use of a highly constrained area by keeping all WUS-related uses close together south of the H Street Bridge. Alternative A would also benefit the neighborhood by creating new connections between the areas on either side of the rail terminal and it would be compatible with the land use shown in the DCOP Future Land Use Map, namely "High Density Commercial, Federal, and High Density Residential."[17]

This beneficial impact on land use would translate into an improvement in WUS user experience relative to the No-Action Alternative. New access points from First, 2nd, and H Streets into the H Street Concourse would make it easier to enter WUS from the surrounding neighborhoods as well as provide connectivity and continuity from First Street to 2nd Street. Retail in the new concourses could potentially become a destination for local residents as well as tourists. The historic station building would remain the heart of the station and its

[16] DC Office of Zoning, Zoning Handbook, Zones. Accessed http://handbook.dcoz.dc.gov. Accessed on March 13, 2020.

[17] District of Columbia Office of Planning. 2013. *Comprehensive Plan Future Land Use, Map 7*. Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/FutureLandUse7.pdf. Accessed on March 13, 2020.

most visible and inviting entrance, however. By alleviating congestion, especially during peak travel times, the additional concourse space and access points would make it easier for passengers and visitors to appreciate and enjoy the grand architecture of the historic station. With the north-south train hall, which would be designed to be a monumental, compelling gateway space worthy of welcoming visitors and travelers to the nation's capital, areas of architectural interest would extend past the historic station building to encompass part of the track and platform area. In combination with enhanced accessibility through wider platforms, full compliance with ADA-requirements, effective signage, more spacious waiting areas, and greater amounts of natural light, this would make boarding or alighting from trains at WUS a much easier and more enjoyable experience than would be the case in the No-Action Alternative.

Similarly, intercity bus passengers would enjoy the benefits of a more contemporary facility with better amenities and greater functional and visual integration with the rest of the station, including the historic station building, via Concourse A. Improved internal circulation, including additional vertical circulation elements, would provide passengers with better connections to the Metrorail Station, an important mode of access for WUS users, particularly tourists and travelers unfamiliar with the station. The First Street, Central, and H Street Concourses, along with headhouses on H Street, would provide a more direct and welcoming connection for DC Streetcar users.

Property Ownership, Land Acquisitions, and Displacements

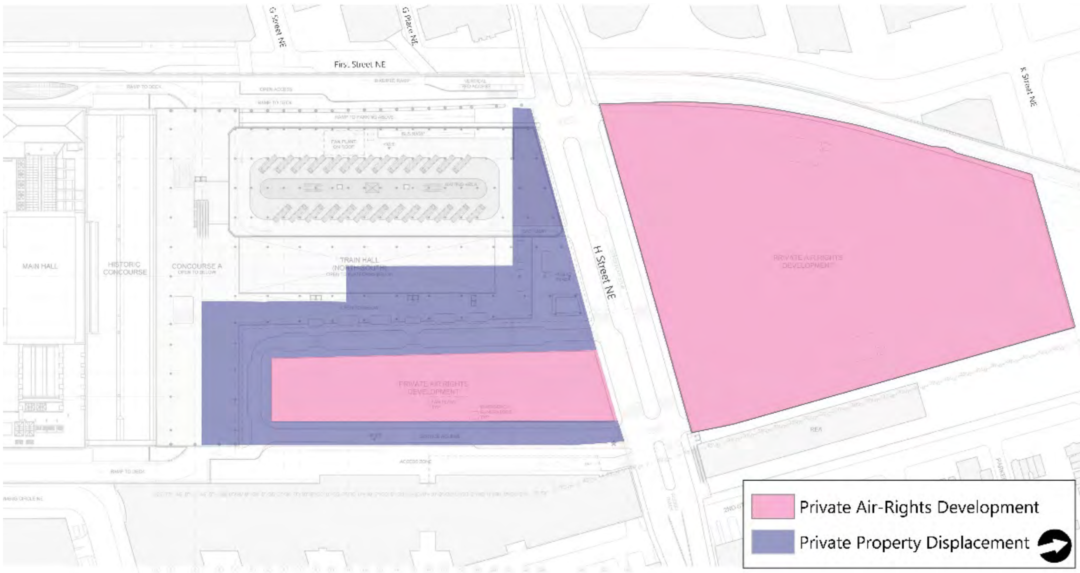
Relative to the No-Action Alternative, Alternative A would have a moderate adverse direct operational impact on property ownership, land acquisitions, and displacements.

Alternative A would have an adverse impact on property ownership because it would involve constructing a portion of the new train hall and access roads adjacent to the train hall within the private air rights above the rail terminal. In this alternative, the area between H Street NE and the bus facility would further be used by the Project to establish an entrance into the station. Altogether, the Project would require acquiring approximately 135,700 square feet of private air-rights property (approximately 3.1 acres) south of H Street.[18] **Figure 9-4** shows the approximate footprint of the private air-rights property that would need to be acquired. It would represent approximately 22 percent of the 622,800-gross-square-foot footprint of the private air rights.[19]

[18] The method of acquisition has not yet been determined and may vary according to the element being accommodated.

[19] Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

Figure 9-4. Approximate Footprint of Property Displacement Impact, Alternative A



The adverse impact would be moderate because, although sizable, the reduction would not preclude developing the remaining air rights. Additionally, the 3.1 acres that would be affected include roads that are needed to serve the private air-rights development as well as WUS. As noted above, WUS-related structures would be concentrated south of H Street NE, leaving the portion of air rights north of H Street fully available for development and minimizing the fragmentation of the developable area.

The Project would also require a property transaction to construct the new H Street Concourse at the location of the existing H Street Tunnel. This is the former at-grade alignment of H Street NE between First and Second Streets NE, which passed under the rail terminal as K Street NE does. This section of H Street was closed off after the construction of the H Street Bridge. It is owned by the District Department of Transportation (DDOT). In Alternative A and all Action Alternatives, the H Street Tunnel would be acquired and replaced by the new concourse.[20]

Relative to the No-Action Alternative, Alternative A would reduce the amount of Federal property for which the private air-rights developer would need an agreement with the Federal government (see **Section 9.5.1.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*). The reduction would be important, as the entire private air-rights deck south of H Street would be within the 70-foot datum area. A property agreement with Amtrak would be potentially needed only for the private air-rights area north of H Street NE, as in the No-Action Alternative.

[20] The exact process through which the tunnel would be acquired has not yet been determined.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative A would have minor to major beneficial direct operational impacts on most relevant local and regional plans, as shown in Table 9-2.

Table 9-2. Impacts of Alternative A on Local and Regional Plans

Local or Regional Plan	Impacts
Comprehensive Plan for The National Capital	Major beneficial impact: Alternative A would support a major goal of the *Comprehensive Plan for the National Capital Transportation Element* that the No-Action Alternative would not support.
H Street NE Strategic Development Plan	Moderate beneficial impact: Alternative A would support important goals of the *H Street NE Strategic Development Plan* that the No-Action Alternative would not support.
NoMA Vision Plan and Development Strategy	Moderate beneficial impact: Alternative A would support important goals of the *NoMA Vision Plan and Development Strategy* that the No-Action Alternative would not support.
Northwest One Redevelopment Plan	Minor beneficial impact: Alternative A would support some of the general goals of the *Northwest One Redevelopment Plan* the No-Action would not support.
Mount Vernon Triangle Action Agenda	No impact: Alternative A would be generally consistent with the *Mount Vernon Triangle Action Agenda* but it is outside the plan's area.

The impacts of Alternative A on plans would generally be beneficial relative to the No-Action Alternative because Alternative A would support many of the goals the No-Action Alternative would not support.

Alternative A would have a major beneficial direct operational impact on the *Comprehensive Plan for the National Capital Transportation Element* because it would expand and modernize WUS, a major consideration of the plan. Applicable plan policies include increasing the utilization of passenger rail service in the Northeast Corridor and points south and west to serve Washington's Union Station, reinforcing its status as a Capital Gateway that announces entry into the capital city. Alternative A would be consistent with these policies.

Alternative A would have a moderate beneficial direct operational impact on the *H Street NE Strategic Development Plan* because it would help achieve the plan's connectivity goals by providing connections between H Street NE and the front of WUS via the north-south train hall and concourses. Alternative A would also support the plan's transit goals by expanding and modernizing multi-modal options at WUS. The impact would be moderate because these goals are only part of a larger set of objectives that Alternative A would neither prevent nor support.

Alternative A would have a moderate beneficial direct operational impact on the *NoMA Vision Plan and Development Strategy* because it would support the plan's connectivity goals by: improving accessibility to transit by bringing the station elements into compliance with Americans with Disabilities Act and Life Safety requirements; [21] providing new pedestrian entrances under the H Street Bridge at First and 2nd Streets NE as well as at the train hall headhouse on H Street NE; and increasing the number of Bikeshare docks and capacity for bicycle storage. The impact would be moderate because these goals are only part of a larger set of objectives that Alternative A would neither prevent nor support.

Alternative A would have a minor beneficial direct operational impact on the *Northwest One Redevelopment Plan.* Although it would not alter K Street NE, Alternative A would contribute to achieving the general connectivity goals of the plan by providing new access points to WUS on and below the H Street Bridge. This beneficial impact would be minor because WUS is outside the plan area and Alternative A would neither preclude nor support most of the plan's objectives.

Alternative A would have no direct operational impact on the *Mount Vernon Triangle Action Agenda*. By providing new retail, Alternative A would generally be consistent with this plan. However, WUS is outside the plan's area and Alternative A would not directly support the plan's objectives.

9.5.2.2 Indirect Operational Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the potential Federal air-rights development in Alternative A would have a minor beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

Alternative A would construct a new bus facility and parking facility in the Federally owned air rights to the southwest of H Street NE. The new structure would rise approximately 91 feet above the crest of the H Street Bridge. Starting approximately 300 feet from the historic station building, the USN zoning designation, which it is assumed would apply by 2040, allows for heights of up to 130 feet above the H Street Bridge. Therefore, air rights space would remain available above the parking facility for potential commercial development that would bring the structure to the maximum permitted height. While the mechanism to allow for this development has not been determined, as an example, FRA could lease the air rights to Union Station Redevelopment Corporation (USRC), which in turn would sublease the development rights.[22]

[21] Life safety requirements include strategies, operations, and technologies that are used to protect people based on building construction, design, and features. Requirements can include but are not limited to fire prevention, emergency plans, smoke detectors, sprinkler systems, and emergency generators.

[22] The FRA-USRC lease and USRC's organizational documents would permit USRC to facilitate the development similar to USRC's role in the 1980s development.

Alternative A would have no indirect adverse impacts on zoning. As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development,* Federal land is not subject to local zoning and NCPC is the zoning authority for Federal land in the District. It can be anticipated that the potential Federal air-rights development would be planned consistent with the USN zoning that applies to the adjacent private air rights. Based on USN zoning, a maximum envelope of approximately 323,720 gross square feet (GSF) would be available for development. If and as planning and design for this development occurs, Floor Area Ratio (FAR) requirements would be reviewed to ensure, as much as practicable, full consistency with USN zoning.

For the purposes of the impact analysis, because of relatively limited amount of space available and its location on top of a parking facility with no opportunity for direct street access, it is assumed that the remaining Federal air rights would be developed as additional commercial parking. [23] This would be a beneficial impact because it would contribute to supporting WUS operations by making use of potentially developable space that otherwise would remain unproductive in a manner consistent with surrounding land uses. This beneficial impact would be minor because such a development would not be fully consistent with the District's Future Land Use Map, which shows mixed-use development with residential, retail, and office space at this location.

Regional Study Area

Relative to the No-Action Alternative, Alternative A would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The improved connectivity and activity at WUS that Alternative A would promote may accelerate medium- or high-density development near WUS. Such development already characterizes most of the Regional Study Area, such as Mount Vernon Triangle and NoMA. Indirect impacts from induced development may be more noticeable along and near the H Street Corridor, currently comprised of a high-activity street (H Street NE) surrounded by residential rowhouse neighborhoods, and across Capitol Hill.

However, the District's zoning regulations and applicable plans would continue to guide the density and character of potential future developments in all these areas. This would avoid the development of incompatible land uses and ensure that neighborhoods evolve in accordance with the District's vision for their future. Therefore, no adverse impacts are anticipated.

[23] This assumption is for analysis purposes only and does not preclude any other type of potential development within the remaining Federal air rights. Of the plausible uses of this space, parking allows for a conservative evaluation of traffic impacts.

9.5.2.3 Construction Impacts

Construction of Alternative A would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction activities in Alternative A would largely be contained within WUS and the rail terminal. Construction would affect rail operations but the phased, east-to-west construction approach would minimize this impact and the resulting disruptions in service as much as possible (see **Section 5.5.2.3**, *Construction Impacts, Commuter and Intercity Railroads* for further discussion of potential impacts on intercity buses and parking during Phase 4). At various times during the construction period (approximately 11 years and 5 months[24]), five areas may be used for access and staging: the West Rail Yard (between K Street and H Street); WUS east access ramp, First Street NE, 2nd Street NE, and the H Street Bridge curbs; the H Street Tunnel; the Railway Express Agency (REA) Parking Lot; and a train access area for potential material delivery and removal in the constricted "throat" of the rail terminal north of K Street NE.

Of these, the WUS east access ramp, First Street NE, and 2nd Street NE curbs are just outside the Project Area. They would be used as access points for personnel, minor equipment, short-term truck parking, and limited material deliveries, generally consistent with their existing use. The H Street Bridge, although within the Project Area, is a public right-of-way. In addition to the uses just listed, it could also be used to place equipment to hoist or pump materials into and out of the site. This would be a short-term use occurring multiple times over the entire period of construction. Close coordination with DDOT and Amtrak would ensure that disruptions to street and rail traffic do not occur or remain minimal.

Use of the West Rail Yard area and the REA Parking Lot for construction access and staging would involve a change in the current use of these areas, including demolitions of existing buildings and construction of access ramps. The West Rail Yard would be a major staging area during Phases 1 to 3 (excluding the Intermediate phase) and part of Phase 4. Use of the REA Parking Lot likely would be mostly during Phase 1. Amtrak, one of the Project Proponents, controls those areas. Construction planning would include minimizing any impacts on the operation of the rail terminal.

The H Street Tunnel (former at-grade H Street right-of-way) would be used for east side access during Phase 1 but that end of the tunnel would be demolished during Phase 1 excavation. The west end of the tunnel would be used for access during Phases 2 through 4.[25]

[24] This includes the 12-month Intermediate Phase between Phases 1 and 2, during which only column removal work would be performed. The need for outside staging space during this phase would be minimal.

[25] As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*, the H Street Tunnel would be acquired to construct the new H Street Concourse.

For the entire duration of the First Street Tunnel column removal work, part of the Retail and Ticketing Concourse would be closed to the public to allow for the removal of columns within the run-through track tunnel as part of the track reconstruction work. This would affect the uses currently accommodated in the eastern third of the concourse, including retail outlets, which would be displaced for up to approximately 2 years and 6 months (total duration of the column removal work including part of Phase 1, the Intermediate Phase, and part of Phase 2).

Preliminary planning indicates that in Alternative A, construction of the deck-level portion of the private air-rights development would not be able to start until the completion of Phase 3 of the construction of the Project. This would be approximately 8 years and 4 months after the start of construction.[26] During Phase 4 of construction, the existing bus facility and parking garage would be demolished and replaced. Intercity bus service and parking would not be available at WUS during this period of approximately 3 years and 1 month (see **Section 5.5.2.3**, *Construction Impacts, Commuter and Intercity Railroads* for further discussion of potential impacts on intercity buses and parking during Phase 4).

9.5.2.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A would have major adverse direct and indirect operational impacts on zoning. This is because the height of the new bus and parking facility and that of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

The impacts of Alternative A on land use, property ownership, and plans relative to existing conditions would be the same as they would be relative to the No-Action Alternative. These impacts would result from features of Alternative A or the Study Area that would not change with the baseline.

9.5.3 Alternative B

9.5.3.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative B would have no direct operational impact on zoning. It would have a major beneficial direct operational impact on land use and development.

Alternative B would have no adverse impact on zoning for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and*

[26] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report.*

Development). The train hall and bus facility would be 42 feet in height above the crest of the H Street Bridge elevation, consistent with both PDR-3 and USN zoning.

Alternative B would have a major beneficial impact on land use by enhancing multi-modal transportation uses and connectivity within the Project Area and providing a more accessible, up-to-date multi-modal facility capable of accommodating more passengers and more train and bus service than in the No-Action Alternative. Alternative B would also benefit the neighborhood by creating new connections between the areas on either side of the rail terminal and it would be compatible with the DCOP Future Land Use Map designation for the Project Area ("High Density Commercial, Federal, and High Density Residential"). Alternative B would keep all WUS-related uses close together south of the H Street Bridge or below ground, making efficient use of a highly constrained area.

Improved land use in Alternative B would have the same beneficial impacts on WUS user experience as in Alternative A. These impacts are described in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*.

Property Ownership, Land Acquisitions, and Displacements

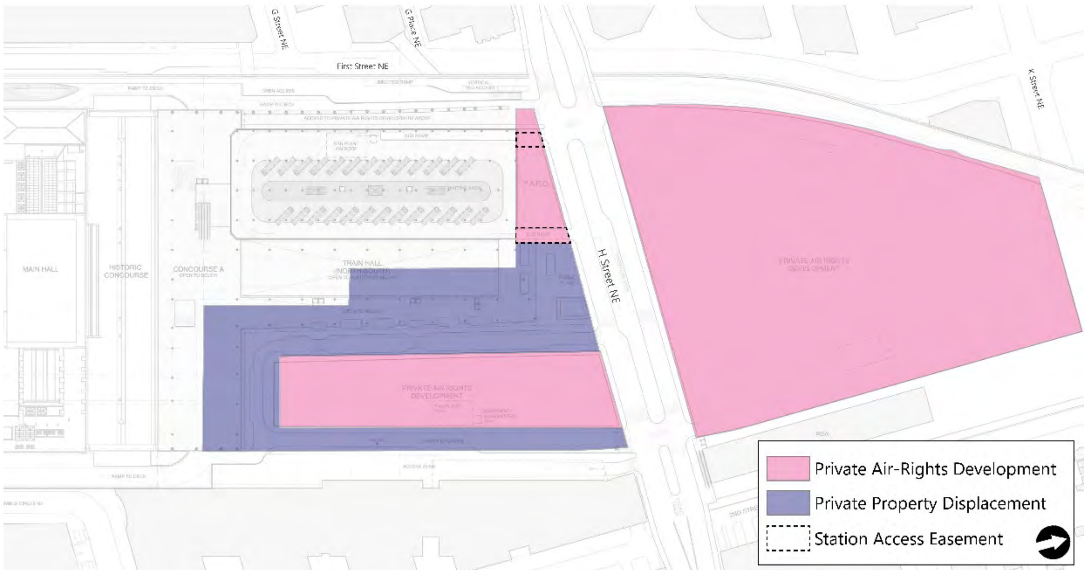
Relative to the No-Action Alternative, Alternative B would have a moderate adverse direct operational impact on property ownership, land acquisitions, and displacements.

Alternative B would have an adverse impact on property ownership because it would involve constructing a portion of the new train hall and access roads adjacent to the train hall within the private air rights above the rail terminal. This would require acquiring approximately 120,800 square feet of private air-rights property (approximately 2.8 acres) south of H Street.[27] **Figure 9-5** shows the approximate footprint of the private air-rights property that would be affected. It would represent approximately 19 percent of the 622,800 gross square foot footprint of the private air rights.[28] Alternative B would also require the acquisition of easements through the private air rights for the access ramps in and out of the bus facility.

27 The method of acquisition has not yet been determined and may vary according to the element being accommodated.

28 Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

Figure 9-5. Approximate Footprint of Property Displacement Impact, Alternative B



These adverse impacts would be moderate for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*). Also as explained in **Section 9.5.2.1**, Alternative B would require acquiring the H Street Tunnel to construct the new H Street Concourse, as in all Action Alternatives. [29] Relative to the No-Action Alternative, Alternative B like Alternative A would reduce the amount of Federal property for which the private air-rights developer would need an agreement with the Federal government (see **Section 9.5.2.1)**.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative B would have minor to major beneficial direct operational impacts on most relevant local and regional plans.

The impacts of Alternative B on local and regional plans would be the same as those of Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Consistency with Local and Regional Plans* and **Table 9-2**).

[29] The exact process through which the tunnel would be acquired has not yet been determined.

9.5.3.2 Indirect Operational Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the development of the Federal air rights in Alternative B would have a major beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning or development; property ownership, land acquisitions, and displacement; or local and regional plans.

Alternative B would construct a new bus facility in the Federally owned air rights to the southwest of H Street NE. The new facility would rise approximately 42 feet above the crest of the H Street Bridge. Within part of this area, approximately 300 feet from the historic station building, the USN zoning designation, which it is assumed would apply by 2040, allows for heights of up to 130 feet above the H Street Bridge. Therefore, air rights would remain available above the facility for potential commercial development that would bring the facility to the maximum permitted height.

As explained for Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*), the mechanism for this development has not been determined but, as an example, it could be achieved through a lease of the Federal air-rights by FRA to USRC, who in turn would sublease the development rights.

Alternative B would have no indirect adverse impacts on zoning. As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development,* for Alternative A, Federal land is not subject to local zoning and NCPC is the zoning authority for Federal land in the District. It can be anticipated that the potential Federal air-right development would be planned consistent with the USN zoning that applies to the adjacent private air rights. Based on USN zoning, a maximum envelope of approximately 917,420 GSF would be available for development. If and as planning and design for this development occurs, FAR requirements would be reviewed to ensure, as much as practicable, full consistency with USN zoning.

Commercial development of this space (assumed to be office space for the purposes of the impact analysis) in Alternative B would have a major beneficial impact on land use within the Project Area, as it would make optimal use of available developable space. It would be consistent with the District's Future Land Use Map, which shows mixed-use development with residential, retail, and office space at this location.

Regional Study Area

Relative to the No-Action Alternative, Alternative B would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The indirect impacts of Alternative B on the Regional Study Area would be the same as those of Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*).

9.5.3.3 Construction Impacts

Construction of Alternative B would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction of Alternative B would generally have similar impacts to those of the construction of Alternative A (see **Section 9.5.2.3**, *Construction Impacts*). The same access and staging areas would be used for similar activities, although for a longer period (14 years and 4 months in total, including the 12-month Intermediate Phase during which only column removal work in the First Street Tunnel would be performed). During Phase 4, or approximately 4 years 11 months, intercity bus service and parking would not be available at WUS.

In Alternative B, construction of the deck-level part of the private air-rights development would not be able to start until the completion of Phase 3 of the construction of the Project. This would be approximately 9 years and 5 months after the beginning of construction.[30]

9.5.3.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative B would have a major adverse indirect operational impact on zoning. This is because the height of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

Other impacts of Alternative B on land use, property ownership, and plans would be the same relative to existing conditions as they would be relative to the No-Action Alternative. These impacts would result from features of Alternative B or the Study Area that would not change with the baseline.

9.5.4 Alternative C

9.5.4.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative C (either option) would have no direct operational impact on zoning. It would have a moderate beneficial direct operational impact on land use and development.

Alternative C would have no adverse impact on zoning for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*). The train hall would be approximately 42 feet in height above the crest of the

[30] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report.*

H Street Bridge elevation, consistent with both PDR-3 and USN zoning. The bus and parking facility would be approximately 59 feet high, consistent with USN zoning.

Alternative C would have a beneficial impact on land use by enhancing multi-modal transportation uses and connectivity within the Project Area and providing a more accessible, up-to-date multi-modal facility capable of accommodating more passengers and more train and bus service than in the No-Action Alternative. Alternative C would also benefit the neighborhood by creating new connections between the areas on either side of the rail terminal and be compatible with the DCOP Future Land Use Map designation ("High Density Commercial, Federal, and High Density Residential"). This beneficial impact would be moderate because of the location of the main bus facility and above-ground parking to the north of the H Street Bridge. This would increase the distance between these facilities and the front of WUS and result in a more spread-out, less cohesive multimodal station than in the No-Action Alternative.

The beneficial impact on land use would translate into an improvement in WUS user experience relative to the No-Action Alternative. In Alternative C as in all Action Alternatives, new access points from First, 2nd, and H Streets into the H Street Concourse would make it easier to enter WUS from the surrounding neighborhoods and provide connectivity and continuity from First Street to 2nd Street. Retail in the new concourses could potentially become a local destination. However, the historic station building would remain the heart of the station and its most visible and inviting entrance. By alleviating congestion, especially during peak travel times, the additional concourse space and access points would make it easier for passengers and visitors to appreciate and enjoy the building's grand architecture. Concourse A and the integrated east-west train hall, which would be designed to be a monumental, compelling space on a scale commensurate with the nation's capital, would extend the area of architectural interest past the historic station building and open up a visual connection toward the track and platform area. This would create in the visitor a better sense of being at a train station than would be the case in the No-Action Alternative, in which tracks and platforms would remain largely out of sight as they are today. This visual connection, in combination with enhanced accessibility through wider platforms, full compliance with ADA-requirements, effective signage, more spacious waiting areas, and greater amounts of natural light, would make boarding or alighting from trains at WUS a much easier, more enjoyable experience than in the No-Action Alternative.

Intercity bus passengers would enjoy the benefits of a more contemporary facility with better amenities. However, the greater distance between the main bus facility and the historic station building would weaken the functional and visual integration between WUS's intermodal elements and detract somewhat from bus riders' experience of the station as a unified place (see **Section 16.5.4.1**, *Direct Operational Impacts*, for further information on increased distance between the bus facility and the historic station building). Passengers of buses using the bus pick-up and drop-off area would enjoy a more integrated experience, with a direct connection to the rest of the station, including the Historic Station Building, via Concourse A.

As in the other Action Alternatives, improved internal circulation, including additional vertical circulation elements, would provide passengers with better connections to the Metrorail Station, an important mode of access for WUS users, particularly tourists and travelers unfamiliar with the station. The First Street, Central, and H Street Concourses, along with headhouses and the main bus facility on H Street, would provide a more direct and welcoming connection for DC Streetcar users.

Property Ownership, Land Acquisitions, and Displacements

Relative to the No-Action Alternative, Alternative C (either option) would have a major adverse direct operational impact on property ownership, land acquisitions, and displacements.

Alternative C would have a major adverse impact on property ownership. It would involve constructing part of the train hall and bus pick-up and drop-off area, and the entirety of the bus facility and above-ground parking facility, within the private air rights above the rail terminal. This would require acquiring approximately 201,200 square feet (East Option) or approximately 208,000 square feet (West Option) of private air-rights property (approximately 4.6 and 4.8 acres, respectively) south and north of H Street NE.[31]

Figures 9-6 and 9-7 show the approximate footprint of the private air-rights property that would need to be acquired in each option, respectively. It would represent approximately 40 percent (East Option) or 39 percent (West Option) of the 622,800-gross-square-foot footprint of the private air rights.[32] Some space would also be needed for easements to accommodate daylighting and access features.[33] The loss of total developable envelope would be less than suggested by the reduction in footprint because the remaining air rights above the parking facility (which would rise approximately 59 feet above the H Street Bridge elevation) would potentially remain available for development. Additionally, the reduction estimate includes areas for roadways that would be needed to serve the private development as well as WUS. The total adverse impact would still be major because of the large square footage of private air rights that would need to be acquired and their distribution across the entire rail terminal, both south and north of H Street NE.

31 The method of acquisition has not yet been determined and may vary according to the element being accommodated.

32 Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

33 Daylighting features would be located in the Daylight Access Zone. The shape, number, and exact location of the daylighting feature easements shown in Figures 9-6 and 9-7 are for illustrative purposes only.

Figure 9-6. Approximate Footprint of Property Displacement Impact, Alternative C-East Option

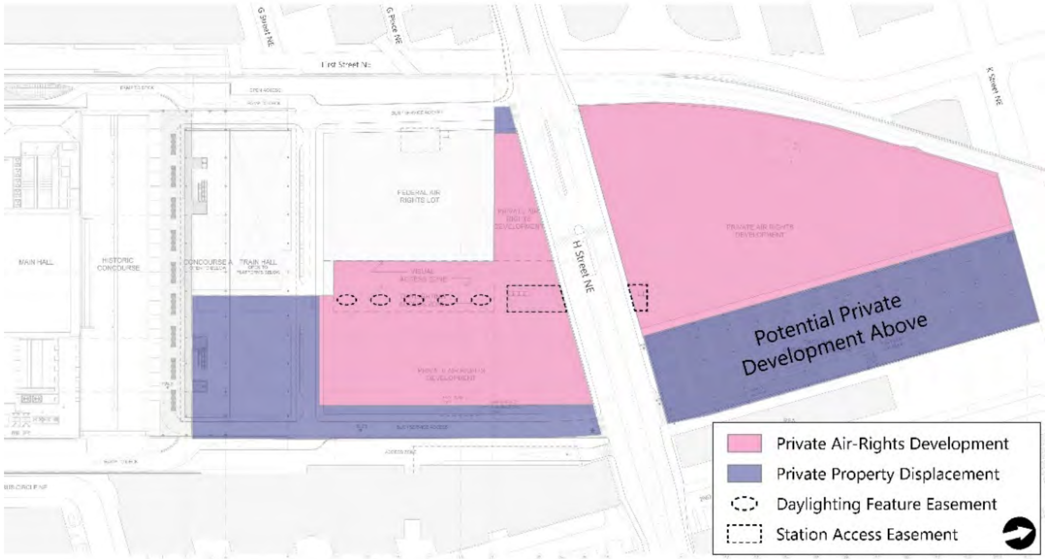


Figure 9-7. Approximate Footprint of Property Displacement Impact, Alternative C-West Option

As explained for Alternative A in **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*, Alternative C, like all Action Alternatives, would require acquiring the H Street Tunnel to construct the new H Street Concourse. [34]

Relative to the No-Action Alternative, Alternative C with either option would reduce the amount of property for which the private developer would need agreements with the Federal government and Amtrak. South of H Street NE, the reduction would be small, as most of the private air rights within the 80-foot datum area (see **Section 9.5.1.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*) would remain available for private development. North of H Street NE, a property agreement with Amtrak would be potentially needed only for the private air-rights area not acquired for construction of the new bus and above-ground parking facilities.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative C (either option) would have minor to major beneficial direct operational impacts on most relevant local and regional plans.

The impacts of Alternative C on local and regional plan would be the same as those of Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Consistency with Local and Regional Plans* and **Table 9-2**).

9.5.4.2 Indirect Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the development of the Federal air rights in Alternative C (either option) would have a major beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

Alternative C would demolish the existing parking garage. The new bus pick-up and drop-off area and train hall would occupy part of the demolished garage's footprint. The remainder would be available for potential commercial development up to the height permitted under the future USN zoning designation. As explained for Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*), no mechanism has yet been determined for this process. As an example, it could be achieved through a lease of the Federal air-rights by FRA to USRC, who in turn would sublease the development rights.

Alternative C would have no indirect adverse impacts on zoning. As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development,* for Alternative A, Federal land is not subject to local zoning and NCPC is the zoning authority for Federal land in

[34] The exact process through which the tunnel would be acquired has not yet been determined.

the District. It can be anticipated that the potential Federal air-right development would be planned consistent with the USN zoning that applies to the adjacent private air rights. Based on USN zoning, a maximum envelope of approximately 952,600 GSF would be available for development. If and as planning and design for this development occurs, FAR requirements would be reviewed to ensure, as much as practicable, full consistency with USN zoning.

Commercial development of this space (assumed to be office space for the purposes of the impact analysis) in Alternative C would be a major beneficial impact on land use within the Project Area because it would make optimal use of the space available for development and fill in what would otherwise remain a major gap in land coverage in the Project Area. It would be consistent with the District's Future Land Use Map, which shows mixed-use development with residential, retail, and office space at this location.

Regional Study Area

Relative to the No-Action Alternative, Alternative C (either option) would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The indirect impacts of Alternative C in the Regional Study Area would be the same as those of Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*).

9.5.4.3 Construction Impacts

Construction of Alternative C (either option) would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction of Alternative C would generally have similar impacts to those of the construction of Alternative A (see **Section 9.5.2.3**, *Construction Impacts*). The same access and staging areas would be used for similar activities, although for a longer period (approximately 12 years and 3 months in total, including the 12-month Intermediate Phase during which only column removal work in the First Street Tunnel would be performed).

In Alternative C, construction of the deck-level part of the private air-rights development would not be able to begin until the completion of Phase 3 of the construction of the Project. This would be approximately 8 years and 3 months after the start of construction.[35]

The bus facility and parking facility would be demolished during Phase 4 of construction. In Alternative C with the West Option, intercity bus service and parking would not be available at WUS for the duration of Phase 4, or approximately 4 years, until the new parking facility and bus facility are completed. Under Alternative C with the East Option, this impact would

[35] Amtrak. November 2019. *Washington Union Station Terminal Infrastructure Project Constructability Report.*

not occur (see **Section 5.5.4.3**, *Construction Impacts* for further discussion of potential impacts on intercity buses and parking during Phase 4).

9.5.4.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative C (either option) would have major adverse indirect operational impacts on zoning. This is because the height of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

Other impacts of Alternative C on land use, property ownership, and plans would be the same relative to existing conditions. These impacts would result from features of Alternative C or the Study Area that would not change with the baseline.

9.5.5 Alternative D

9.5.5.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative D would have no direct operational impact on zoning. It would have a moderate beneficial direct operational impact on land use and development.

Alternative D would have no adverse impact on zoning for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*). The train hall would be approximately 44 feet in height above the crest of the H Street Bridge elevation, consistent with both PDR-3 and USN zoning. The above-ground parking facility, just south of K Street NE, would be 43 feet high, consistent with the USN designation.

Alternative D would have a beneficial impact on land use by enhancing multi-modal transportation uses and connectivity within the Project Area and providing a more accessible, up-to-date multi-modal facility capable of accommodating more passengers and more train and bus service than in the No-Action Alternative. Alternative D would also benefit the neighborhood by creating new connections between the areas on either side of the rail terminal and be compatible with the DCOP Future Land Use Map designation ("High Density Commercial, Federal, and High Density Residential"). This beneficial impact would be moderate because of the location of the above-ground parking facility to the north of the H Street Bridge, just south of K Street. This would increase walking distances for some WUS users and make a more spread-out, less cohesive multimodal station than in the No-Action Alternative.

This beneficial impact on land use would translate into an improvement in WUS user experience relative to the No-Action Alternative. In Alternative D as in all Action Alternatives, new access points from First, 2nd, and H Streets into the H Street Concourse would make it easier to enter WUS from the surrounding neighborhoods and provide connectivity and continuity from First Street to 2nd Street. Retail in the new concourses could potentially become a local destination. However, the historic station building would remain the heart of the station and its most visible and inviting entrance. By alleviating congestion, especially during peak travel times, the additional concourse space and access points would make it easier for passengers and visitors to appreciate and enjoy the building's grand architecture. Concourse A and the integrated east-west train hall, which would be designed to be a monumental, compelling space on a scale commensurate with the nation's capital, would extend the area of architectural interest past the historic station building and open up a visual connection toward the track and platform area. This would create in the visitor a better sense of being at a train station than would be the case in the No-Action Alternative, in which tracks and platforms would remain largely out of sight as they are today. This visual connection, in combination with enhanced accessibility through wider platforms, full compliance with ADA-requirements, effective signage, more spacious waiting areas, and greater amounts of natural light, would make boarding or alighting from trains at WUS a much easier, more enjoyable experience than in the No-Action Alternative.

Intercity bus passengers would enjoy the benefits of a facility functionally and visually integrated with the train hall and the rest of the station, including the historic station building, reinforcing the experience of WUS as a single place and multimodal transportation center. As in the other Action Alternatives, improved internal circulation, including additional vertical circulation elements, would provide passengers with better connections to the Metrorail Station, an important mode of access for WUS users, particularly tourists and travelers unfamiliar with the station. The First Street, Central, and H Street Concourses, along with headhouses and the main bus facility on H Street, would provide a more direct and welcoming connection for DC Streetcar users.

Property Ownership, Land Acquisitions, and Displacements

Relative to the No-Action Alternative, Alternative D would have a moderate adverse direct operational impact on property ownership, land acquisitions, and displacements.

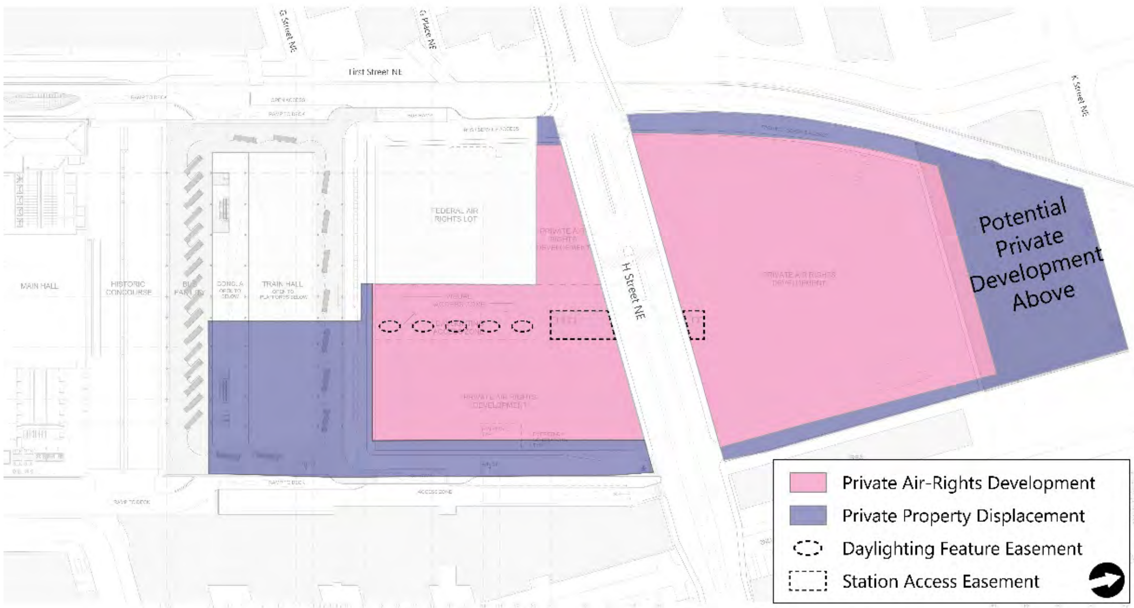
Alternative D would have a major adverse impact on property ownership because it would involve constructing part of the train hall and bus facility, as well as the above-ground parking facility, within the private air rights above the rail terminal. This would require acquiring approximately 211,100 square feet of private air-rights property (approximately 4.8 acres) south and north of H Street NE.[36]

Figure 9-8 shows the approximate footprint of the private air-rights property that would need to be acquired. It would represent approximately 37 percent of the 622,800-gross-

[36] The method of acquisition has not yet been determined and may vary according to the element being accommodated.

square-foot footprint of the private air rights.[37] Space would also be needed to accommodate easements for daylighting and access features.[38] The actual loss in total developable envelope would be less than is suggested by the reduction in footprint because the remaining air rights above the parking facility (which would rise approximately 43 feet above the H Street Bridge elevation) would potentially be available for development. Additionally, the reduction estimate takes into account areas for roadways that would be needed to serve the private development as well as WUS.

Figure 9-8. Approximate Footprint of Property Displacement Impact, Alternative D



The net impact would be moderate because, despite the substantial amount of private air-rights space that would need to be acquired, it would be located on the border of the private air-rights area, minimizing the fragmentation of the developable space.

As explained for Alternative A in **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*, Alternative D, like all Action Alternatives, would require acquiring the H Street Tunnel to construct the new H Street Concourse.[39]

Relative to the No-Action Alternative, Alternative D would reduce the amount of property for which the private developer would need agreements with the Federal government and Amtrak. South of H Street NE, the reduction would be small, as most of the private air rights within the 80-foot datum area (see **Section 9.5.1.1**, *Direct Operational Impacts, Property*

37 Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

38 Daylighting features would be located in the Daylight Access Zone. The shape, number, and exact location of the daylighting feature easements shown in Figure 9-8 are for illustrative purposes only.

39 The exact process through which the tunnel would be acquired has not yet been determined.

Ownership, Land Acquisitions, and Displacements) would remain available for private development. North of H Street NE, a property agreement with Amtrak would potentially be needed only for the private air-rights area not acquired for construction of the new above-ground parking facility.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative D would have minor to major beneficial direct operational impacts on most relevant local and regional plans.

The impacts of Alternative D on local and regional plan would be the same as those of Alternative A (**Section 9.5.2.1**, *Direct Operational Impacts, Consistency with Local and Regional Plans* and **Table 9-2**).

9.5.5.2 Indirect Operational Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the development of the Federal air rights in Alternative D would have a major beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

Alternative D would demolish the existing parking garage. The train hall and new bus facility would occupy part of the demolished garage's footprint. The remainder would be available for potential commercial development up to the height permitted under the future USN zoning designation as explained for Alternative A and the other Action Alternatives (see **Section 9.5.2.2***, Indirect Operational Impacts, Potential Federal Air-Rights Development*). The specific mechanism for this development has not yet been determined but, as an example, it could be achieved through a lease of the Federal air-rights by FRA to USRC, who in turn would sublease the development rights.

Alternative D would have no indirect adverse impacts on zoning. As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development,* for Alternative A, Federal land is not subject to local zoning and NCPC is the zoning authority for Federal land in the District. It can be anticipated that the potential Federal air-right development would be planned consistent with the USN zoning that applies to the adjacent private air rights. Based on USN zoning, a maximum envelope of approximately 688,050 GSF would be available for development. If and as planning and design for this development occurs, FAR requirements would be reviewed to ensure, as much as practicable, full consistency with USN zoning.

Commercial development of this space (assumed to be office space for the purposes of the impact analysis) in Alternative D would be a major beneficial impact on land use within the Project Area. It would be consistent with the District's Future Land Use Map, which shows mixed-use development with residential, retail, and office space at this location. The beneficial impact would be major because it would optimize the use of developable space in the Project Area and fill in what would otherwise remain a major gap in land coverage after the demolition of the existing parking garage.

Regional Study Area

Relative to the No-Action Alternative, Alternative D would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The indirect impacts of Alternative D in the Regional Study Area would be the same as those of Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*).

9.5.5.3 Construction Impacts

Construction of Alternative D would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction of Alternative D would have similar impacts to those of construction of Alternative C (see **Section 9.5.4.3**, *Construction Impacts*).

9.5.5.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative D would have major adverse indirect operational impacts on zoning. This is because the height of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

Other impacts of Alternative D on land use, property ownership, and plans would be the same relative to existing conditions. These impacts would result from features of Alternative D or the Study Area that would not change with the baseline.

9.5.6 Alternative E

9.5.6.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative E would have no direct operational impact on zoning. It would have a major beneficial direct operational impact on land use and development.

Alternative E would have no adverse impact on zoning for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*). The train hall would be approximately 44 feet in height above the crest of the H Street Bridge elevation, consistent with both PDR-3 and USN zoning.

Like Alternative B and for similar reasons, Alternative E would have a major beneficial impact on land use within the Project Area (See **Section 9.5.3.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*).

Improved land use in Alternative E would have the same beneficial impacts on WUS user experience as in Alternative D. These impacts are described in **Section 9.5.5.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*.

Property Ownership, Land Acquisitions, and Displacements

Relative to the No-Action Alternative, Alternative E would have a moderate adverse direct operational impact on property ownership, land acquisitions, and displacements.

Alternative E would have a moderate adverse impact on property ownership because it would involve constructing part of the train hall and bus facility within the private air rights above the rail terminal. This would require acquiring approximately 85,000 square feet of private air-rights property (approximately 1.9 acres) south of H Street NE.[40]

Figure 9-9 shows the approximate footprint of the private air-rights property that would need to be acquired. It would represent approximately 20 percent of the 622,800-gross-square-foot footprint of the private air rights.[41] Additional space would be needed to accommodate daylighting and access easements.[42]

The adverse impact would be moderate for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*).

As explained for Alternative A in **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*, Alternative E, like all Action Alternatives, would require acquiring the H Street Tunnel to construct the new H Street Concourse.[43]

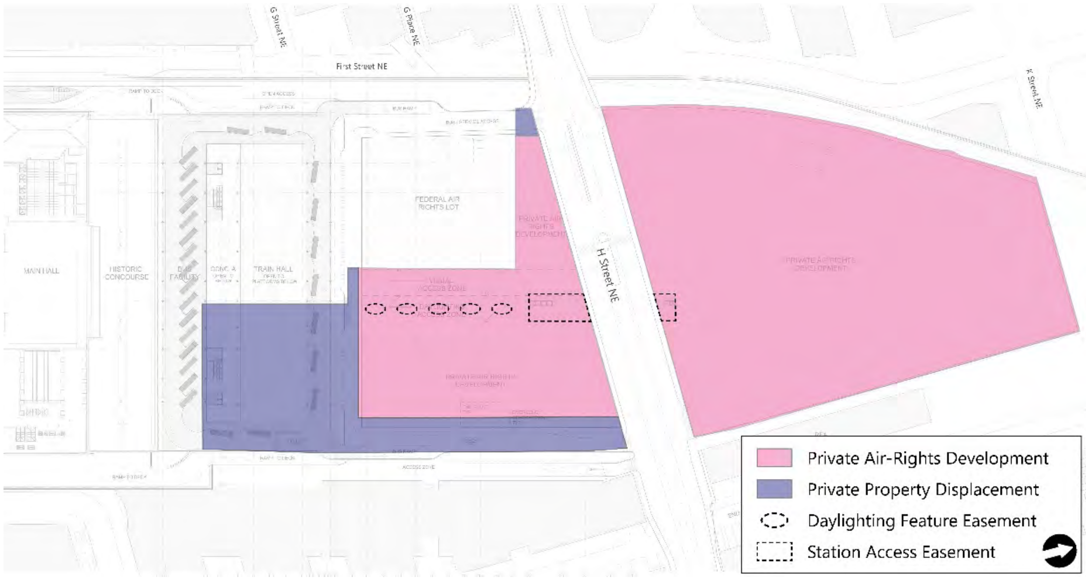
[40] The method of acquisition has not yet been determined and may vary according to the element being accommodated.

[41] Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

[42] Daylighting features would be located in the Daylight Access Zone. The shape, number, and exact location of the daylighting feature easements shown in Figure 9-9 are for illustrative purposes only.

[43] The exact process through which the tunnel would be acquired has not yet been determined.

Figure 9-9. Property Displacement Impacts, Alternative E



Relative to the No-Action Alternative, Alternative E would reduce the amount of property for which the private developer would need an agreement with the Federal government. The reduction would be moderate, as most of the private air rights within the 80-foot datum area (see **Section 9.5.1.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*) would remain available for private development. A property agreement with Amtrak would potentially be needed north of H Street, as in the No-Action Alternative.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative E would have minor to major beneficial direct operational impacts on most relevant local and regional plans.

The impacts of Alternative E on local and regional plan would be the same as those of Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Consistency with Local and Regional Plans* and **Table 9-2**).

9.5.6.2 Indirect Operational Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the development of the Federal air rights in Alternative E would have a major beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

In Alternative E, the same envelope of Federal air rights would be available for potential development as in Alternative D. Impacts would be the same (see **Section 9.5.6.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*).

Regional Study Area

Relative to the No-Action Alternative, Alternative E would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The indirect impacts of Alternative E in the Regional Study Area would be the same as those of Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*).

9.5.6.3 Construction Impacts

Construction of Alternative E would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction of Alternative E would have similar impacts to those of construction of Alternative B (see **Section 9.5.3.3**, *Construction Impacts*).

9.5.6.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative E would have major adverse indirect operational impacts on zoning. This is because the height of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

Other impacts of Alternative E on land use, property ownership, and plans would be the same relative to existing conditions as they would be relative to the No-Action Alternative. These impacts would result from features of Alternative E or the Study Area that would not change with the baseline.

9.5.7 Alternative A-C (Preferred Alternative)

9.5.7.1 Direct Operational Impacts

Zoning, Land Use, and Development

Relative to the No-Action Alternative, Alternative A-C would have no direct operational impact on zoning. It would have a major beneficial direct operational impact on land use and development.

The impacts of Alternative A-C on zoning, land use, and development would be the same as those of Alternative A, described in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development*.

The beneficial impact on land use would translate into an improvement in WUS user experience relative to the No-Action Alternative. New access points from First, 2nd, and H Streets into the H Street Concourse would make it easier to enter WUS from the surrounding neighborhoods as well as provide connectivity and continuity from First Street to 2nd Street. Retail in the new concourses could potentially become a destination for local residents as well as tourists. The historic station building would remain the heart of the station and its most visible and inviting entrance, however. By alleviating congestion, especially during peak travel times, the additional concourse space and access points would make it easier for passengers and visitors to appreciate and enjoy the grand architecture of the historic station.

Concourse A and the integrated east-west train hall, which would be designed to be a monumental, compelling space on a scale commensurate with the nation's capital, would extend the area of architectural interest past the historic station building and open up a visual connection toward the track and platform area. This would create in the visitor a better sense of being at a train station than would be the case in the No-Action Alternative, in which tracks and platforms would remain largely out of sight as they are today. This visual connection, in combination with enhanced accessibility through wider platforms, full compliance with ADA-requirements, effective signage, more spacious waiting areas, and greater amounts of natural light, would make boarding or alighting from trains at WUS a much easier, more enjoyable experience than in the No-Action Alternative.

Similarly, intercity bus passengers would enjoy the benefits of a more modern facility with better amenities and greater functional and visual integration with the rest of the station, including the historic station building, via Concourse A. In Alternative A-C as in the other Action Alternatives, improved internal circulation, including additional vertical circulation elements, would provide passengers with better connections to the Metrorail Station, an important mode of access for WUS users, particularly tourists and travelers unfamiliar with the station. The First Street, Central, and H Street Concourses, along with headhouses and the main bus facility on H Street, would provide a more direct and welcoming connection for DC Streetcar users.

Property Ownership, Land Acquisitions, and Displacements

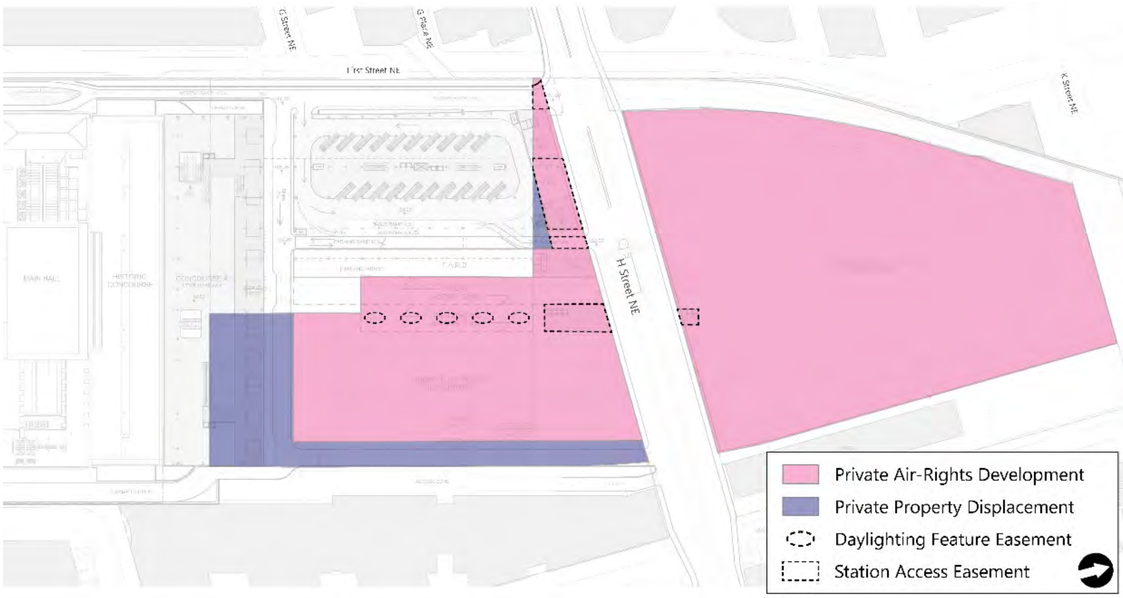
Relative to the No-Action Alternative, Alternative A-C would have a moderate adverse direct operational impact on property ownership, land acquisitions, and displacements.

Alternative A-C would have an adverse impact on property ownership because it would involve constructing a portion of the new train hall and east-west access road within the private air rights above the rail terminal. This would require acquiring approximately 49,500 square feet of private air-rights property (approximately 1.1 acres) south of H Street.[44] **Figure 9-10** shows the approximate footprint of the private air-rights property that would need to

[44] The method of acquisition has not yet been determined and may vary according to the element being accommodated.

be acquired. It would represent approximately 7 percent of the 622,800 gross square foot footprint of the private air rights.[45] Additional space would be needed to accommodate daylighting and access easements, including an entrance to the bus facility.[46]

Figure 9-10. Approximate Footprint of Property Displacement Impact, Alternative A-C



The adverse impact would be moderate for the same reasons as explained for Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Property Ownership, Land Acquisitions, and Displacements*.[47] Also as explained in **Section 9.5.2.1**, Alternative A-C would require acquiring the H Street Tunnel to construct the new H Street Concourse, as in all Action Alternatives.

Relative to the No-Action Alternative, Alternative A-C would reduce the amount of Federal property for which the private air-rights developer would need an agreement with the Federal government (see **Section 9.5.1.1**, *Direct Operational Impacts, Property Ownership, Land Acquisition, and Displacements*). The reduction would be important, as the entire private deck south of H Street would be within the 70-foot datum area. A property agreement with Amtrak would be potentially needed only for the private air-rights area north of H Street NE, as in the No-Action Alternative

[45] Total area as stated in Letter from Akridge to FRA dated May 31, 2016.

[46] Daylighting features would be located in the Daylight Access Zone. The shape, number, and exact location of the daylighting feature easements shown in Figure 9-10 are for illustrative purposes only.

[47] The exact process through which the tunnel would be acquired has not yet been determined.

Consistency with Local and Regional Plans

Relative to the No-Action Alternative, Alternative A-C would have minor to major beneficial direct operational impacts on most relevant local and regional plans.

The impacts of Alternative A-C on local and regional plans would be the same as those of Alternative A (see **Section 9.5.2.1**, *Direct Operational Impacts, Consistency with Local and Regional Plans* and **Table 9-2**).

9.5.7.2 Indirect Operational Impacts

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, the development of the Federal air rights in Alternative A-C would have a major beneficial indirect operational impact on land use. It would have no adverse indirect operational impacts on zoning or development; property ownership, land acquisitions, and displacement; or local and regional plans.

Alternative A-C would construct a new bus facility and parking facility in the Federally owned air rights to the southwest of H Street NE. The new facility would rise approximately 104 feet above the crest of the H Street Bridge. Within part of this area, approximately 300 feet from the historic station building, the USN zoning designation, which it is assumed would apply by 2040, allows for heights of up to 130 feet above the H Street Bridge. Therefore, air rights would remain available above the facility for potential commercial development that would bring the facility to the maximum permitted height. Space within the Federal air rights would also be available along the eastern side of the bus facility and parking facility. As explained for Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*), the mechanism for this development has not yet been determined. As an example, it could be achieved through a lease of the Federal air-rights by FRA to USRC, who in turn would sublease the development rights.

Alternative A-C would have no indirect adverse impacts on zoning. As explained in **Section 9.5.2.1**, *Direct Operational Impacts, Zoning, Land Use, and Development,* for Alternative A, Federal land is not subject to local zoning and NCPC is the zoning authority for Federal land in the District. It can be anticipated that the potential Federal air-right development would be planned consistent with the USN zoning that applies to the adjacent private air rights. Based on USN zoning, a maximum envelope of approximately 380,000 GSF would be available for development. If and as planning and design for this development occurs, FAR requirements would be reviewed to ensure, as much as practicable, full consistency with USN zoning.

Commercial development of this space (assumed to be office space for the purposes of the impact analysis) in Alternative A-C would be a major beneficial impact on land use within the Project Area, as it would make optimal use of available developable space. It would be consistent with the District's Future Land Use Map, which shows mixed-use development with residential, retail, and office space at this location.

Regional Study Area

Relative to the No-Action Alternative, Alternative A-C would have no adverse indirect operational impacts on zoning, land use, or development; property ownership, land acquisitions, and displacement; or local and regional plans.

The indirect impacts of Alternative A-C on the Regional Study Area would be the same as those of Alternative A (see **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*).

9.5.7.3 Construction Impacts

Construction of Alternative A-C would have moderate adverse impacts on land use and development. It would have no impacts on zoning; property ownership, land acquisitions, and displacement; or local and regional plans.

Construction of Alternative A-C would have the same impacts to those of the construction of Alternative A (see **Section 9.5.2.3**, *Construction Impacts*). The same access and staging areas would be used for similar activities. Construction would require the same amount of time (approximately 11 years and 5 months in total, including the 12-month Intermediate Phase of reduced activity).

9.5.7.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would have a major adverse indirect operational impact on zoning. This is because the height of the potential Federal air-rights development would exceed what the existing PDR-3 zoning allows.

Other impacts of Alternative A-C on land use, property ownership, and plans would be the same relative to existing conditions as they would be relative to the No-Action Alternative. These impacts would result from features of Alternative A-C or the Study Area that would not change with the baseline.

9.6 Comparison of Alternatives

Table 9-3 compares the impacts of the alternatives, including the No-Action Alternative. All alternatives would be consistent with anticipated future zoning in the Project Area and result in more varied and intensive land use than currently. The No-Action Alternative would differ from the Action Alternatives in the following respects:

- It would not enhance multi-modal transportation uses in the Project Area or improve connectivity with surrounding neighborhoods. As such, unlike the Action Alternatives, it would not support most relevant local and regional plans.

- It would allow for the full development of the private air rights above the rail terminal. The Action Alternatives would require acquiring part of these air rights to accommodate some of the Project elements.
- In areas where the lower limit of the private air rights is at 80 feet, construction of the private air-rights deck would potentially encroach into Federal and Amtrak property and require an agreement with the Federal government and Amtrak.
- It would not provide the opportunity to develop the Federally owned air rights above the rail terminal. Part or all of the Federal air rights could potentially be developed with commercial uses in all Action Alternatives.

Among themselves, the Action Alternatives would differ in several respects:

- **Land Use**: All Action Alternatives would enhance multimodal land uses within the Project Area. However, they would vary regarding where the various Project elements are located in relation to each other. Alternatives A, A-C, B, and E would place all Project elements south of the H Street Bridge or below-ground, making an efficient use of a very constrained area. The other Action Alternatives would have above-ground elements both north and south of the H Street Bridge, resulting in a more spread-out layout and greater distances among elements. Alternative D would be the alternative with the greatest distance between the above-ground parking facility and the front of WUS. Alternative C with the East Option would be the alternative with the greatest distance between the bus facility and the front of WUS, followed by Alternative C with the West Option. As a result, while all Action Alternatives would result in a marked improvement in WUS user experience, this improvement would be somewhat less in Alternatives C and D.
- **Private Property**: All Action Alternatives would require acquiring some of the privately owned air rights above WUS. Amount and spatial distribution would vary depending on the alternative. Alternative A-C would have the smallest impact, with approximately 1.1 acres, all south of the H Street Bridge. Alternative C with the West Option and Alternative D would have the greatest impact, with a total of approximately 4.8 acres on both sides of the bridge.
- **Federal and Amtrak Property**: In all Action Alternatives, the potential amount of property for which the private air-rights developer would need an agreement with the Federal government would be reduced relative to the No-Action Alternative, due to the acquisition for the Project of some of the private air rights within the 80-foot datum area. Alternatives A and B would result in the greatest reduction and Alternatives C and A-C in the smallest one. Only Alternatives C and D would also reduce the potential need for an agreement with Amtrak north of H Street NE.
- **Federal Air Rights**: All Action Alternatives would allow for the potential development of the Federally owned air rights that would not be needed for Project elements. The size of the maximum developable envelope would vary with the alternative, with

Alternative A offering the smallest envelope and Alternative C (either option) the largest one.

9.7 Avoidance, Minimization and Mitigation Evaluation

During conceptual design of the Action Alternatives, minimization and avoidance measures to land use impacts were considered to the greatest extent possible. The Action Alternatives were designed to be consistent with the zoning, land use, and regional and local plans. All the Action Alternatives would have an adverse impact on private property due to the displacement of approximately 1.1 to 4.8 acres of private air rights. Acquisition of the needed property would be conducted consistent with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, which would ensure the owner of the air rights received just compensation for the property.[48]

All Action Alternatives would also potentially result in construction delays for the development of the adjacent private air rights. Such delays would be minimized as much as practicable through coordination by the Project Proponents with the private air-rights developer during construction planning.

9.8 Permits and Regulatory Compliance

The following permits and processes (**Table 9-4**) will potentially need to be completed and authorized for land use, planning, and property-related aspects of the Project, to comply with the listed laws and regulations.

[48] 49 CFR 24, *Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally-Assisted Programs*.

Table 9-3. Comparison of Alternatives

Impact Category	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C – East Option	Alternative C – West Option	Alternative D	Alternative E	Alternative A-C (Preferred)
Zoning	Direct Operational	No impacts.							
	Indirect Operational	No impacts.							
	Construction	No impacts.							
Land Use and Development	Direct Operational	Major beneficial impact due to private air rights development.	Major beneficial impact due to enhanced multimodal uses and increased connectivity. All WUS uses concentrated south of H Street Bridge.	Major beneficial impact due to enhanced multimodal uses and increased connectivity. All WUS uses south of the H Street Bridge or below-ground.	Moderate beneficial impact due to enhanced multimodal uses and increased connectivity. Above-ground parking and bus facility to the northeast of H Street Bridge.	Moderate beneficial impact due to enhanced multimodal uses and increased connectivity. Above-ground parking and bus facility to the northwest of H Street Bridge.	Moderate beneficial impact due to enhanced multimodal uses and increased connectivity. Above-ground parking south of K Street NE.	Major beneficial impact due to enhanced multimodal uses and increased connectivity. All WUS uses south of the H Street Bridge or below-ground.	Major beneficial impact due to enhanced multimodal uses and increased connectivity. All WUS uses concentrated south of H Street Bridge.
	Indirect Operational	No impacts.	Minor beneficial impact from potential Federal air-rights development.	Major beneficial impact from potential Federal air-rights development.					
	Construction	Minor adverse impacts.	Moderate adverse impacts. Construction of deck-level part of the private air-rights development could not start until approximately 8 years and 4 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.	Moderate adverse impacts. Construction of deck-level part of the private air-rights development could not start until approximately 9 years and 5 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.	Moderate adverse impacts. Construction of deck-level part of the private air-right development could not start until approximately 8 years and 3 months from the start of construction.	Moderate adverse impacts. Construction of deck-level part of the private air-right development could not start until approximately 8 years and 3 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.	Moderate adverse impacts. Construction of deck-level part of the private air-right development could not start until approximately 8 years and 3 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.	Moderate adverse impacts. Construction of deck-level part of the private air-right development could not start until approximately 9 years and 5 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.	Moderate adverse impacts. Construction of deck-level part of the private air-rights development could not start until approximately 8 years and 4 months from the start of construction. Interim bus and parking facility in private air rights during Phase 4.
Property	Direct Operational	No impacts. Potential encroachment of the private air-rights development deck into Federal and Amtrak property	Moderate adverse impact. Acquisition of approximately 3.1 acres all south of H Street Bridge.	Moderate adverse impact. Acquisition of approximately 2.8 acres all south of H Street Bridge	Major adverse impact. Acquisition of approximately 4.6 acres on both sides of H Street Bridge.	Major adverse impact. Acquisition of approximately 4.8 acres on both sides of H Street Bridge.	Moderate adverse impact. Acquisition of approximately 4.8 acres on both sides of H Street Bridge but limited fragmentation.	Moderate adverse impact. Acquisition of approximately 1.9 acres all south of H Street Bridge.	Moderate adverse impact. Acquisition of approximately 1.1 acres all south of H Street Bridge.
	Indirect Operational	No Impacts.							
	Construction	No Impacts.							

Impact Category	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C – East Option	Alternative C – West Option	Alternative D	Alternative E	Alternative A-C (Preferred)
Local and Regional Plans	**Direct Operational**	Minor Adverse Impact. Generally inconsistent due to no improvement to connectivity.	Major to minor beneficial Impacts depending on the plan. Consistent with the relevant goals and objectives of most plans.						
	Indirect Operational	No Impacts.							
	Construction	No Impacts.							

Table 9-4. List of Potential Permits and Approvals Necessary for the WUS Expansion Project

Permitting Entity	Description and Laws/Regulations	Potential Permits and Processes
District Department of Consumer and Regulatory Affairs	Authorizes the building of a project according to a specific scope of work, including approved plans. Any modification of permit scope or approved plans must also be approved. - 12 District of Columbia Municipal Regulations (DCMR) Construction Codes[49] - Title 6 Housing and Building Restrictions and Regulations[50] - Title 42 Real Property[51]	Building Permit[52]
District Department of Transportation	Manages and maintains publicly owned transportation infrastructure in the District. Lead agency with authority over the planning, design, construction, and maintenance of alleys, bridges, sidewalks, streets, streetlights, and traffic signals in DC. Right-of-Way Policies and Procedures Manual to establish a fair and efficient manner to complete the acquisitions or transfers of property, and to issue permits to allow for uses of the right-of-way that is compatible with overall operations. [53]	Public Space Permit – Construction and Occupancy[54] Fences and Retaining Walls Permit[55] Sidewalk, Curb, and Gutter Permit[56]

49 District of Columbia Construction Codes, 12 DCMR. Accessed from https://dcra.dc.gov/page/dc-construction-codes. Accessed on March 29, 2020.

50 District of Columbia Title 6 Housing and Building Restrictions and Regulations. Accessed from https://code.dccouncil.us/dc/council/code/titles/6/. Accessed on March 29, 2020.

51 District of Columbia Title 42 Real Property. Accessed from https://code.dccouncil.us/dc/council/code/titles/42/. Accessed on March 29, 2020.

52 District of Columbia Building Permit Application. Accessed from https://mybusiness.dc.gov/#/. Accessed on January 25, 2018.

53 District Department of Transportation. 2011. *Right of Way Policies and Procedures Manual.* Accessed from https://ddot.dc.gov/page/right-way-policies-and-procedures-manual. Accessed on March 29, 2020.

54 District Department of Transportation Public Space Permit. Accessed from https://ddot.dc.gov/node/496092. Accessed on March 29, 2020.

55 District Department of Transportation, Fences and Retaining Walls. Accessed from https://ddot.dc.gov/node/482312. Accessed on March 29, 2020.

56 District Department of Transportation, Sidewalk, Curb, Gutter. Accessed from https://ddot.dc.gov/node/482482. Accessed on March 29, 2020.

10 Noise and Vibration

10.1 Overview

This section addresses the potential noise and vibration impacts of the No-Action and Action Alternatives. Primary permanent noise and vibration sources near WUS include street and rail traffic. Construction activities are another common source of noise and vibration in urban environments. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and it identifies potential permitting and regulatory compliance requirements.

10.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to noise and vibration that are relevant to the Project include:

- Federal Railroad Administration (FRA) *High-Speed Ground Transportation Noise and Vibration Impact Assessment*;[1]
- Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment*;[2] and
- Federal Highway Administration (FHWA), *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 Code of Federal Regulations [CFR] 772).[3]

District of Columbia (District) policies, regulations, and guidance include:

- District Department of Transportation's (DDOT) *Noise Policy*[4] (January 2011); and

1 Federal Railroad Administration. October 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*. Report DOT/FRA/ORD-12/15. Accessed from https://www.fra.dot.gov/eLib/Details/L04090. Accessed on June 6, 2017.

2 Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment*. Report FTA-VA-90-1003-06. Accessed from https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf. Accessed on June 6, 2017.

3 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise. Accessed from https://www.fhwa.dot.gov/legsregs/directives/fapg/cfr0772.htm. Accessed on August 31, 2018.

4 District Department of Transportation. January 10, 2011. *District Department of Transportation Noise Policy.* Accessed from https://comp.ddot.dc.gov/Documents/Highway%20Noise%20Policy.pdf. Accessed on June 6, 2017.

- District Noise Ordinance (Municipal Regulations Chapter 20-27).

10.3 Study Area

There are two Local Study Areas: one for operational impacts and one for construction impacts. There is no potential for noise and vibration impacts outside the Local Study Areas. Therefore, no Regional Study Area was defined for this resource.

10.3.1 Operational Noise and Vibration Study Area

The Study Area for operational noise and vibration impacts encompasses the physical limits of the Project Area and noise and vibration-sensitive locations near the Project Area. The *FTA Transit Noise and Vibration Impact Assessment* provides noise and vibration screening distance standards for different railroad and transit projects that can be used to determine study area limits. If noise and vibration sensitive uses are present within the screening distances, further evaluation is necessary to determine potential impacts, the context and intensity of those impacts, and the need for mitigation.

The FTA noise screening distances are based on typical operational conditions for a range of railroad projects. They account for the presence or lack of intervening buildings between the project and sensitive receptors. To define the noise study area for a project, the screening distance must be adjusted to reflect conditions specific to the project.

The general noise screening distance for a new commuter railroad station without horn-blowing where there is no existing railroad infrastructure is 200 feet when there are intervening buildings. For the Project, based on the substantial increase in future train operations,[5] potential noise effects may extend farther than 200 feet from the Project Area. The Project would also involve changes in traffic conditions throughout the traffic study area.[6] To reflect these conditions, the operational noise study area includes receptors that are within 500 feet of the project area and within the traffic study area.

The FTA vibration screening distances depend on the type of sensitive land use and the type of railroad project. For commuter train operations, the vibration screening distance is 200 feet for residential uses; 120 feet for institutional uses; and up to 600 feet for particularly sensitive receptors such as historic properties, television, and recording studios. The study area can potentially extend farther if particularly sensitive uses are present or if underlying soils have particularly efficient vibration propagation characteristics. All structures within the vibration study area are evaluated for potential structural damage from vibration. Buildings

[5] See **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroads, Tables 5-33, 5-39, and 5-43.*

[6] See **Section 5.5.2.1** *Direct Operational Impacts, Vehicular Traffic* for Alternative A and the corresponding sections for the other Action Alternatives.

with vibration-sensitive uses, based on FTA receptor categories described in **Section 10.4**, *Methodology*, are also evaluated for potential human annoyance.

Based on these considerations, the combined Operational Noise and Vibration Study Area, shown in **Figure 10-1,** consists of noise and vibration-sensitive receptors within 600 feet of the Project Area and within the traffic study area.

The Operational Noise and Vibration Study Area was further refined to not bisect parcels of lands or roadways. It is approximately bounded by D Street NE to the south; 3rd Street NE to the east south of M Street; 6th Street NE to the east north of M Street; Brentwood Parkway and New York Avenue to the northeast; R Street NE, Harry Thomas Way NE, and Eckington Place NE to the northwest; and North Capitol Street (to the west).

Operational noise and vibration impacts were evaluated at the following receptor locations, shown in **Figure 10-2**:

- **West of Union Station, South of K Street NE (Receptors R1 – R11):** Receptors in this area are primarily FTA Category 3 institutional land uses.[7] These include Gonzaga College High School (R11), University of the District of Columbia (UDC) Community College (R8), and the St. Aloysius Church (R10). The Smithsonian Postal Museum (R5), Lower Senate Park (R2), and Union Station Plaza (R1) are historic properties. The Cable News Network (CNN) (R9), National Broadcasting Company (NBC) and Fox News (R3) television studios – which are FTA Category 1 – are also located in this area. Since the historic station building and existing parking garage shield receptors in this area from train operations, the primary source of noise is traffic on major roadways such as Massachusetts Avenue, North Capitol Street, and other local streets.
- **North of K Street NE and South of New York Avenue NE (Receptors R12 – R39):** Receptors in this area are primarily FTA Category 2 land uses including high-density residential apartment buildings and hotels along First Street NE and North Capitol Street. There are also several planned residential or mixed-use developments in this area. Institutional FTA Category 3 receptors include places of worship such as St. Phillips Baptist (R12) and Mt. Airy Baptist Church (R17) as well as the United States (U.S.) Equal Employment Opportunity Commission (EEOC) historic building (R26). The National Public Radio (NPR) broadcasting studio (R19) is an FTA Category 1 receptor. The primary sources of noise in this area are traffic on local roadways, such as North Capitol Street and New York Avenue, and train operations for those receptors close to the tracks.

[7] See **Section 1.4**, *Methodology* in **Appendix C2**, *Washington Union Station Expansion Project, Affected Environment Technical Report.* Category 1 receptors include locations where quiet is an essential element of their use (such as amphitheaters or certain historic landmarks). Category 2 receptors include locations where people sleep, such as residences, hospitals, and hotels. Category 3 receptors include institutional uses where noise can interfere with daytime activities, such as schools, places of worship, libraries, and museums.

Figure 10-1. Operational Noise and Vibration Study Area

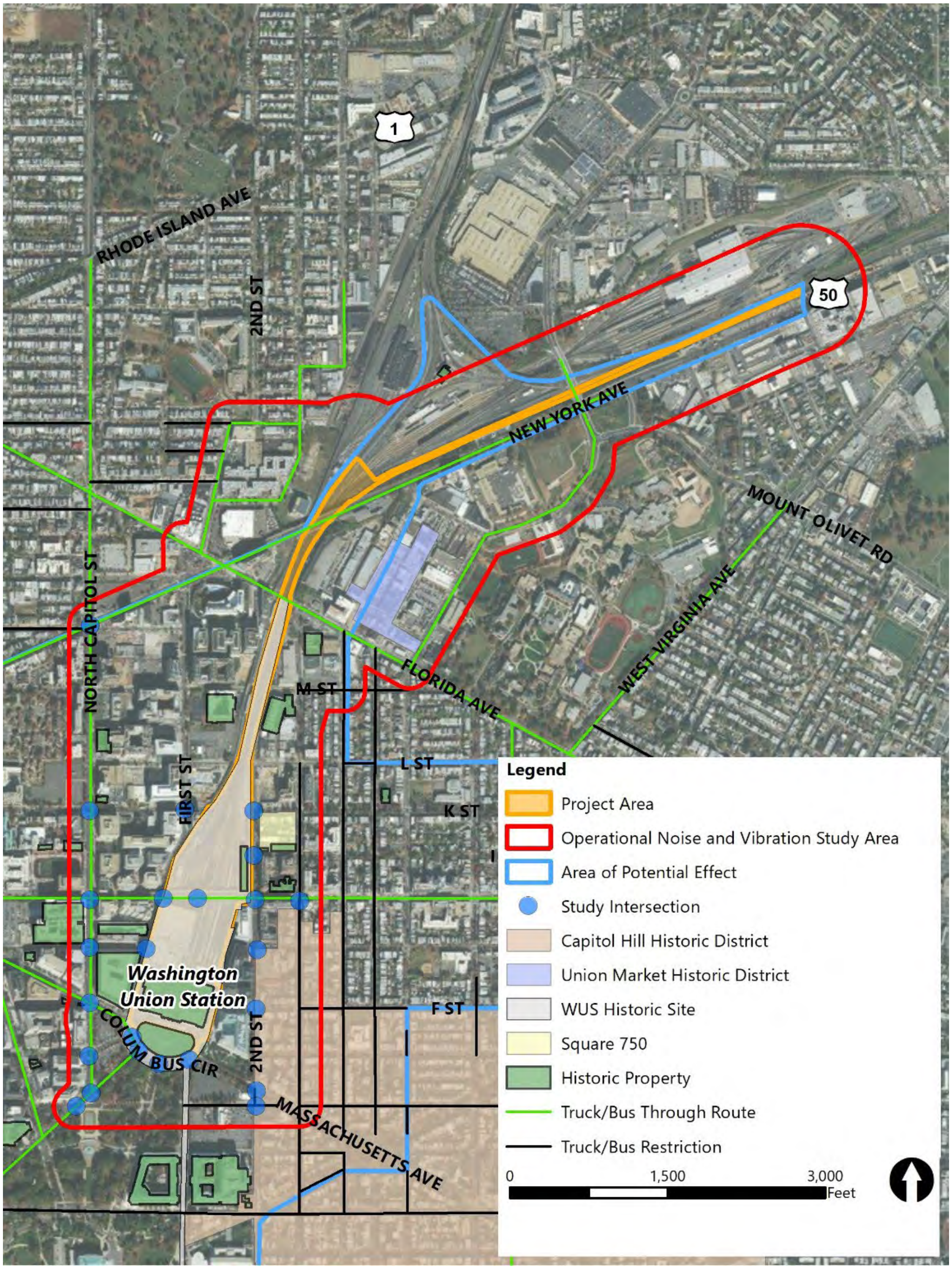
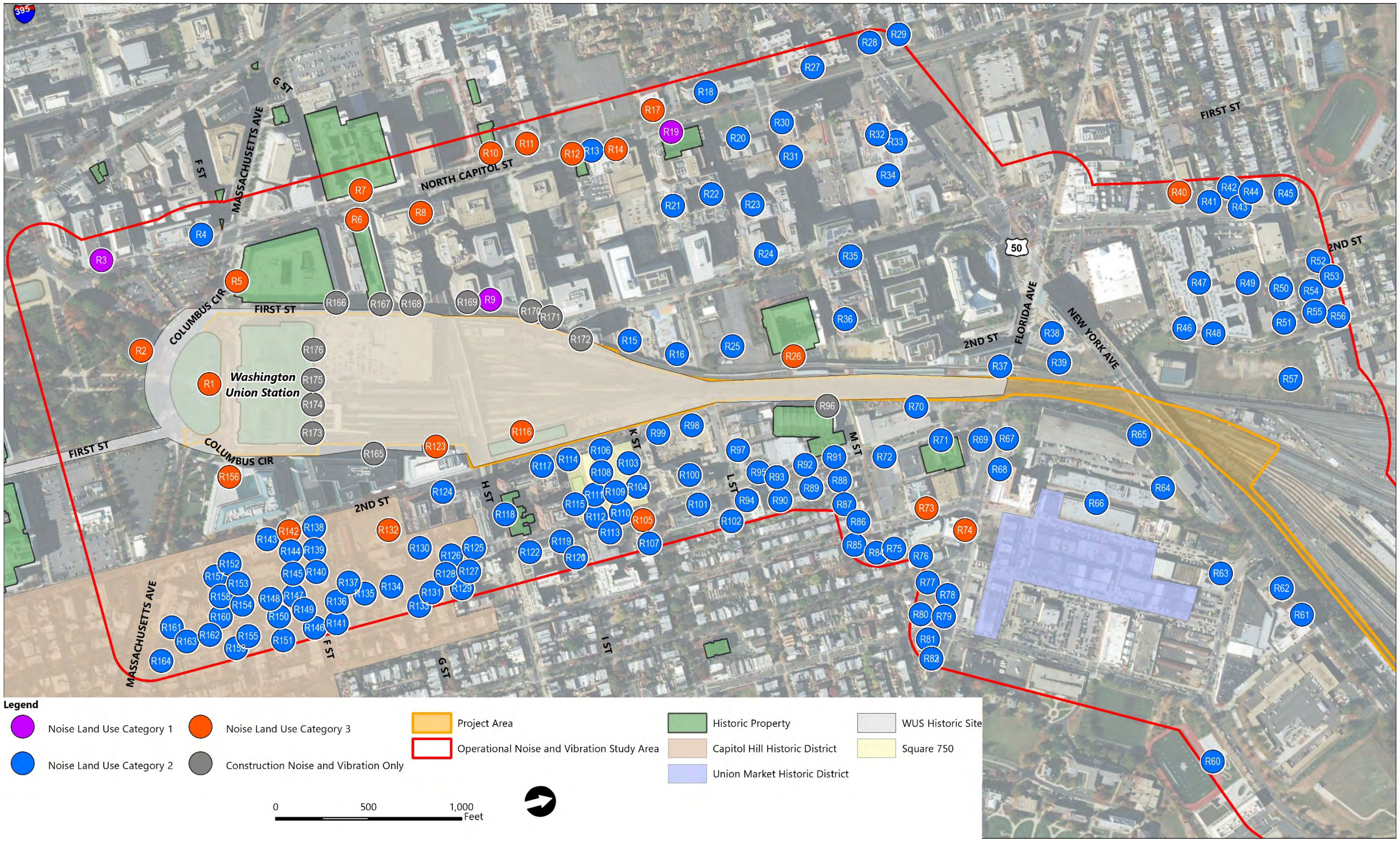


Figure 10-2. Noise and Vibration Receptors



- **North of New York Avenue NE (Receptors R40 – R57):** Receptors in this area consist primarily of FTA Category 2 land uses, including single or multi-family residential buildings, high-density residential apartment buildings, and FTA Category 3 institutional land uses such as the Friendship Public Charter School (R40). Several high-density residential buildings are planned for development in this area. The primary sources of noise are traffic on New York Avenue NE and Washington Metropolitan Area Transit Authority (WMATA) Red Line train operations.
- **New York Avenue Area (Receptors R58 – R62):** Receptors in this area include primarily FTA Category 2 land uses such as existing and proposed high-density apartment buildings, houses, and hotels. Institutional FTA Category 3 land uses include the Gallaudet University campus (R60). Since the tracks are setback from receptors on New York Avenue, the primary source of noise in this area is traffic on New York Avenue NE. This area includes the proposed Virginia Railway Express (VRE) Midday Storage Replacement Facility (MSRF).
- **Union Market Area (Receptors R63 – R68):** The historic Union Market area includes FTA Category 2 land uses such as high-density residential buildings, several residential and mixed-use developments under construction, and several planned developments. The primary sources of noise in this area are delivery trucks traveling to the area for delivery loading and unloading as well as train operations and traffic on Florida Avenue NE. The proposed VRE MSRF project would introduce a new track with relatively tight-radius curves that have the potential to generate wheel squeal.
- **South of Florida Avenue NE and North of K Street NE (Receptors R69 – R102):** Receptors in this area are primarily FTA Category 2 land uses, including single or multi-family residential buildings interspersed with a few high-density apartment buildings. There are several high-density apartment buildings planned for development. Institutional land uses include the Two Rivers Public Charter School (R72-R73). The primary sources of noise in this area are traffic on major roadways such as Florida Avenue NE and train operations.
- **East of Union Station, South of K Street NE (Receptors R103 –R164):** Receptors in this area include FTA Category 2 land uses such as historic residential rowhouses and townhomes along 2nd Street NE and 3rd Street NE between K Street NE and E Street NE as well as high-density residential apartments and condominium buildings. Institutional FTA Category 3 receptors include the Center City Public Charter School within the historic Railway Express Agency (REA) Building (R116), Capitol Hill Montessori School (R132), Community Holiness Church (R105), National Community Church (R142), the historic Thurgood Marshall Building (R156), and the Kaiser Permanente Medical Center (R123). The Railway Express Agency (REA) Building/Center City Public Charter School and the Kaiser Permanente Medical Center are particularly susceptible to noise and vibration impacts because they are adjacent to the rail terminal.

10.3.2 Construction Noise and Vibration Study Area

The Construction Noise and Vibration Study Area for provides the framework to evaluate the following impacts: [8]

- Noise from stationary construction sources;
- Vibration from stationary construction sources;
- Noise from mobile sources, including construction trucks, worker vehicles, and construction trains that would haul materials to and from WUS; and
- Vibration from mobile sources, including heavy construction trucks.

Figure 10-3 shows the Construction Noise and Vibration Study Area. The following considerations informed the definition of its boundaries:

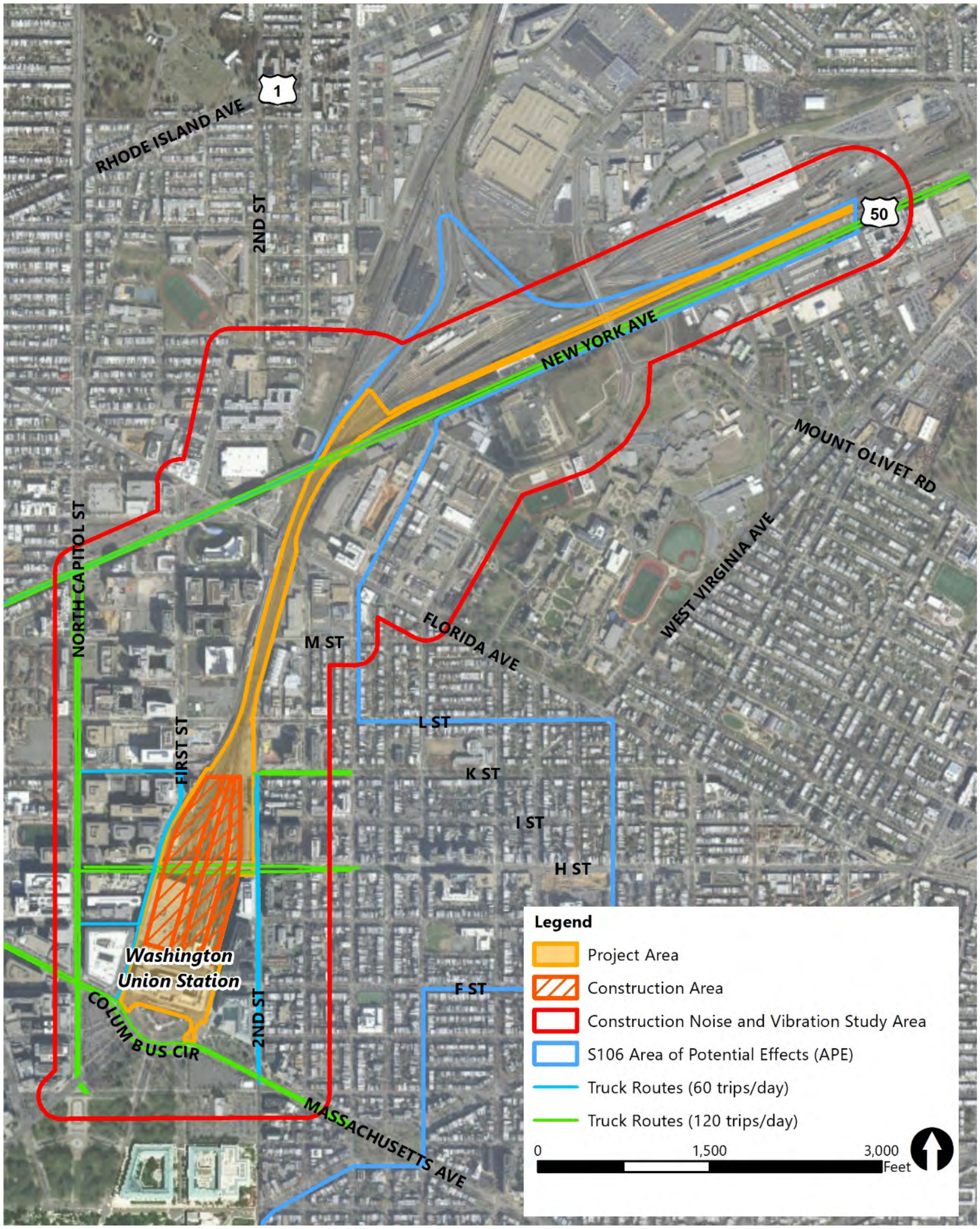
- **Construction noise from stationary sources:** The Study Area extends out 500 feet from the edge of construction, consistent with the most stringent stationary construction noise limit (65 decibel [dBA] maximum A-weighted level [Lmax]);[9] the maximum sound emissions from construction equipment not including pile driving (90 dBA at 50 feet); and sound propagation conditions between the Project Area and nearby receptors (which include intervening buildings).
- **Vibration from stationary sources:** The Study Area extends out 200 feet from the edge of construction. This distance was selected based on the most stringent construction vibration limits for potential human annoyance (65 vibration decibels [VdB])[10] and the maximum level of vibration emissions from construction equipment (typical pile driving, 104 VdB at 25 feet).
- **Construction noise from mobile sources:** The Study Area was defined based on the transportation Study Area and District truck routes. It includes receptors within 200 feet of the roads in the Study Area that are anticipated to be used as construction truck routes.

8 The construction impact modeling does not include the column removal work. In all Action Alternatives, the contribution of this work to ambient noise levels in the study area would be the same and would be negligible. During Phases 1 and 2 of construction, the column removal work would overlap with the excavation and reconstruction of portions of the rail terminal. However, this work would take place within the historic station building and involve installing temporary supports, removing, and replacing structural elements. These activities are not machine-intensive and would not involve the type of noisy excavation or foundation installation work associated with the reconstruction of the rail terminal. The part of WUS where the work would take place would be walled off from the rest of the building. Given the small scale of the column removal work, the noise and vibration associated with this work has no potential to result in an exceedance of any applicable criterion at any modeled locations.

9 A-weighted sound levels weight different frequencies of sound to correspond to human hearing and are expressed in decibel notation as “dBA.” Lmax represents the highest sound level generated by a source.

10 Vibration levels are expressed in decibel notation as “VdB” to differentiate them from sound decibels.

Figure 10-3. Construction Noise and Vibration Study Areas



- **Vibration from mobile sources:** The Study Area includes receptors within 50 feet of the roadways that may be used as truck routes.

Combining these considerations, the Construction Noise and Vibration Study Area extends out 500 feet from the Project Area. It is approximately bounded by D Street NE to the south; 3rd Street NE to the east south of M Street; 6th Street NE to the east north of M Street; Brentwood Parkway and New York Avenue to the northeast; R Street NE, Harry Thomas Way NE, and Eckington Place NE to the northwest; and North Capitol Street to the west.

The Construction Noise and Vibration Study Area was defined to primarily address the potential for noise impact along roadways close to the Project, where there is the greatest potential for noise increases due to construction vehicles. It does not extend farther along truck through-routes such as New York Avenue, 9th Street NE, North Capitol Street, H Street, and Massachusetts Avenue because the relative increase in traffic from construction vehicles is not anticipated to have a substantial effect on noise conditions so far from the Project Area.

The Construction Noise and Vibration Study Area includes several historic properties which are listed in or eligible for the National Register of Historic Places; District of Columbia Inventory of Historic Sites (DC Inventory); National Park Service sites; and Architect of the Capitol cultural resources.

10.4 Methodology

Section 10 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) presents the general approach used to assess noise and vibration impacts. The following sections explains in more detail how the methodology was applied to model and evaluate these impacts.

10.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The Project may have operational noise and vibration impacts because of modifications to the transportation infrastructure, increases in vehicle traffic volumes, and increases in train operations. Substantial increases in noise can affect people by causing annoyance at sensitive locations such as residences, museums, libraries, medical facilities, places of worship, and parks. Increases in vibration levels from modifications to the railroad track infrastructure or increases in the number of vibration events due to increased train operations can affect people by causing annoyance inside vibration-sensitive buildings. This section describes the methodologies used to predict potential operational noise and vibration impacts and the criteria for assessing these impacts.

As seen in **Table 10-1**, the number of Amtrak regional, Acela, VRE, and Maryland Area Regional Commuter (MARC), train operations would increase under the No-Action Alternative. Implementation of the Action Alternatives would facilitate further increases in train operations, including the introduction of a new Metropolitan train service. No increases in the WMATA Metrorail Red Line or DC Streetcar operations are anticipated. However, DC Streetcar service would be extended across the H Street Bridge under all alternatives. Future traffic volumes would experience typical background growth and new vehicle trips would be generated by developments in the Study Area. Changes in vehicle trips associated with the increase in train operations would occur as well.

10.4.1.1 Operational Noise Prediction Methodology

The methodology used to measure existing noise and vibration conditions and to identify and categorize noise and vibration receptors is presented in the July 2018, *WUS Affected Environment Technical Report*. Operational noise after completion of the Project would primarily include noise from train operations and traffic on nearby roadways. Train operations are the predominant source of noise at receptors adjacent or close to the railroad tracks. At distances of 100 feet or farther from the tracks, or where there are a substantial number of intervening buildings, traffic noise typically is the predominant source.

There are several planned developments in the Operational Noise and Vibration Study Area. Consistent with FRA and FTA guidance and with FHWA regulations, noise and vibration were assessed at existing sensitive uses and at properties that have already been permitted for sensitive use. Locations that are currently in the planning phase and are not permitted for sensitive use are not eligible for potential noise mitigation. However, future noise conditions at these locations were evaluated for informational and development planning purposes.

The operational noise modeling included trains, streetcars, and roadway sources. Train noise was predicted based on FTA's *Transit Noise and Vibration Impact Assessment*. Roadway noise was predicted with FHWA's Traffic Noise Model (TNM) version 2.5 modeled in Cadna-A software. The modeling results were validated by comparing them to predictions from standard modeling methods outlined in FTA's *Transit Noise and Vibration Impact Assessment* and FHWA's TNM version 2.5 and to measurement results. A difference within 3 dBA between the model and measurements was considered sufficient to confirm the accuracy of the model at all receptor locations. The model was validated at all measurement locations except for one measurement in the Union Market Area. Noise at this location had substantial contributions from temporary construction activities that are unrepresentative of long-term operational conditions.

The noise analysis included site-specific results at individual receptors and broader noise level mapping across the Study Area. The noise level mapping showed absolute sound level contours for existing conditions, the No-Action Alternative, and the Action Alternatives as well as comparative contours showing the change in noise that would occur in each Action Alternative relative to existing conditions and the No-Action Alternative.

The Project would also introduce new stationary sources of noise in the Operational Noise and Vibration Study Area. These would include fan plant rooms with exhaust fans for ventilating air; cooling towers for cooling areas; and emergency generators. Mechanical, electrical, and plumbing designs for the Project have not been completed and the location, size, sound level, and sound attenuation features such as silencers and enclosures of such equipment are undefined. Therefore, the assessment for noise from stationary mechanical equipment includes a summary of applicable noise limits and a qualitative assessment of potential impacts based on assumed locations and types of equipment.

Train Operations

MARC, VRE, Amtrak (including Acela and northeast regional trains), and WMATA service WUS, while the DC Streetcar operated by DDOT provide service along H Street NE, north of the station. MARC, VRE and Amtrak regional trains include passenger coach trains hauled by diesel-electric locomotives and Acela trains with electric locomotives. Train operations include revenue passenger operations and non-revenue movements to and from the rail yards and maintenance facilities north of New York Avenue. Diesel-electric switcher locomotives move locomotives and coaches in and out of WUS and run continuously throughout the day. WMATA Metrorail is a heavy-rail, electric, multiple-unit system. The DC Streetcar is a light rail transit system. The DC Streetcar generally sounds its bell when departing WUS on H Street NE. **Table 10-1** summarizes existing and anticipated future rail operations.

Table 10-1. Existing, No-Action and Action Alternative Rail Operations

Rail Service	Period	Number of Trains		
		Existing Conditions	No-Action Alternative	Action Alternatives
MARC	Day	78	90	262
	Night	17	20	35
	Total	95	110	297
Amtrak	Day	35	35	56
	Night	6	6	14
	Total	41	41	70
Metro	Day	220	220	220
	Night	52	52	52
	Total	272	272	272
Metropolitan	Day	-	-	99
	Night	-	-	33
	Total	-	-	132
VRE	Day	27	29	86
	Night	5	5	6
	Total	32	34	92

Rail Service	Period	Number of Trains		
		Existing Conditions	No-Action Alternative	Action Alternatives
Acela	**Day**	28	52	104
	Night	4	8	38
	Total	32	60	142
DC Streetcar	**Day**	90	90	90
	Night	18	18	18
	Total	108	108	108

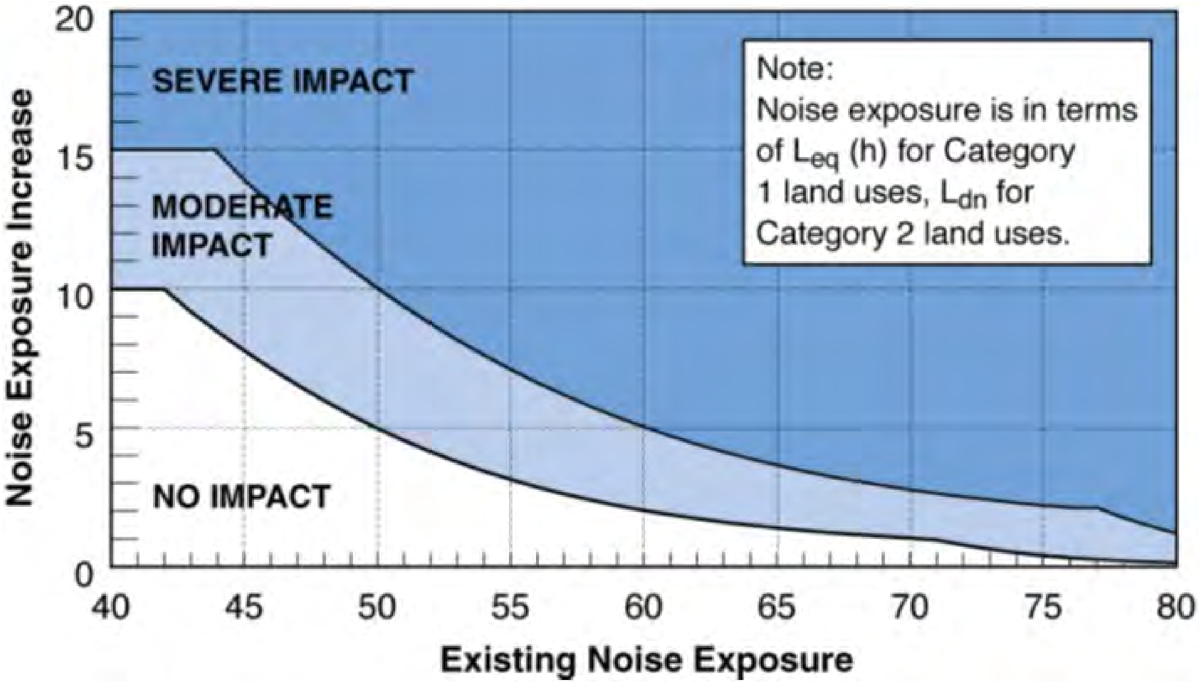
Source: Amtrak, VRE, Metro, MARC, and DDOT, 2018.

Trains operate at relatively low speeds (approximately 10 miles per hour) in and out of WUS and generally below 20 miles per hour throughout the Study Area. The tracks include both continuously-welded-rail and jointed rail segments and there are many track turnouts including interlocking “C” and interlocking “K.” Jointed rail and track turnouts introduce gaps in the rail running surface, which increase noise and vibration. The No-Action Alternative modeling includes planned station and track improvements and the proposed relocation of the VRE MSRF.

Operational Noise Impact Criteria

FTA noise impact criteria are known as "ambient-based" criteria. These criteria are used to evaluate the impact of a change in the noise environment due to the introduction of new noise sources or modification of existing sources. The noise impact criteria for human annoyance, presented in **Figure 10-4,** are based on potential increases in outdoor day-night average sound level (Ldn) for residential (Category 2) land uses or peak transit hour equivalent sound level (Leq) for institutional (Category 3) land uses, taking existing noise levels into account. Impacts are categorized as no impact, moderate impact, or severe impact. A severe impact is where a significant percentage of people would be highly annoyed by a project’s noise. Moderate impact is where the change in the cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong, adverse reactions.

Figure 10-4. FTA Noise Impact Increase Criteria



Source: FTA, 2006

Based on the FTA impact criteria, NEPA noise impact assessments were made using the following scale: Severe impacts per the FTA criteria were considered major adverse impacts and moderate impacts per the FTA criteria were considered moderate adverse impacts. No impact per the FTA criteria was considered no adverse impact. Although some measurable changes in noise levels may occur, they would always be below 3 dBA, which is the lowest perceptible change. When noise levels would decrease rather than increase, the impact was considered beneficial without further characterization.

The District noise ordinance (Chapter 20-2801) limits noise from stationary mechanical equipment such as fan plant rooms, cooling towers, and emergency generators to 60 dBA when measured at the property line or as close to the property lines as practicable if there is an obstruction.

10.4.1.2 Operational Vibration Prediction Methodology

Train operations are the cause of operational vibration in the Study Area. Since there already are train operations in the Study Area, impacts were evaluated based on potential increases in vibration levels from modifications to the track infrastructure and increases in the number of vibration events resulting from increased train operations.

A detailed vibration assessment consistent with Chapter 8 of FTA's *Transit Noise and Vibration Impact Assessment* was conducted to characterize existing vibration conditions and predict future conditions under the various alternatives. As rail infrastructure is already present in the Study Area and the same types of trains would continue to operate at WUS, vibration impacts were predicted based primarily on measurements of existing trains. Vibration propagation conditions were determined through measurement of vibration from existing sources at a range of distances. Typical adjustments were made as needed, such as outdoor-to-indoor building coupling vibration attenuation. Since many new tracks would be supported by deep foundations integrated into WUS, additional vibration attenuation relative to typical adjustments may occur.

The analysis considered the risk of structural damage to structures from vibration. Typically, vibration from train operations is substantially below the thresholds for potential structural damage. Historic buildings may be more fragile and susceptible to damage from vibration than more recent structures, however.

Operational Vibration Impact Criteria

FTA vibration criteria are based on maximum levels for a single event and depend on the type of land use and the frequency of events. Additionally, for projects in an existing rail corridor, the vibration impact assessment depends on existing vibration conditions in the Study Area.

There are two sets of FTA vibration criteria: general vibration assessment impact criteria, based on overall vibration levels; and detailed vibration assessment impact criteria, based on the frequency content of the vibration measured in one-third octave bands. The general vibration impact criteria are more conservative than the detailed vibration impact criteria because they are based on vibration levels over the entire frequency range rather than just in specific frequency bands.

The FTA general vibration assessment impact criteria include ground-borne vibration and ground-borne noise thresholds, as shown in **Table 10-2**. These vibration criteria reflect the potential for human annoyance for different land use categories including high sensitivity (Category 1), residential (Category 2), and institutional (Category 3). In general, the threshold of human perceptibility of vibration is 65 VdB.

Table 10-2. FTA Ground-Borne Vibration and Noise Impact Criteria for General Assessment

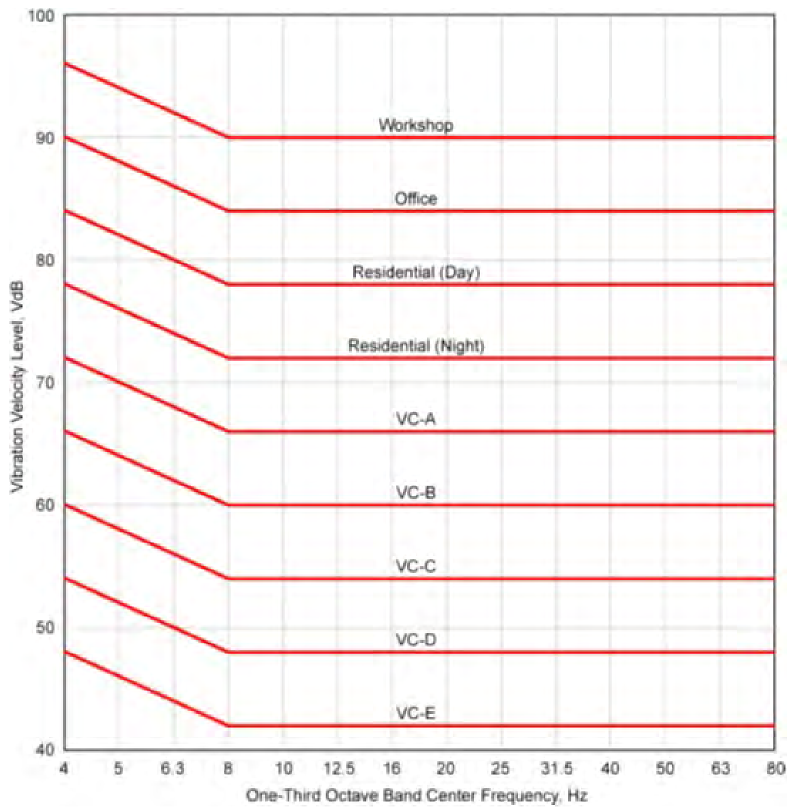
Land Use Category	Ground-Borne Vibration Levels (VdB)[1]			Ground-Borne Noise Levels (dBA)[2]		
	Frequent Events[3]	Occasional Events[4]	Infrequent Events[5]	Frequent Events[3]	Occasional Event[4]	Infrequent Event[5]
Category 1: Buildings where low vibration is essential for interior operations.	65	65	65	N/A	N/A	N/A
Category 2: Residences and buildings where people normally sleep.	72	75	80	35	38	43
Category 3: Institutional buildings with primarily daytime use.	75	78	83	40	43	48

Source: FTA, 2006.
N/A = “not applicable.” Vibration-sensitive equipment is not sensitive to ground-borne noise.
Notes: 1. Root mean square (RMS) vibration velocity levels are reported in VdB referenced to 1 micro inch per second (in/s). 2. Ground-Borne noise levels are reported in dBA referenced to 20 micro Pascals. 3. “Frequent Events” is defined as more than 70 vibration events per day. 4. “Occasional Events” is defined as between 30 and 70 vibration events per day. 5. “Infrequent Events” is defined as fewer than 30 vibration events per day.

The FTA detailed vibration assessment impact criteria, as shown in **Figure 10-5**, are used when the frequency content of vibration is available through measurements and modeling. These detailed vibration criteria, like the general vibration assessment criteria, apply to residential uses, institutional uses, and vibration-sensitive equipment.

Because the Project is in an existing railroad corridor, the vibration criteria also depend on existing conditions. For projects in existing railroad corridors with more than 12 trains per day, a project is considered to cause impacts if projected vibration levels exceed the FTA criteria and the project would significantly increase the number of vibration events (approximately doubling it) or increase vibration levels by 3 VdB or more. If a project moves existing tracks, there would be impacts only if the track relocation results in vibration levels exceeding the FTA criteria and increasing vibration levels by more than 3 VdB.

Figure 10-5. FTA Detailed Ground-Borne Vibration Criteria



Source: FTA, 2006.

10.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Noise and vibration from construction activities have the potential to affect nearby receptors by causing annoyance; perceptible vibration inside buildings; and structural damage to buildings and structures. The methodology for predicting and assessing construction noise and vibration impacts depends on the noise and vibration source.

10.4.2.1 Methodology for Predicting Construction Noise

Construction noise from stationary sources was predicted using methods consistent with those described in FTA's *Transit Noise and Vibration Impact Assessment* (Chapter 12) and the *FHWA Roadway Construction Noise Model.* Since the Construction Noise and Vibration Study Area is dense, urban, and includes features affecting sound propagation, such as large intervening buildings, retained fill sections, and roadway underpasses, the Cadna-A sound prediction software was used to implement the FTA and FHWA construction noise methods. Construction noise was evaluated at 25 feet from the outermost limits of construction, in accordance with the District's noise ordinance, and at specific residential, commercial, and industrial receptor locations, in accordance with FTA construction noise guideline criteria.

The construction activities with the most potential to generate noise and vibration impacts include support of excavation (SOE) construction, excavation, caissons drilling, and pressure slabs pouring. Construction noise was modeled for SOE and excavation and drilling, which generally are the longest-lasting and loudest activities. Construction would take place in four phases, during which the focus of construction would shift from east to west as certain tracks are temporarily put out of service. [11] Phase 1 would be located along the easternmost portion of the Project Area including Tracks 25, 26, 27, 28, 29 and 30. Phase 2 would be located just west of Phase 1 and include Tracks 17, 18, 19, 20, 22, 23 and 24. Phase 3 would be located just west of Phase 2 and include Tracks 13, 14, 15, and 15. Phase 4 would be in the westernmost portion of the Project Area and include Tracks 7, 8, 9, 10, and 12.

Noise was evaluated for open-cut excavation methods at the start of excavation, when equipment would be at the highest elevation; and the end of excavation, when equipment would be at the lowest elevation. As excavation proceeds, the equipment would be located closer to the bottom, resulting in greater sound attenuation from the SOE and surrounding buildings and lower noise levels at nearby receptors.

The noise modeling is based on typical equipment that would be mobilized during each phase of construction and the amount of time, or utilization factor, that the equipment would be used. **Table 10-3** presents the noise emissions from the equipment and utilization factors for each phase. SOE construction would vary depending on the Action Alternative. The noise and vibration analysis evaluated SOE Option #2 for Alternative A, SOE Option #1 for Alternatives B and E, and SOE Option #5 for Alternatives C and D.[12]

Construction of the Project would involve substantial excavation and removal of soils and debris for disposal. Depending on the Action Alternative, a total of between 1.16 million and 1.85 million loose cubic yards of spoils would be generated, at a rate of approximately 1,200 cubic yards (CY) per day. Excavation spoil removal would occur by dump trucks, which can haul approximately 10 CY, or by 10-gondola work trains, with each gondola holding approximately 60 CY. Up to 120 heavy trucks would travel to and from the site each day for 20 hours a day if all excavation spoil was removed by truck. Up to two 10-gondola trains would be used if all excavation spoil was removed by train. The construction noise analysis

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[11] The construction impact modeling does not include the column removal work. In all Action Alternatives, the contribution of this work to ambient noise levels in the study area would be the same. During Phases 1 and 2 of construction, the column removal work would overlap with the excavation and reconstruction of portions of the rail terminal. However, this work would take place within the historic station building and involve installing temporary supports, removing, and replacing structural elements. These activities are not machine-intensive and would not involve the type of excavation or foundation installation work associated with the reconstruction of the rail terminal. The part of WUS where the work would take place would be walled off from the rest of the building. Given the small scale of the column removal work, the noise and vibration associated with this work has no potential to result in an exceedance of any applicable criterion at any modeled locations.

[12] See **Appendix A7,** *Support of Excavation (SOE) Diagrams*.

considered three scenarios for spoil removal: removal by trucks only (120 trucks per day); removal by trucks and trains (one train and 60 trucks per day); and removal by trains only (two trains per day). The first scenario yields a conservative, maximum estimate of construction-related mobile source noise. The other scenarios show by how much noise levels could be reduced by using work trains. At this time, the spoil removal method is undetermined. Regardless of the method, approximately 10 to 20 trucks would travel to and from the site for deliveries every day.

The noise generated by construction trucks and trains was predicted using the Cadna-A sound prediction software. Existing noise from traffic and train operations was factored in. Train noise was predicted based on the Detailed Noise Assessment methodology in FTA's *Transit Noise and Vibration Impact Assessment.* Roadway noise was predicted based on the FHWA's TNM methods as implemented in the Cadna-A software.

Table 10-3. Construction Equipment Noise Emissions

Equipment	Quantity	Noise Level at 50 feet per Unit (dBA, Lmax)	Utilization Factor	Construction Phase
Crane	6	85	16%	Slurry Wall SOE (Alt. B/E)
Auger Drill Rig	3	85	20%	Slurry Wall SOE (Alt. B/E)
Slurry Trenching Machine	7	82	50%	Slurry Wall SOE (Alt. B/E)
Pumps	1	77	50%	Slurry Wall SOE (Alt. B/E)
Clam Shovel (dropping)	3	93	20%	Slurry Wall SOE (Alt. B/E)
Excavator	1	85	40%	Slurry Wall SOE (Alt. B/E)
Front End Loader	12	80	40%	Slurry Wall SOE (Alt. B/E)
Concrete Pump Truck	1	82	20%	Slurry Wall SOE (Alt. B/E)
Dump Truck	10	84	40%	Slurry Wall SOE (Alt. B/E)
Drop Hammer	2	95	20%	Slurry Wall SOE (Alt. B/E)
Generator	1	80	40%	Slurry Wall SOE (Alt. B/E)
Crane	6	85	16%	Slurry Wall SOE (Alt. B/E)
Welder / Torch	1	73	40%	Slurry Wall SOE (Alt. B/E)
Compressor (air)	1	80	40%	Slurry Wall SOE (Alt. B/E)
Slurry Plant	1	78	100%	Slurry Wall SOE (Alt. B/E)
Crane	2	85	16%	Secant Wall SOE (Alt. A/B/E)
Auger Drill Rig	2	85	20%	Secant Wall SOE (Alt. A/B/E)
Concrete Pump Truck	1	82	20%	Secant Wall SOE (Alt. A/B/E)
Dump Truck	7	84	40%	Secant Wall SOE (Alt. A/B/E)
Welder / Torch	1	73	40%	Secant Wall SOE (Alt. A/B/E)
Auger Drill Rig	4	85	20%	Sheet Pile Wall SOE (All Alternatives)
Crane	4	85	16%	Sheet Pile Wall SOE (All Alternatives)
Vibratory Pile Driver	4	95	20%	Sheet Pile Wall SOE (All Alternatives)
Auger Drill Rig	4	95	20%	Caisson Drilling[1]
Crane	3	95	20%	Caisson Drilling[1]
Dozer	1	85	40%	Excavation (Spoil Removal by Truck)
Front End Loader	2	80	40%	Excavation (Spoil Removal by Truck)

Equipment	Quantity	Noise Level at 50 feet per Unit (dBA, Lmax)	Utilization Factor	Construction Phase
Backhoe	1	80	40%	Excavation (Spoil Removal by Truck)
Clam Shovel (dropping)	1	93	20%	Excavation (Spoil Removal by Truck)
Dump Truck	21	84	40%	Excavation (Spoil Removal by Truck)
Dozer	1	85	40%	Excavation (Spoil Removal by Train)
Front End Loader	2	80	40%	Excavation (Spoil Removal by Train)
Backhoe	1	80	40%	Excavation (Spoil Removal by Train)
Clam Shovel (dropping)	1	93	20%	Excavation (Spoil Removal by Train)
Dump Truck	6	84	40%	Excavation (Spoil Removal by Train)
Work Train	1	73	100%	Excavation (Spoil Removal by Train)

Source: FHWA, 2006.
1. Caisson drilling equipment quantities would vary by phase. Highest quantity assumed based on Phase 4 construction.

10.4.2.2 Construction Noise Impact Criteria

The District's noise ordinance (Municipal Regulations Chapter 20-27 and 20-28) prohibits construction sound levels above 80 dBA Leq (except for pile driving) as measured 25 feet from the outermost limits of the construction site between 7:00 AM and 7:00 PM unless a variance is granted. From 7:00 PM to 7:00 AM, construction activities are limited to 65 dBA (Lmax) 25 feet from the outermost limits of the construction site for noise originating in an industrial zone. Leq accounts for how loud an event is during a period of time, how long the sound lasts, and how many times it occurs. These criteria are intended to apply to stationary construction sources, not to construction vehicles.

The FTA defined construction noise guideline criteria that depend on the type of land use and the time of day, as shown in **Table 10-4**. These criteria are general guidelines that may be used for projects when there are no local construction noise ordinances or project-specific criteria. The FTA guideline criteria include 8-hour Leq daytime and nighttime limits as well as a 30-day average Ldn construction noise limit. Ldn represents the sound energy over a 24-hour period with a 10-decibel (dB) penalty applied to sound that occurs between 10:00 PM and 7:00 AM when people are more sensitive to noise. Ldn accounts for how loud events are, how long they last, how many times they occur, and whether they occur at night.

Table 10-4. FTA Guideline Construction Noise Criteria

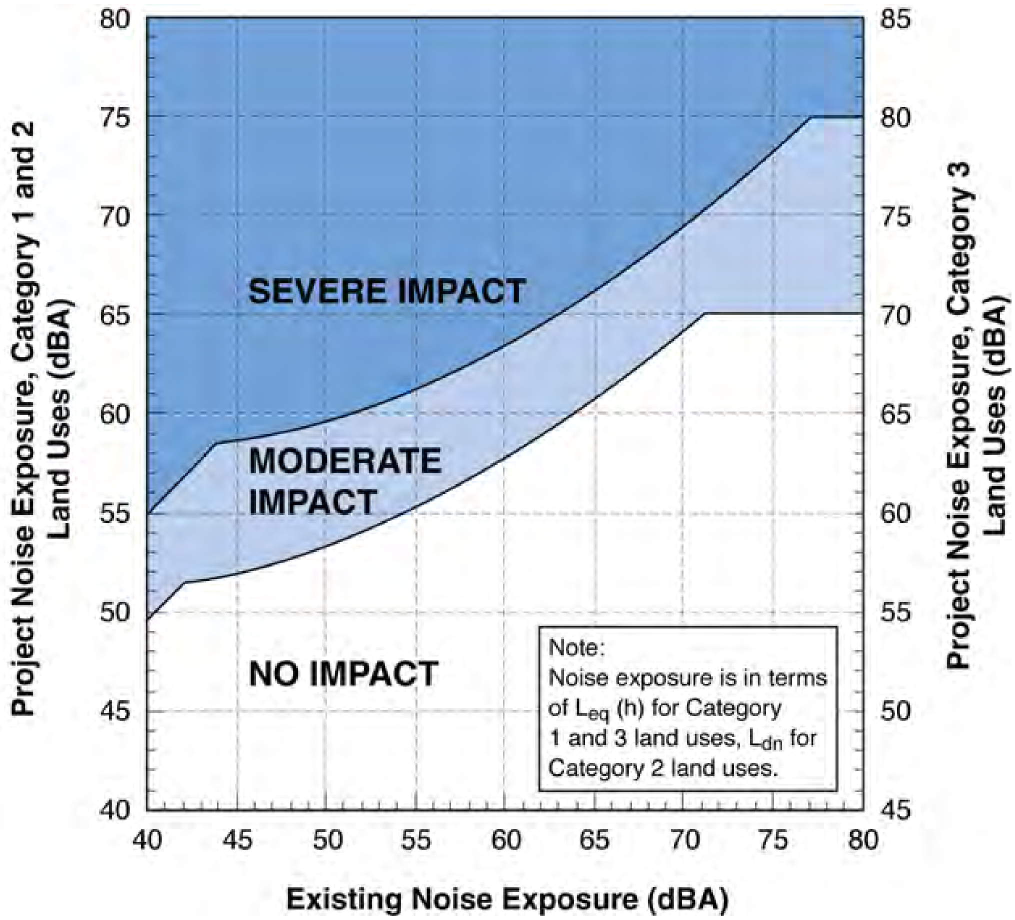
Land Use	8-hour (Leq)		Ldn (dBA)
	Day	Night	30-day Average
Residential	80	70	75[1]
Commercial	85	85	80[2]
Industrial	90	90	85[2]

Source: FTA, 2006.
Notes: 1. In urban areas with very high ambient noise levels (Ldn > 65 dB), Ldn from construction operations should not exceed existing ambient + 10 dB. 2. Twenty-four-hour Leq, not Ldn.

Construction of the Project would take from approximately 11 years 5 months to 14 years 4 months depending on the Action Alternative (including the 12-month Intermediate Phase of reduced activity between Phases 1 and 2, when only column removal work would be conducted). The SOE, excavation, and caisson drilling phases of construction have the greatest potential to adversely affect people at nearby residences and commercial properties due to the extended duration of these activities and the potential need for construction trucks to travel through the Study Area. The potential for trucks to haul excavation away during the night is of particular concern, as there is a greater sensitivity to noise at night. Depending on the Action Alternative, excavation and caisson drilling would last for approximately 3 years and 6 months to approximately 4 years and 6 months.

Since construction would occur over a long time, potential noise impacts from excavation were conservatively assessed based on the long-term operational FRA and FTA noise impact criteria shown in **Figure 10-6**. This approach is substantially more conservative than using the FTA construction noise guideline criteria. For example, in areas where existing noise levels are 65 to 75 dBA (Ldn), the threshold for moderate noise impact due to long-term construction would be 60 to 65 dBA (Ldn) and the threshold for severe impact would be approximately 66 to 73 dBA (Ldn). The moderate criteria would be approximately 10 to 15 dBA lower and the severe criteria would be 2 to 9 dBA lower than the 30-day average threshold of 75 dBA for residences. These criteria would generally result in moderate impacts when construction noise is approximately 5 dBA below ambient levels and severe impact when construction noise is similar to ambient levels. This is lower than the FTA guideline criteria, which could allow construction noise to be 10 dBA or more above ambient levels - a doubling or more in loudness.

Figure 10-6. FTA Project Noise Impact Criteria (Applied to Long-term Construction)



Source: FTA, 2006.

10.4.2.3 Methodology for the Prediction of Construction Vibration

The construction vibration analysis was conducted for activities that typically generates substantial vibration such as use of clam shovels during slurry wall construction; drilling during secant pile wall construction; vibratory sheet pile driving; caisson drilling; operation of hoe rams and jackhammers during concrete removal; operation of excavators, backhoes, and loaded trucks during excavation; and use of vibratory rollers for track re-construction.

The potential impacts from construction vibration were evaluated based on the methods described in the FTA guidance manual. FTA's assessment methodology includes identifying the types of vibration-generating construction equipment and predicting typical construction vibration levels at various distances from the equipment. This information provides a general estimate of construction vibration and potential increase in the risk of structural damage.

Construction Vibration Impact Criteria

Certain construction activities, such as earthwork and foundation work, may potentially cause structural damage to nearby buildings or annoy people inside nearby buildings. The potential for structural damage is typically limited to impact-type construction activities, such as drilling and slurry wall construction, conducted very close to buildings (within 25 feet). Potential damage from vibration depends on the specific construction activity and how the building is constructed.

FTA criteria for potential structural damage are shown in **Table 10-5**. Depending on their construction, historic buildings may require vibration levels that comply with Building Category IV. The criteria for potential structural damage are presented in both VdB and peak-particle velocity (PPV) inches per second (in/s).

Table 10-5. FTA Criteria for Potential Structural Damage

Building Category		Vibration Criteria for Potential Damage to Structures	
		Vibration Level (VdB)	Peak-Particle Velocity (in/s)
I.	**Reinforced-concrete, steel or timber**	102	0.5
II.	**Engineered-concrete and masonry**	98	0.3
III.	**Non-engineered timber and masonry**	94	0.2
IV.	**Buildings extremely susceptible to vibration damage**	90	0.12

Source: FTA, 2006.

Table 10-6 presents the reference PPV vibration level from typical construction equipment and the distance from the equipment where vibration levels would exceed the thresholds for potential structural damage (0.5, 0.3, 0.2, and 0.12 in/s) as well as the threshold for interior human annoyance (72 VdB). For most equipment including heavy trucks, excavators, hoe rams and jackhammers, vibration levels would only exceed 0.5 in/s within 8 feet. Clam shovels and vibratory rollers may exceed 0.5 in/s within 14 feet.

Table 10-6. Typical Construction Vibration Source Levels and Distances

Equipment	PPV at 25 feet (in/s)	Distance to Exceeding FTA Criterion (Feet)				
		0.5 in/s (102 VdB)	0.3 in/s (98 VdB)	0.2 in/s (94 VdB)	0.12 in/s (90 VdB)	0.016 in/s (72 VdB)[1]
Heavy Truck	0.076	7	10	14	18	27
Excavator	0.089	8	11	15	20	29
Hoe Ram	0.089	8	11	15	20	29
Jackhammer	0.035	4	6	8	11	16
Drilling	0.089	8	11	15	20	29
Clam Shovel Drop	0.202	14	18	25	34	50
Hydromill (in Soil)	0.017	3	4	6	8	12
Vibratory Pile Driver	0.170	13	17	23	31	45
Vibratory Roller	0.210	14	18	25	34	50

1. Includes a 13-VdB building coupling loss for large masonry buildings for assessing interior vibration effects.

10.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on noise and vibration levels. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational and construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

10.5.1 No-Action Alternative

10.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would have beneficial direct operational noise impacts at locations near the private air-rights development. There would be negligible adverse direct operational noise impacts elsewhere in the Study Area as noise levels would increase by no more than 3 dBA relative to existing levels. There would be negligible adverse direct operational impacts on vibration.

Operational Noise

Figure 10-7 shows modeled noise level mapping for the No-Action Alternative. Noise levels would range from 60 to 75 dBA (Ldn) at most locations. Such levels are typical of dense urban areas. Predominant sources of noise include the rail terminal, New York Avenue NE, Florida

Avenue NE, K Street NE, and Massachusetts Avenue NE. **Figure 10-8** shows the difference between No-Action Alternative and existing noise levels.

There would be a beneficial impact on noise at receptors adjacent to the private air-rights development south of K Street NE in the No-Action Alternative. Noise levels would decrease relative to existing conditions because of the acoustic shielding the development would provide as it would enclose the rail terminal south of K Street**.** Reductions would vary depending on the receptor. At the Kaiser Permanente Medical Center (R123) and REA Building/Center City Public Charter School (R116), it would be greater than 10 dBA. A reduction of 10 dBA is generally perceived as a halving of the noise level. Multiple residential receptors along 2nd Street NE and Parker Street NE would experience appreciable sound level reductions greater than 3 dBA.

At receptors north of K Street NE and away from the private air-rights development, noise from trains and traffic would increase under the No-Action Alternative because of greater traffic volumes and more train operations. This would be a negligible adverse impact because everywhere increases would be less than 1 dBA, except in the Union Market area. There, increases could be higher because of the introduction of a new track leading to the new VRE MSRF and the operation of non-revenue VRE trains on this track during midday storage. The track would have relatively tight-radius curves, which has the potential to generate wheel squeal. Wheel squeal is a phenomenon that results in high amplitude, high-frequency noise. The train wheels vibrate because of the interaction of the wheels with the rail surface. Even assuming that the design of this track segment would minimize the risk of wheel squeal, modeling shows noise levels in the Union Market area would increase at some location. However, the increase would not exceed 3 dBA and remain a negligible impact.

Noise impacts from new stationary sources would also be negligible. Several new stationary sources would be introduced in the Project Area in the No-Action Alternative:

- Fan plants would be integrated into the southern portion of the private air-rights development on the east side of the Project Area, south of H Street NE; and into the northern portion of the private air-rights development on both the east and west sides of the Project Area, south of K Street NE.
- An emergency generator would be integrated into the private air-rights development on the east side of the Project Area, mid-way between H Street NE and K Street NE.
- A cooling tower would be integrated into the private air-rights development on the east side of the Project Area, mid-way between H Street NE and K Street NE.

Figure 10-7. No-Action Alternative Noise Levels

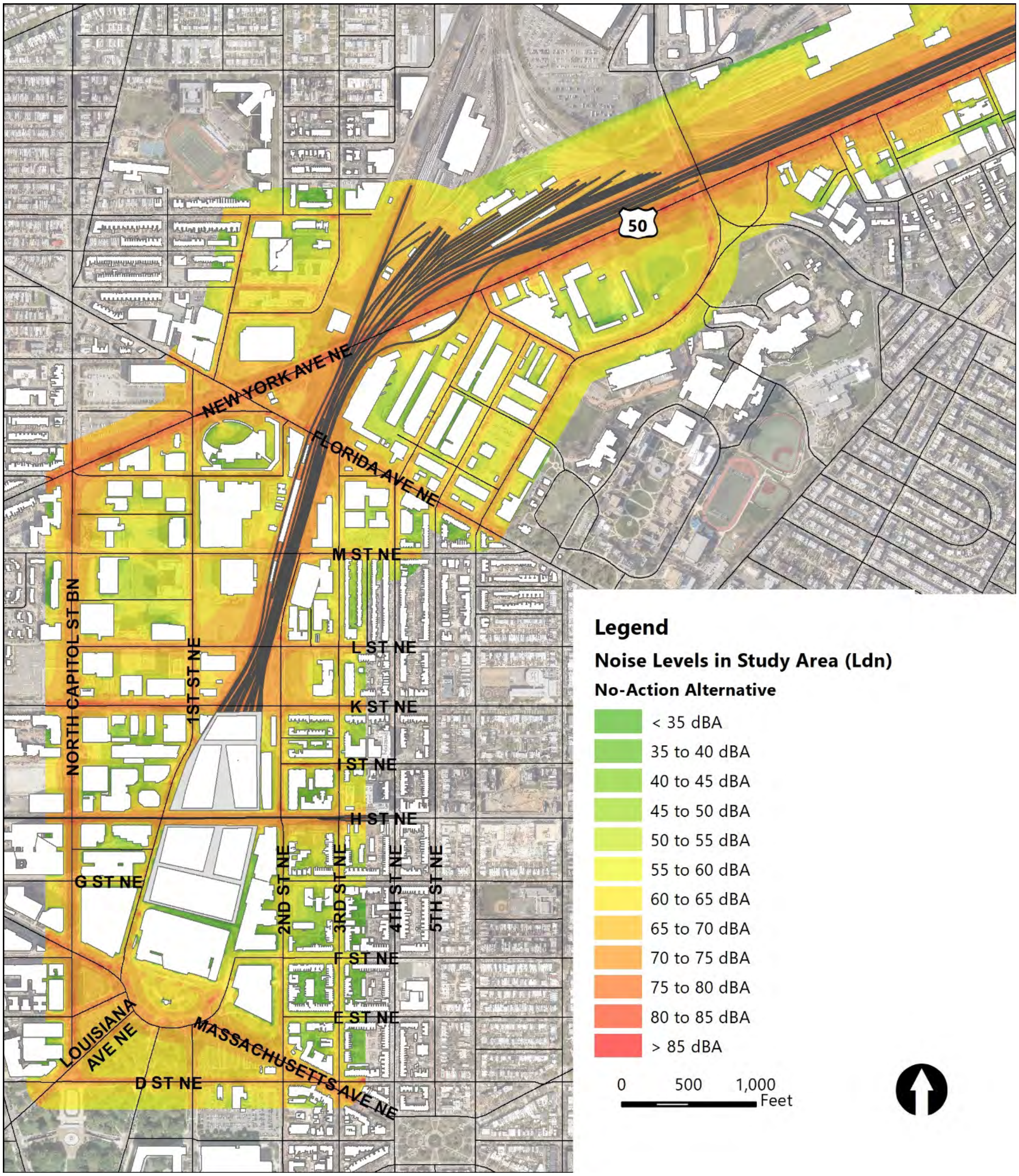
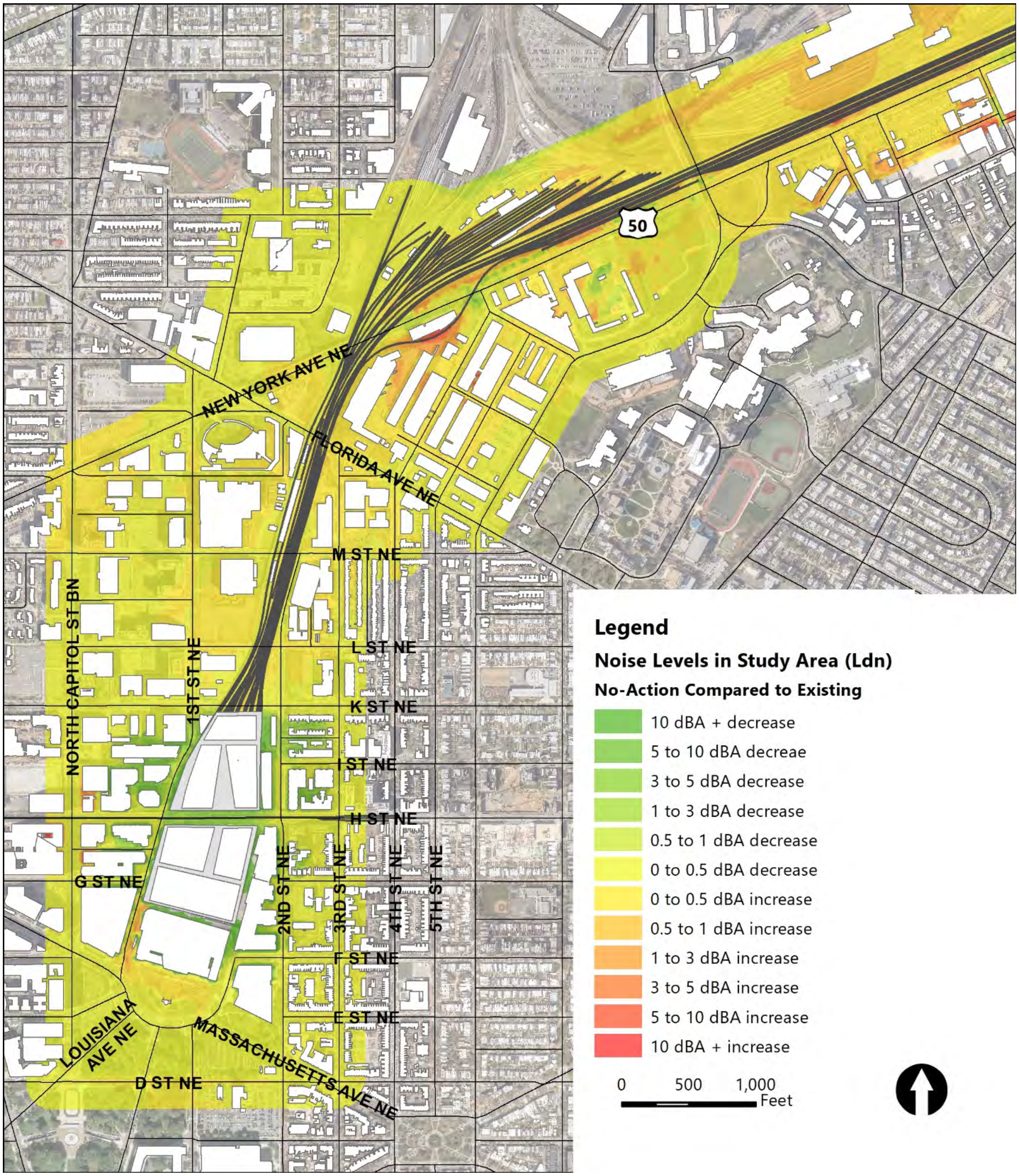


Figure 10-8. Comparison of No-Action Alternative and Existing Noise Conditions



This stationary mechanical equipment would likely be located approximately 50 feet from the property line, which would attenuate sound and maintain noise levels below the District's noise ordinance standard (60 dBA). The equipment would also need to meet the noise level requirements set forth in the National Fire Protection Association 130 Standard for Fixed Guideway Transit and Passenger rail Systems. These requirements pertain primarily to potential effects on emergency response personnel and effects on the speech intelligibility of voice communication systems. Mechanical, electrical, and plumbing designs for the private air-rights development have not been completed. The location, size, sound level, and sound attenuation features such as silencers and enclosures of this equipment of new stationary sources are undefined. As mechanical equipment designs advance, other sound attenuation elements, would likely be incorporated, if and as needed. Therefore, impacts from stationary noise sources are anticipated to be negligible.

Operational Vibration

Impacts from changes in vibration levels would be negligible. Several programmed improvements to the track infrastructure would be completed in the No-Action Alternative. These include electrifying Tracks 8-9; rehabilitating Track 22; and introducing new tracks with the proposed VRE MSRF. This work would not affect track locations, track conditions, train operations, or speeds at most locations. Therefore, the amplitude of vibration or vibration levels from train passbys would not change except for receptors in the Union Market Area near the new track leading to the proposed VRE MSRF, as described in the following paragraphs.

South of K Street NE as well as north of K Street NE south of New York Avenue NE, there would be no substantial changes to tracks. Therefore, vibration levels would not change relative to existing conditions. The following bullets summarize vibration conditions at the receptor locations closest to the rail terminal.

- The CNN TV studio (R9) at 840 First Street NE is approximately 80 feet from the rail terminal and the Metrorail Red Line tracks. The maximum exterior overall vibration level measured at Site V2, which is located at this receptor, was 63 VdB. Including the additional distance from the façade to sensitive spaces inside the building and an outdoor-to-indoor building coupling attenuation of 10 dBA for large masonry buildings, interior vibration levels are predicted to be approximately 50 VdB, which is substantially lower than the FTA vibration criterion for TV Studios (65 VdB). Similarly, vibration levels are predicted to be below the FTA impact criteria at all other receptors in this area, including the Smithsonian Postal Museum (R5).
- The closest residential receptors (R106, R114, R117) on 2nd Street NE are approximately 200 feet from the nearest tracks and are historic properties. The maximum exterior overall vibration levels measured at Site V5, which was located at these receptors, ranged from 61 to 65 VdB, substantially below the vibration impact criterion of 72 VdB.

- Interior vibration levels at the REA Building/Center City Public Charter School (R116) are approximately 62 VdB or lower based on the maximum exterior vibration level measured at the REA building (Site V1) and a 10 VdB outdoor-to-indoor building coupling vibration attenuation. This is below the FTA vibration criteria. Similarly, interior vibration levels are below the FTA vibration criteria at the other closest receptors including the Kaiser Permanente building (R123) and the Thurgood Marshall Building (R156).
- All other vibration-sensitive receptors in this area are at similar distances or farther away from the rail terminal than the above sites. Vibration levels are below the FTA criteria and would remain so under the No-Action Alternative.
- The Toll Brothers City Living residences (R98 and R99) are approximately 150 feet away from the nearest track. The maximum exterior overall vibration levels measured at Site V5 ranged from 61 to 65 VdB and are representative of vibration conditions at these receptors. Therefore, interior vibration levels at these receptors are and would remain substantially below the vibration impact criterion of 72 VdB.
- The maximum exterior vibration level at Site V3, which is representative of the closest façade of the Uline Ice Company Plant and Arena Complex (R96), a historic property, was measured to be 67 VdB. Vibration in this location is attenuated due to the tracks being elevated on the M Street bridge and less efficient vibration propagation. This building does not contain vibration-sensitive uses. However, interior vibration levels would be approximately 57 VdB, substantially below the FTA vibration criteria for Category 1, 2, or 3 land uses.
- The maximum exterior vibration levels at Site V6, at the existing Central Armature Works property (R70), were an overall level of 80 VdB at 50 feet and 76 VdB at 100 feet and a maximum 1/3-octave band level of 75 VdB at 50 feet and 71 VdB at 100 feet. This location is at-grade with the tracks and has more efficient vibration propagation than locations where the tracks are elevated or on retained fill. This site does not currently have vibration sensitive uses but sensitive uses are being planned. The interior vibration levels of a new building with vibration-sensitive uses would typically be 10 VdB or more below these exterior measurements due to the building coupling attenuation. Vibration levels inside a new building with vibration-sensitive uses set back 50 feet from the nearest track would be approximately 70 VdB (overall) and 65 VdB (maximum 1/3-octave band level), below the FTA vibration criteria.
- The Courtyard Marriott at 1325 2nd Street NE (R37) is approximately 30 feet from the Metrorail tracks. The maximum overall exterior vibration level at the façade of the building was measured to be 63 VdB. Interior vibration levels at this receptor and other receptors in this area, which include the planned Washington Gateway development (R39), Teachers Insurance and Annuity Association (TIAA) Flats Apartments (R36), the U.S. EEOC (historic) property (R26), the planned NoMA Station – Bristol planned development (R25), Equity Residential (R15), and Perseus

Realty/Four Points planned development (R16), would be or remain below the FTA impact criteria.

- All other vibration-sensitive receptors in this area are at similar distances or farther away from the tracks than these sites. Vibration levels are currently below the FTA criteria and would remain so under the No-Action Alternative.

North of New York Avenue NE and Union Market:

- The new tracks leading to the VRE MSRF project would be close to the proposed Kettler mixed-use development at 300 Morse Street (R64 and R65). Existing vibration levels in the Union Market area were characterized by measurements taken at the existing Central Armature Works building (Site V6). Interior No-Action Alternative vibration levels were predicted on the basis of these measurements adjusted for distance based on the FTA generalized surface vibration curves, continuous-welded rail, and outdoor-to-indoor building coupling vibration attenuation. Interior No-Action Alternative vibration levels at the planned Kettler development would be 77 VdB (maximum in any 1/3-octave band), which exceeds applicable FTA vibration criteria. Since this development is still in the planning phase, the developer is working with VRE to address potential noise and vibration effects.
- Vibration levels at the planned Eckington Park Apartments (R57), which is at-grade relative to the tracks, were characterized based on the measurements taken at Site V6. Like at the Central Armature Works property, interior vibration levels at the Eckington Park Apartments set back 50 feet from the nearest track would be approximately 70 VdB (overall) and 65 VdB (maximum 1/3-octave band level). This would be below the applicable FTA vibration criteria.
- Along New York Avenue NE, the VRE MSRF tracks would affect vibration conditions; however, the closest vibration-sensitive receptors would be approximately 200 feet from the closest tracks, on the opposite side of New York Avenue NE. Maximum overall interior vibration levels would be approximately 60 VdB or lower, below the FTA vibration impact criteria.

10.5.1.2 Indirect Operational Impacts

Relative to existing conditions, there would be no indirect noise or vibration effects under the No-Action Alternative.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.1.3 Construction Impacts

Construction of the projects included in the No-Action Alternative would cause noise and vibration impacts. Available information on methods and schedules of construction is insufficient to characterize these impacts.

In the No-Action Alternative, the Project would not be constructed and would not cause any construction-related noise or vibration impacts. The construction of the private air-rights development, the replacement of the H Street Bridge, and the other projects that are included in the No-Action Alternative would generate noise and vibration from the operation of construction equipment and vehicles. Noise and vibration levels would depend on the type of equipment and vehicles used as well as the schedule of each project. This information is not currently available. In general, it can be assumed that noise and vibration levels would be typical of those associated with medium- to large-scale construction projects.

10.5.2 Alternative A

10.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative A noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative A would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Figure 10-9 shows modeled noise levels in Alternative A. At most locations, noise levels would range from 60 to 75 dBA (Ldn). Such levels are typical of a dense urban setting. Predominant noise sources include the rail terminal and tracks and traffic on New York Avenue NE, Florida Avenue NE, K Street NE, and Massachusetts Avenue NE. **Figure 10-10** shows the difference in noise levels between Alternative A and the No-Action Alternative.

Increases in train operations and traffic in Alternative A would generally cause noise levels to increase relative to the No-Action Alternative. South of K Street NE, increases would be less than 1 dBA. North of K Street NE, they would range from 1 to 3 dBA. Changes less than 3 dBA are generally not perceptible. Therefore, the anticipated increases in noise levels would result in negligible adverse noise impacts except at those locations where they would cause the FTA threshold to be exceeded. At locations along First Street NE, noise levels would decrease due to a reduction in traffic volumes as First Street NE would change from a two-way to a one-way street.

As shown in **Figure 10-11** and **Table 10-7** below, noise levels would fall within the range for moderate adverse noise impacts at 14 existing receptors. Additionally, at 10 planned development locations, noise levels would increase sufficiently to result in moderate noise impact if these locations have been developed with, or permitted for, sensitive uses by the planning horizon year (2040).

Figure 10-9. Alternative A Noise Levels

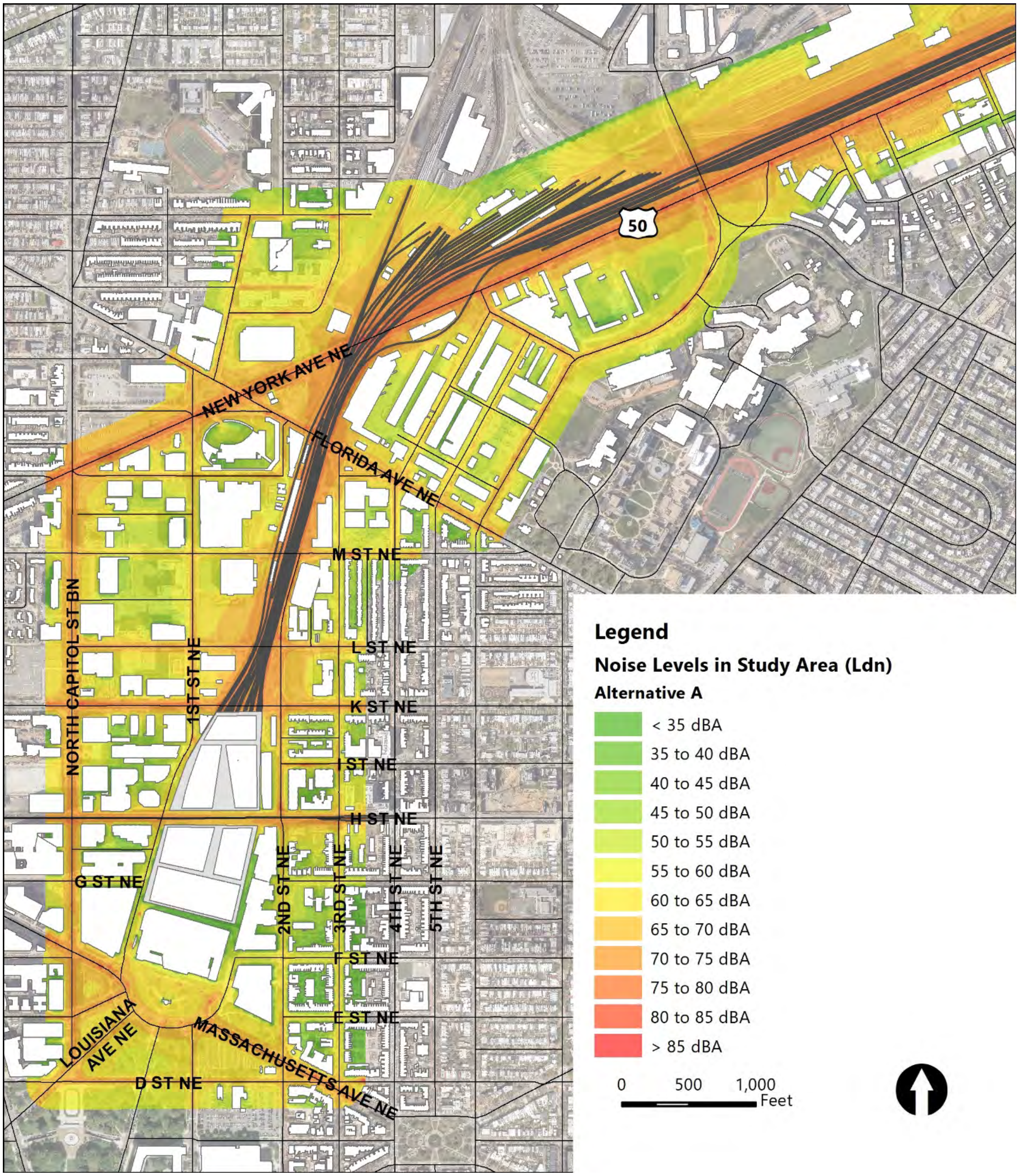


Figure 10-10. Comparison of Alternative A and No-Action Alternative Noise Conditions

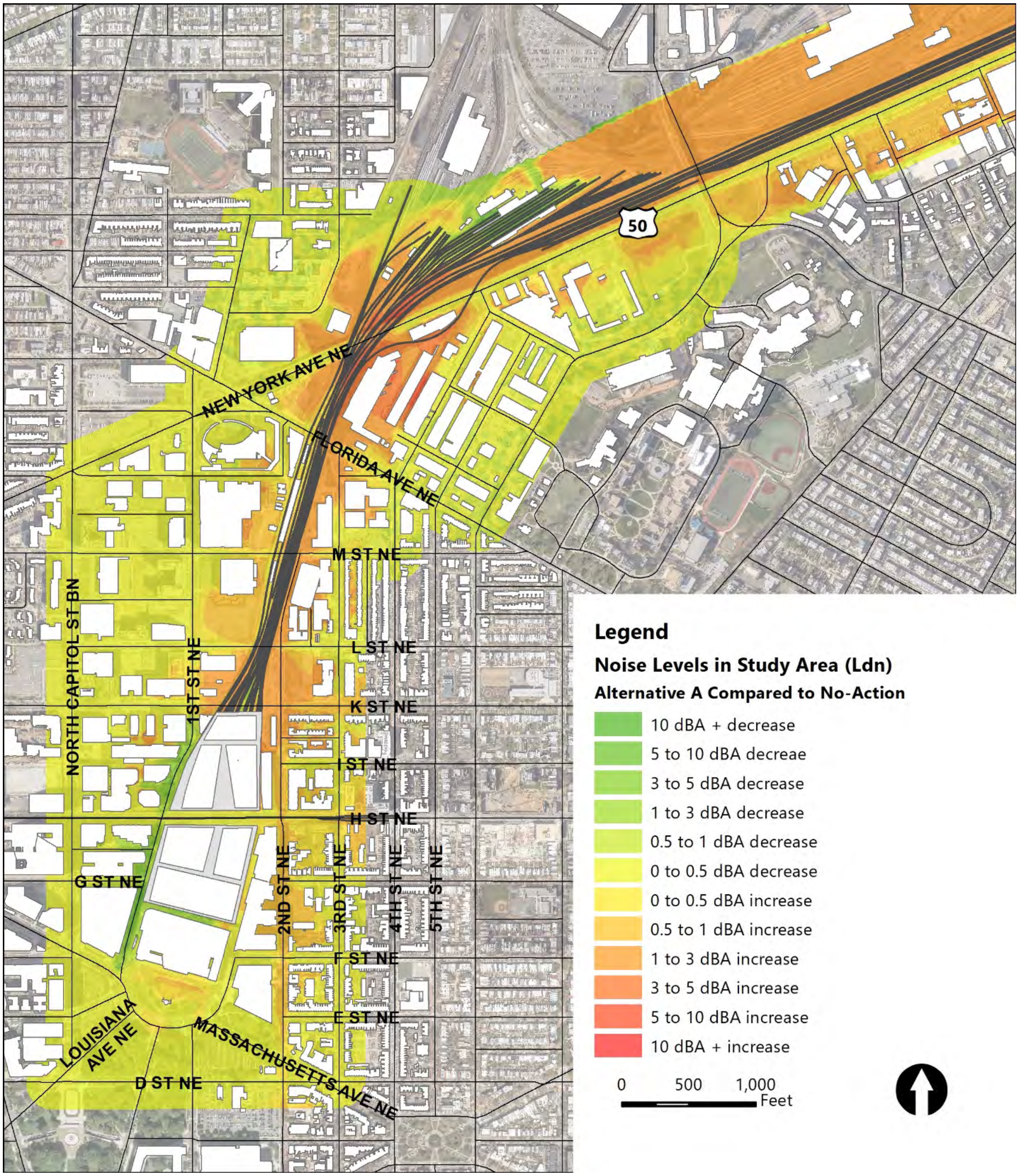


Figure 10-11. Alternative A Operational Noise Impacts

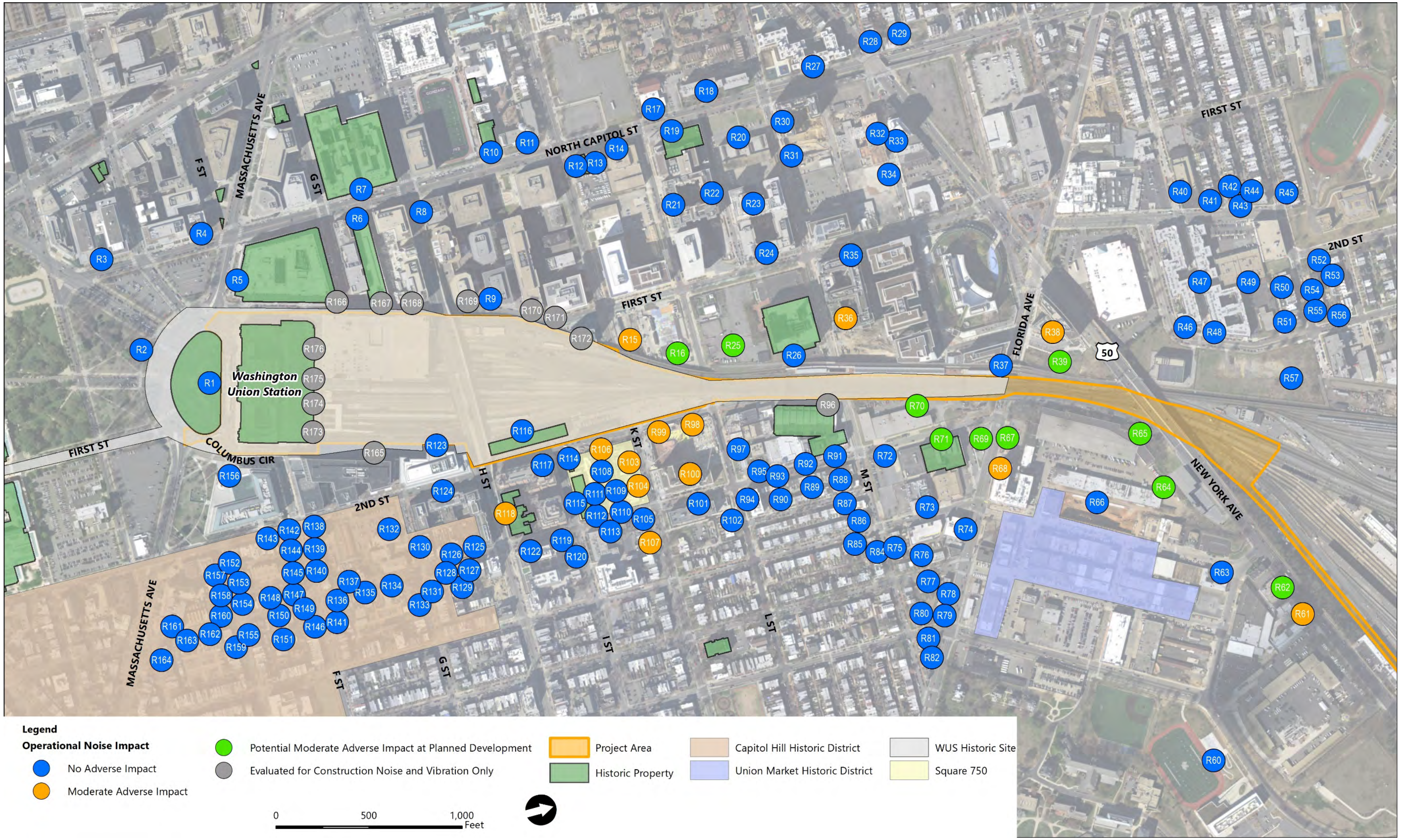


Table 10-7. Operational Noise Impact Assessment, Alternative A

Receptor [1]	Address	Land Description	Noise Level (Ldn, dBA)							FTA Noise Impact Assessment
			Existing	Future Impact Criteria (re: Existing)		No-Action	Future Impact Criteria (re: No-Action)		Alt. A	
				Moderate	Severe		Moderate	Severe		
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73.0	N/A[2]
R58[3]	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse Street Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[4]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75.0	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71.0	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.4	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.0	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.7	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1 Addresses with multiple receptor ID's include multiple elevations at same location. 2 Planned developments are evaluated for noise effects but are not assessed for impact. 3 For the map to remain on a legible scale, this receptor is not shown in **Figure 10-10**. It is located to the northeast of R61. 4 Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both Existing and No-Action noise level criteria.

The moderate noise impacts that would occur close to the rail terminal would be due to the increase in train operations. This includes impacts on the Equity Residential building (R15); the TIAA Flats Apartments (R36); the Washington Gateway Elevation Apartments (R38); and the Toll Brothers City Living (R98 and R99). The moderate impacts along New York Avenue, at the Hecht Warehouse Lofts (R58) and the Homewood Suites and Hampton Inn (R61), would be due to the projected growth in traffic volumes on this roadway. At other locations, such as the Edison building (R58) on Florida Avenue NE and residential receptors along K Street NE, the moderate impacts would be due to both train operations and traffic volumes increases.

Additionally, as shown in **Table 10-7** above, modeled noise levels would exceed the threshold for a moderate impact at nine planned development locations: Storey Park (R16); 170 L Street NE (R25); 102 Florida Avenue NE (R39); 411 New York Avenue (R62); 300 Morse Street NE (R64); 320 Florida Avenue NE (R67); 301 Florida Avenue NE (R69); 1200 3rd Street NE (R70); and 301 N Street NE (R71). The threshold for severe impact would be exceeded at one planned development location: 300 Morse Street NE (R65). Impacts would occur at these locations only if they have been developed with or permitted for sensitive land uses at the time Project construction occurs.

Alternative A would create the same new stationary sources of noise as the No-Action Alternative. All stationary mechanical equipment would likely be located approximately at least 50 feet from the property line, which would help attenuate sound and maintain noise levels below the District’s noise ordinance standard (60 dBA). As mechanical equipment design advances, other sound attenuation elements, such as silencers and enclosures could be incorporated, if and as needed. Therefore, impacts from stationary noise sources are anticipated to be negligible.

Operational Vibration

As explained in **Section 10.4.1.2**, *Operational Vibration Prediction Methodology*, vibration impacts in existing rail corridors are assessed based on (1) whether vibration levels would exceed the FTA criteria and (2) whether there would be either a 3 VdB increase in vibration or at least a doubling of the number of train operations. While, as shown in **Table 10-1**, the number of train operations (not including Metro and DC streetcar operations) would approximately triple relative to the No-Action Alternative, the FTA criteria would not be exceeded in Alternative A. Vibration levels in Alternative A would be similar to those in the No-Action Alternative except that Alternative A would cause an increase in vibration of up to 2 VdB at the closest receptors to Track 43 in the throat of the rail terminal. This would be a minor impact.

Alternative A includes improvements to the track infrastructure in the rail terminal and the throat (segment of tracks between K Street NE and New York Avenue NE), including extending platform lengths; modifying rail profiles to achieve clearance under the H Street bridge; providing space for train storage on multiple tracks in the throat; using direct fixation for tracks in station; using number 9 turnouts or greater to optimize train speeds through special trackwork; and introducing pocket tracks. These proposed improvements would not affect the specific train types operating on each track or train speeds. Therefore, the level of vibration from train events would not be affected. Track reconstruction would generally help to improve rail conditions, including reducing rail roughness, minimizing potential for rail corrugation, and minimizing gaps in the rail running surface associated with jointed rail and/or connections between tangent track and special trackwork.

10.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, there would be no indirect noise or vibration operational impacts in Alternative A.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.2.3 Construction Impacts

Support of Excavation Noise

In Alternative A, construction of the SOE would result in major adverse noise impacts at 26 locations and moderate adverse noise impacts at six locations.

The Alternative A SOE would include a secant pile wall 64 feet deep around the outer perimeter of the Project Area and interior sheet-pile walls up to 100 feet deep. Construction of the SOE structures would involve the use cranes, drill rigs, dump trucks, concrete pump trucks, and vibratory sheet pile drivers that would generate noise while operating.

Modeling indicated that the noise generated by SOE construction activities would exceed applicable District or FTA criteria at multiple receptors adjacent to WUS and along 2nd Street NE north of H Street, resulting in major adverse impacts at 26 locations and moderate adverse impacts at six locations (**Figure 10-12**).[13] In addition, the site of three planned developments (Storey Park, 170 L Street NE, 1109 Congress Street NE) would experience noise levels in excess of the severe threshold. Noise levels would also exceed the 65 dBA (Lmax) District noise ordinance limit for nighttime construction. **Table 10-8** identifies the affected receptors and the corresponding modeled noise levels.

Locations where there would be major adverse noise impacts from SOE construction include: WUS at the south end of the rail terminal; the REA Building; the US Securities and Exchange Commission building; the Kaiser Permanente Medical Center as well as multiple residential and commercial building along First, 2nd. K, I (Eye), and Parker Streets NE. Impacts would occur during all four phases of construction at most locations.

[13] Some locations include multiple modeled receptors.

Figure 10-12. Alternative A Support of Excavation Noise Impacts

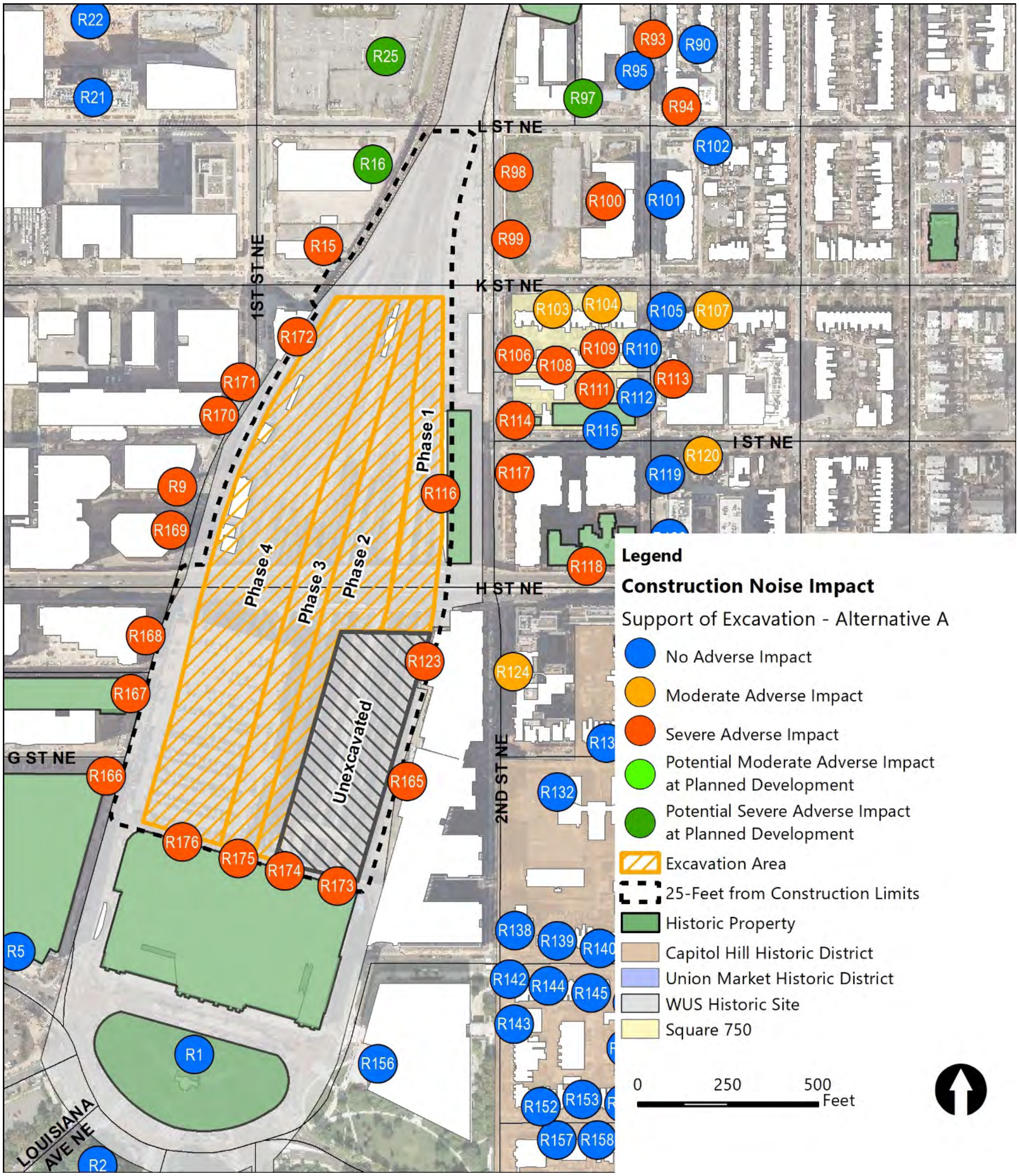


Table 10-8. Support of Excavation Construction Noise Impact Assessment, Alternative A

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R9	**First Street NE**	**CNN TV Studio**		61.2	58.5	64.0	73.7	**Severe**
R15	**100 K Street**	**Equity Residential**		69.3	63.8	69.0	79.1	**Severe**
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development (Planned)**		70.4	64.7	69.8	71.8	N/A[2]
R25	**170 L Street NE**	**NoMA Station - Bristol Development (Planned)**		68.6	63.3	68.5	73.7	N/A[2]
R93	**1111-1139 3rd Street NE**	**Residential**		57.7	56.6	62.3	67.0	**Severe**
R94	**300 L Street**	**The Aria on L (First-level)**		64	60.2	65.6	63.3	Moderate[3]
R94-1	**300 L Street**	**The Aria on L (Mid-level)**		63.5	59.9	65.3	63.2	Moderate[3]
R94-2	**300 L Street**	**The Aria on L (Top-level)**		63.4	59.8	65.2	66.3	**Severe**
R97	**1109 Congress Street NE**	**J St Developers Co. Residences (Planned)**		59.7	57.6	63.2	75.7	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**		68.9	63.5	68.7	79.1	**Severe**
R99	**230 K Street NE II**	**Toll Brothers City Living Phase II**		67.9	62.8	68.1	77.7	**Severe**
R100	**250 K Street NE**	**Loree Grand Apartments (First-level)**		57.9	56.7	62.4	67.6	**Severe**
R100-1	**250 K Street NE**	**Loree Grand Apartments (Mid-level)**		61.4	58.6	64.1	74.1	**Severe[3]**
R100-2	**250 K Street NE**	**Loree Grand Apartments (Top-level)**		61.5	58.6	64.2	74.6	**Severe[3]**
R103	**203-219 K St NE**	**Residential**	Yes	65.3	61.0	66.4	65.8	Moderate
R104	**221-243 K Street NE**	**Residential**	Yes	64.4	60.4	65.8	64.8	Moderate
R106	**917-923 2nd Street NE**	**Residential**	Yes	64.7	60.6	66.0	83.0	**Severe**
R107	**301-319 K Street NE**	**Residential**		62.9	59.5	65.0	59.9	Moderate
R108	**208-224 Parker Street NE**	**Residential**	Yes	53.6	54.7	60.7	72.6	**Severe**
R109	**226-242 Parker Street NE**	**Residential**	Yes	49.8	53.3	59.5	68.3	**Severe**
R111	**219-231 Parker Street NE**	**Residential**	Yes	49.3	53.1	59.4	67.9	**Severe**
R113	**907-913 3rd Street NE**	**Residential**		57.7	56.6	62.3	64.2	**Severe**
R114	**220 I Street NE**	**Intern Housing**	Yes	62.5	59.2	64.7	77.9	**Severe**

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R116	**900 2nd Street NE**	**Center City Public Charter School**	Yes	72.1	70.0	76.0	92.9	**Severe**
R117	**201 I Street NE**	**Senate Square Apartments (First-level)**		60.2	57.9	63.5	70.9	**Severe**
R117-1	**201 I Street NE**	**Senate Square Apartments (Mid-level)**		59.9	57.7	63.3	75.0	**Severe**[3]
R117-2	**201 I Street NE**	**Senate Square Apartments (Top-level)**		63.4	59.8	65.2	80.3	**Severe**[3]
R118	**211 I Street NE**	**Landmark Lofts**	Yes	68	62.9	68.1	70.3	**Severe**
R120	**307-313 I Street NE**	**Residential**		58.7	57.1	62.8	57.2	Moderate
R121	**307-313 I Street NE**	**Residential (Balcony)**		58.2	56.8	62.5	57.2	Moderate[3]
R123	**700 2nd Street NE**	**Kaiser Permanente Medical Center (First-level)**		70.5	69.7	74.8	92.2	**Severe**
R123-1	**700 2nd Street NE-Mid**	**Kaiser Permanente Medical Center (Mid-level)**		69	68.6	73.8	88.6	**Severe**[3]
R123-2	**700 2nd Street NE-Top**	**Kaiser Permanente Medical Center (Top-level)**		67.4	67.5	72.7	85.8	**Severe**[3]
R124	**701 2nd Street NE**	**Station House Apartments**		61	58.4	63.9	63.1	Moderate
R129	**731-745 3rd Street NE**	**Residential**	Yes	48.2	52.8	59.2	53.3	Moderate
R165	**100 F Street NE**	**US Securities and Exchange Commission (First-level)**		66.3	66.7	72.0	88.5	**Severe**
R165-1	**100 F Street NE - Mid**	**US Securities and Exchange Commission (Mid-level)**		65.6	66.2	71.6	87.2	**Severe**[3]
R165-2	**100 F Street NE - Top**	**US Securities and Exchange Commission (Top-level)**		64.5	65.5	70.9	85.3	**Severe**[3]
R166	**2 Mass Avenue NE**	**Postal Museum - Construction Side**	Yes	58.4	61.9	67.6	75.1	**Severe**
R167	**10 G Street NE**	**US Printing Warehouse - Construction Side**	Yes	61.6	63.7	69.2	76.2	**Severe**
R168	**750 First Street NE**	**Union Station Redevelopment Corp**		62.9	64.5	70.0	76.2	**Severe**
R169	**810 First Street NE**	**Davita Union Plaza**		62.5	64.2	69.7	73.7	**Severe**
R170	**888 First Street NE**	**Federal Energy Reg Commission**		62.5	64.2	69.7	73.7	**Severe**
R171	**77 K Street NE**	**IRS Taxpayer Assistance Center**		66	66.5	71.8	75.8	**Severe**
R172	**111 K Street NE**	**NASPA**		74.4	70.0	77.7	86.7	**Severe**
R173	**Union Station**	**WUS - Tracks 25-28**	Yes	61.2	63.5	69.0	90.1	**Severe**
R174	**Union Station**	**WUS - Tracks 22-25**	Yes	53.7	59.7	65.7	88.8	**Severe**[3]

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R175	**Union Station**	**WUS - Tracks 10-12**	Yes	54.5	60.1	66.0	89.2	**Severe**[3]
R176	**Union Station**	**WUS - Tracks 25-28**	Yes	53.9	59.8	65.8	87.3	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at the same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. 3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Excavation Noise

In Alternative A, the rail terminal would be excavated down to the concourse with minimal deeper excavation for back of the house space. Equipment used for excavation activities would include dump trucks, backhoes, bulldozers, and clam shovels.

Spoil removal would be wholly by truck, or using work trains, or a mix of the two. Accordingly, the excavation noise assessment considered three scenarios: removal by trucks only (All Truck Scenario: 120 trucks a day); removal by trains only (Work Train Scenario: two trains a day); and removal by both trucks and trains (Mixed Scenario: 60 trucks and one train a day).

Trucks would travel along designated truck routes and only use local streets – such as K Street NE, G Street NE (between North Capitol Street and First Street), First Street NE, and 2nd Street NE – to access the construction site. For the purposes of the noise assessment, it was assumed that all trucks would travel on New York Avenue, North Capitol Street, Massachusetts Avenue, H Street NE, and K Street NE east of 2nd Street NE. It was also assumed that trucks would travel north and south from and to the Project Area on either First Street or 2nd Street NE. Therefore, only half the trucks would operate on each of these two streets. Trains would generally be moved outside of the peak service periods.

<u>Start of Excavation</u>

In Alternative A, at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck Scenario and Mixed Scenario) or eight locations (Work Train Scenario).

The start of excavation activities, when all the operating equipment would be at the same grade as surrounding land uses, is when noise impacts would be greatest. The noise levels generated by start of excavation activities would vary according with the methods of spoil removal. In general, they would be greatest in the All Truck Scenario (ranging from 60 to 91 dBA [Ldn]), least in the Work Train Scenario (ranging from 50 to 88 dBA [Ldn]), and intermediary in the Mixed Scenario (ranging from 57 to 90 dBA [Ldn]). Generally, construction noise levels would be approximately 4 dBA (Ldn) higher in the All Truck Scenario than in the Work Train Scenario.

The difference would be primarily due to trucks operating during the nighttime hours of the 20-hour daily construction period. However, the primary sources of noise during excavation are on-site dump trucks, clam shovels, and excavators. Noise exposure from these stationary sources would occur for longer durations than exposure from dump truck passbys.

At multiple locations, in all three scenarios, resulting noise levels would exceed the long-term construction noise Impact criteria for severe or moderate impacts, or the District's noise ordinance, resulting in major and moderate noise impacts.

The criteria for severe or moderate impact would also be exceeded in three locations with planned developments in all three scenarios. There would be impacts at those locations if they have been developed with or permitted for sensitive uses by the time construction occurs. The affected locations are identified in **Table 10-9**. **Figure 10-13** and **Figure 10-14** illustrate impacts in the All Truck Scenario and in the Work Train Scenario, respectively.

Locations adjacent to the rail terminal, such as the north side of the historic station building, the REA Building, the US Securities and Exchange Commission Building, the Kaiser Permanente Medical Center, as well as multiple commercial residential uses along K Street NE, First Street NE, 2nd Street NE north of H Street, and Parker Street NE, would experience major adverse impacts in all three scenarios. Most locations that would experience lesser impacts in the Work Train Scenario as located along the streets that trucks would use to travel in and out of the Project Area: First Street NE,2nd Street NE, and K Street NE. The most notable difference would be on 2nd Street south of H Street, where several locations that would experience moderate adverse impacts in the All Truck Scenario would drop below the threshold in the Work Train Scenario. On First Street NE north of H Street, several location would drop below the severe impact criteria but remain above the moderate criteria.

<u>**End of Excavation**</u>

In Alternative A, at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario and Mixed Scenario) or four locations (Work Train Scenario). There would be moderate adverse noise impacts at 19 locations (All Truck Scenario), 15 locations (Mixed Scenario), or 12 locations (Work Train Scenario).

As excavation proceeds, noisy equipment would be located closer to the bottom, resulting in greater sound attenuation from the SOE structures and surrounding buildings, and lower noise levels at nearby receptors. By the end of the excavation work, noise levels would be significantly lower than at the start. In the All Truck Scenario, they would range from 56 to 88 dBA (Ldn); in the Mixed Scenario, they would range from 55 to 87 dBA (Ldn); and in the Work Train Scenario, they would range from 48 to 85 dBA (Ldn). Noise levels would be approximately 4 dBA (Ldn) higher in the All Truck Scenario than in the Work Train Scenario.

Table 10-10 identifies the receptors that where noise levels would exceed the criteria for severe or moderate impact in any of the three scenarios. **Figure 10-15** and **Figure 10-16** illustrate impacts in the All Truck Scenario and in the Work Train Scenario, respectively.

Figure 10-13. Alternative A Start of Excavation Noise Impacts (All Truck Scenario)

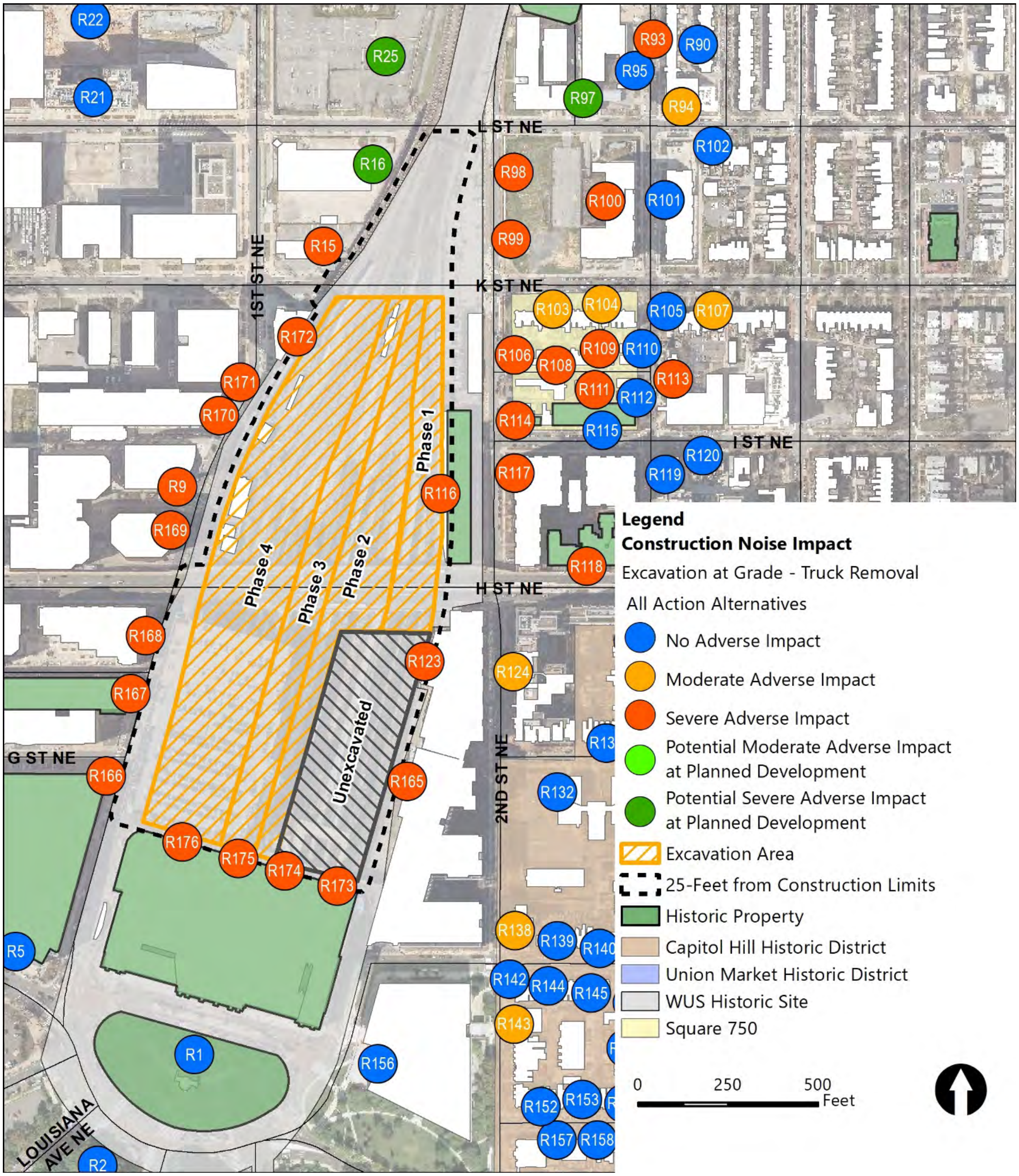


Figure 10-14. Alternative A Start of Excavation Noise Impacts (Work Train Scenario)

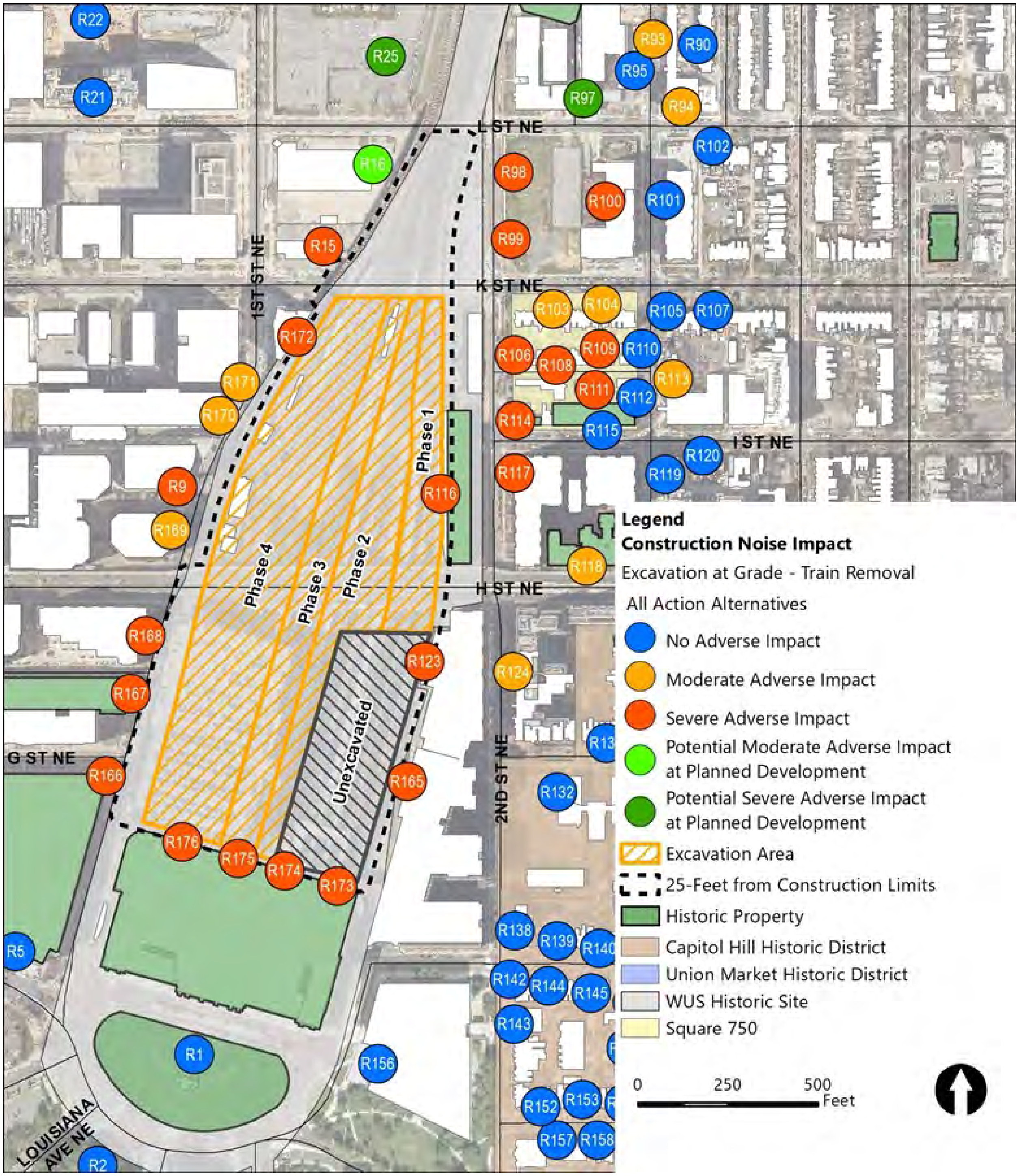


Table 10-9. Start of Excavation Noise Impact Assessment, Alternative A

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)						Impact		
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise (Removal by 120 Trucks per Day)	Construction Noise (Removal by 60 Trucks and 1 Train per Day)	Construction Noise (Removal by 2 Trains per Day)	120 Trucks	60 Trucks and 1 Train	2 Trains
					Moderate	Severe						
R9	First Street NE	CNN TV Studio		61.2	58.5	64.0	72.2	70.9	68.8	Severe	Severe	Severe
R15	100 K Street	Equity Residential		69.3	63.8	69.0	77.5	76.3	74.2	Severe	Severe	Severe
R16	Storey Park	Perseus Realty/Four Points LLC Development (Planned)		70.4	64.7	69.8	70.1	68.9	66.9	N/A[2]	N/A[2]	N/A[2]
R25	170 L Street NE	NoMA Station - Bristol Development (Planned)		68.6	63.3	68.5	72.1	70.9	68.8	N/A[2]	N/A[2]	N/A[2]
R93	1111-1139 3rd Street NE	Residential		57.7	56.6	62.3	65.4	64.2	62.1	Severe	Severe	Moderate
R94	300 L Street	The Aria on L		64	60.2	65.6	61.7	60.5	58.4	Moderate[3]	Moderate[3]	
R94-1	300 L Street	The Aria on L (Mid-level)		63.5	59.9	65.3	61.7	60.4	58.4	Moderate[3]	Moderate[3]	
R94-2	300 L Street	The Aria on L (Top-level)		63.4	59.8	65.2	64.7	63.5	61.4	Moderate	Moderate	Moderate
R97	1109 Congress Street NE	J Street Developers Co. Residences (Planned)		59.7	57.6	63.2	74.1	72.9	70.8	N/A[2]	N/A[2]	N/A[2]
R98	230 K Street NE	Toll Brothers City Living		68.9	63.5	68.7	77.5	76.3	74.2	Severe	Severe	Severe
R99	230 K Street NE II	Toll Brothers City Living Phase II		67.9	62.8	68.1	75.9	74.7	72.6	Severe	Severe	Severe
R100	250 K Street NE	Loree Grand Apartments (First-level)		57.9	56.7	62.4	66.0	64.8	62.7	Severe	Severe	Severe
R100-1	250 K Street NE	Loree Grand Apartments (Mid-level)		61.4	58.6	64.1	72.5	71.3	69.2	Severe[3]	Severe[3]	Severe[3]
R100-2	250 K Street NE	Loree Grand Apartments (Top-level)		61.5	58.6	64.2	73.0	71.8	69.7	Severe[3]	Severe[3]	Severe[3]
R103	203-219 K Street NE	Residential	Yes	65.3	61.0	66.4	65.4	63.8	61.5	Moderate	Moderate	Moderate
R104	221-243 K Street NE	Residential	Yes	64.4	60.4	65.8	64.7	63.0	60.6	Moderate	Moderate	Moderate
R106	917-923 2nd Street NE	Residential	Yes	64.7	60.6	66.0	81.2	80.0	77.9	Severe	Severe	Severe
R107	301-319 K Street NE	Residential		62.9	59.5	65.0	61.8	59.8	57.1	Moderate	Moderate	
R108	208-224 Parker Street NE	Residential	Yes	53.6	54.7	60.7	70.8	69.6	67.5	Severe	Severe	Severe
R109	226-242 Parker Street NE	Residential	Yes	49.8	53.3	59.5	66.7	65.5	63.4	Severe	Severe	Severe
R111	219-231 Parker Street NE	Residential	Yes	49.3	53.1	59.4	66.2	65.0	62.9	Severe	Severe	Severe
R113	907-913 3rd Street NE	Residential		57.7	56.6	62.3	62.7	61.5	59.3	Severe	Moderate	Moderate
R114	220 I Street NE	Intern Housing	Yes	62.5	59.2	64.7	76.2	74.9	72.8	Severe	Severe	Severe
R116	900 2nd Street NE	REA Building/Center City Public Charter School	Yes	72.1	70.0	76.0	91.1	89.9	87.8	Severe	Severe	Severe
R117	201 I Street NE	Senate Square Apartments (First-level)		60.2	57.9	63.5	69.4	68.1	65.9	Severe	Severe	Severe
R117-1	201 I Street NE	Senate Square Apartments (Mid-level)		59.9	57.7	63.3	73.3	72.1	69.9	Severe[3]	Severe[3]	Severe[3]
R117-2	201 I Street NE	Senate Square Apartments (Top-level)		63.4	59.8	65.2	78.6	77.4	75.3	Severe[3]	Severe[3]	Severe[3]
R118	211 I Street NE	Landmark Lofts	Yes	68	62.9	68.1	69.3	67.8	65.6	Severe	Moderate	Moderate
R123	700 2nd Street NE	Kaiser Permanente Medical Center (First-level)		70.5	69.7	74.8	90.4	89.2	87.1	Severe	Severe	Severe
R123-1	700 2nd Street NE	Kaiser Permanente Medical Center (Mid-level)		69	68.6	73.8	86.8	85.6	83.5	Severe[3]	Severe[3]	Severe[3]
R123-2	700 2nd Street NE	Kaiser Permanente Medical Center (Top-level)		67.4	67.5	72.7	84.0	82.8	80.7	Severe[3]	Severe[3]	Severe[3]
R124	701 2nd Street NE	Station House Apartments		61	58.4	63.9	63.5	61.7	58.4	Moderate	Moderate	Moderate
R138	603-607 2nd Street NE	Residential	Yes	58.3	56.9	62.6	59.8	57.2	51.3	Moderate	Moderate	
R143	521-527 2nd Street NE	Residential	Yes	59.4	57.5	63.1	59.9	57.1	50.3	Moderate		

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)						Impact		
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise (Removal by 120 Trucks per Day)	Construction Noise (Removal by 60 Trucks and 1 Train per Day)	Construction Noise (Removal by 2 Trains per Day)	120 Trucks	60 Trucks and 1 Train	2 Trains
					Moderate	Severe						
R165	**100 F Street NE**	**US Securities and Exchange Commission (First-level)**		66.3	66.7	72.0	86.7	85.5	83.4	**Severe**	**Severe**	**Severe**
R165-1	**100 F Street NE - Mid**	**US Securities and Exchange Commission (Mid-level)**		65.6	66.2	71.6	85.4	84.2	82.1	**Severe**[3]	**Severe**[3]	**Severe**[3]
R165-2	**100 F Street NE - Top**	**US Securities and Exchange Commission (Top-level)**		64.5	65.5	70.9	83.5	82.3	80.2	**Severe**[3]	**Severe**[3]	**Severe**[3]
R166	**2 Mass Avenue NE**	**Postal Museum**	Yes	58.4	61.9	67.6	73.5	72.2	70.1	**Severe**	**Severe**	**Severe**
R167	**10 G Street NE**	**US Printing Warehouse**	Yes	61.6	63.7	69.2	74.7	73.4	71.3	**Severe**	**Severe**	**Severe**
R168	**750 First Street NE**	**Union Station Redevelopment Corp**		62.9	64.5	70.0	74.6	73.3	71.2	**Severe**	**Severe**	**Severe**
R169	**810 First Street NE**	**Davita Union Plaza**		62.5	64.2	69.7	72.1	70.9	68.7	**Severe**	**Severe**	Moderate
R170	**888 First Street NE**	**Federal Energy Reg Commission**		62.5	64.2	69.7	72.1	70.9	68.8	**Severe**	**Severe**	Moderate
R171	**77 K Street NE**	**IRS Taxpayer Assistance Center**		66	66.5	71.8	74.3	73.0	70.9	**Severe**	**Severe**	Moderate
R172	**111 K Street NE**	**National Association of Student Personnel Administrators**		74.4	70.0	77.7	85.0	83.8	81.7	**Severe**	**Severe**	**Severe**
R173	**Union Station**	**WUS - Tracks 25-28**	Yes	61.2	63.5	69.0	88.3	87.1	85.0	**Severe**	**Severe**	**Severe**
R174	**Union Station**	**WUS - Tracks 22-25**	Yes	53.7	59.7	65.7	87.2	86.0	83.9	**Severe**[3]	**Severe**[3]	**Severe**[3]
R175	**Union Station**	**WUS - Tracks 10-12**	Yes	54.5	60.1	66.0	87.6	86.4	84.3	**Severe**[3]	**Severe**[3]	**Severe**[3]
R176	**Union Station**	**WUS - Tracks 1-10**	Yes	53.9	59.8	65.8	85.7	84.5	82.4	**Severe**[3]	**Severe**[3]	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. 3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Figure 10-15. Alternative A End of Excavation Noise Impacts (All Truck Scenario)

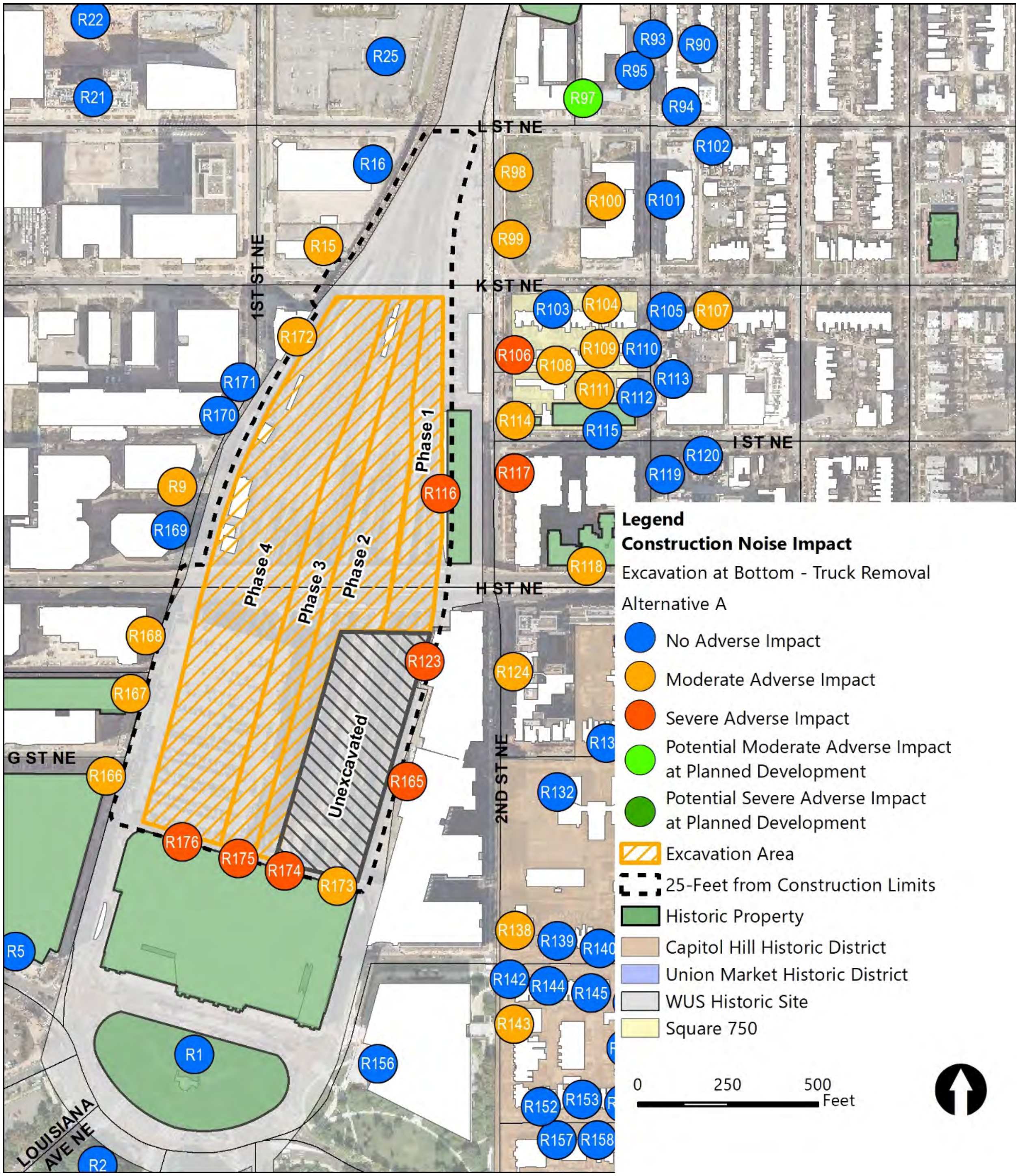


Figure 10-16. Alternative A End of Excavation Noise Impacts (Work Train Scenario)

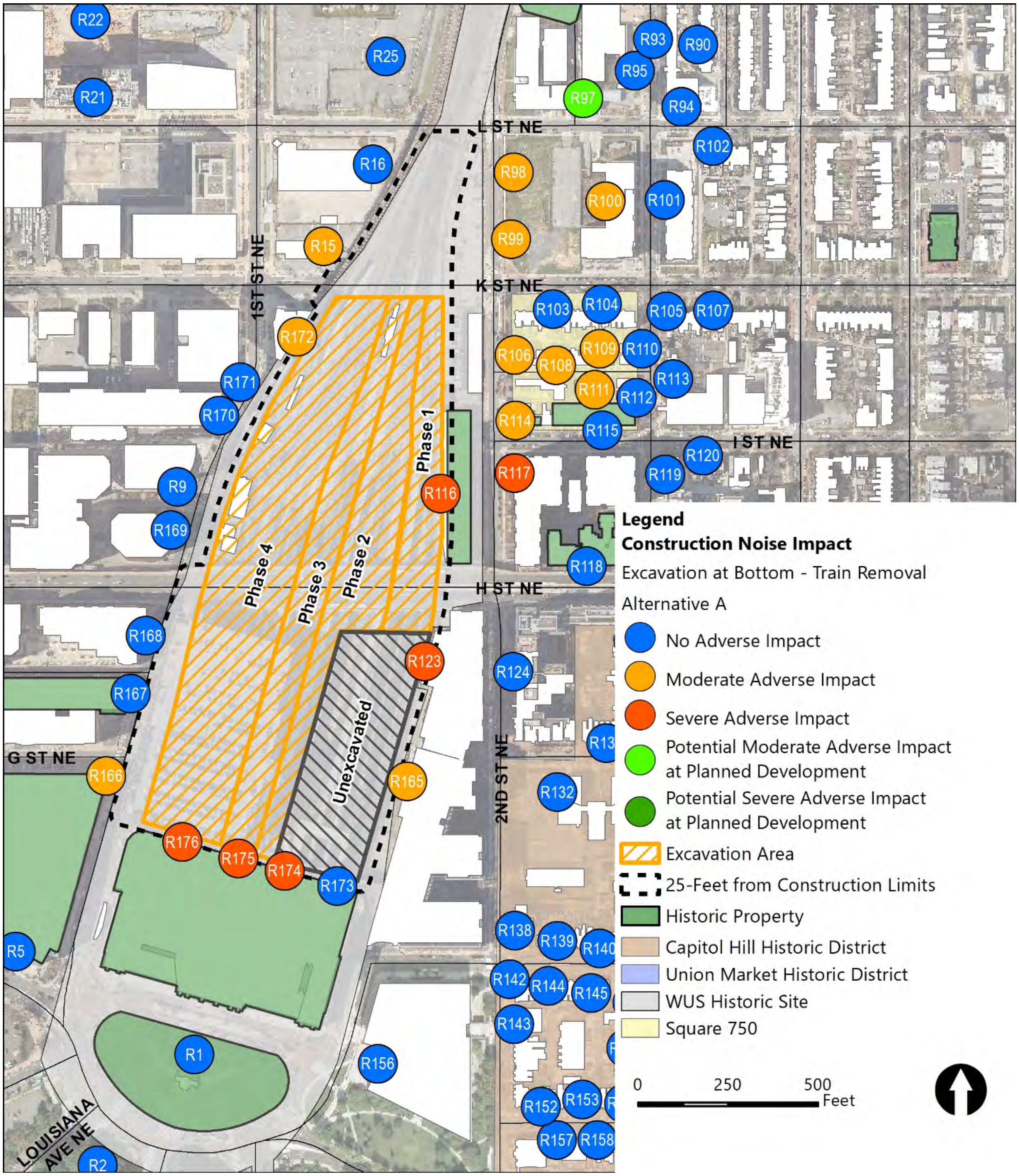


Table 10-10. End of Excavation Noise Impact Assessment, Alternative A

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)						Impact		
				Existing	(Long-Term) Mobile Source Project Noise Impact Criteria		Construction Noise (Removal by 120 Trucks per Day)	Construction Noise (Removal by 60 Trucks and 1 Train per Day)	Construction Noise (Removal by 2 Trains per Day)	120 Trucks	60 Trucks and 1 Train	2 Trains
					Moderate	Severe						
R9	First Street NE	CNN TV Studio		61.2	58.5	64.0	62.1	60.9	59.2	Moderate	Moderate	
R15	100 K Street	Equity Residential		69.3	63.8	69.0	67.3	66.2	64.6	Moderate	Moderate	Moderate
R97	1109 Congress Street NE	J St Developers Co. Residences (Planned)		59.7	57.6	63.2	62.8	61.7	59.9	N/A[2]	N/A[2]	N/A[2]
R98	230 K Street NE	Toll Brothers City Living		68.9	63.5	68.7	67.3	66.1	64.5	Moderate	Moderate	Moderate
R99	230 K Street NE II	Toll Brothers City Living Phase II		67.9	62.8	68.1	67.9	66.7	65.1	Moderate	Moderate	Moderate
R100-1	250 K Street NE	Loree Grand Apartments (Mid-level)		61.4	58.6	64.1	62.1	61.0	59.5	Moderate	Moderate	Moderate
R100-2	250 K Street NE	Loree Grand Apartments (Top-level)		61.5	58.6	64.2	63.9	62.8	61.3	Moderate[3]	Moderate[3]	Moderate[3]
R104	221-243 K Street NE	Residential	Yes	64.4	60.4	65.8	60.8	58.4	55.6	Moderate		
R106	917-923 2nd Street NE	Residential	Yes	64.7	60.6	66.0	67.2	65.9	64.1	**Severe**	Moderate	Moderate
R107	301-319 K Street NE	Residential		62.9	59.5	65.0	59.8	57.2	54.0	Moderate		
R108	208-224 Parker Street NE	Residential	Yes	53.6	54.7	60.7	59.9	58.7	57.1	Moderate	Moderate	Moderate
R109	226-242 Parker Street NE	Residential	Yes	49.8	53.3	59.5	57.8	56.6	55.0	Moderate	Moderate	Moderate
R111	219-231 Parker Street NE	Residential	Yes	49.3	53.1	59.4	56.5	55.3	53.5	Moderate	Moderate	Moderate
R114	220 I Street NE	Intern Housing	Yes	62.5	59.2	64.7	64.3	62.9	60.6	Moderate	Moderate	Moderate
R116	900 2nd Street NE	Center City Public Charter School	Yes	72.1	70.0	76.0	88.0	86.9	85.1	**Severe**	**Severe**	**Severe**
R117	201 I Street NE	Senate Square Apartments (First-level)		60.2	57.9	63.5	62.3	60.6	57.8	Moderate[3]	Moderate[3]	
R117-1	201 I Street NE	Senate Square Apartments (Mid-level)		59.9	57.7	63.3	67.7	66.5	64.7	**Severe**	**Severe**	**Severe**
R117-2	201 I Street NE	Senate Square Apartments (Top-level)		63.4	59.8	65.2	75.4	74.2	72.5	**Severe**[3]	**Severe**[3]	**Severe**[3]
R118	211 I Street NE	Landmark Lofts	Yes	68	62.9	68.1	63.9	61.9	59.3	Moderate		
R123-1	700 2nd Street NE - Mid	Kaiser Permanente Medical Center (Mid-level)		69	68.6	73.8	78.8	77.7	75.9	**Severe**	**Severe**	**Severe**
R123-2	700 2nd Street NE - Top	Kaiser Permanente Medical Center (Top-level)		67.4	67.5	72.7	78.2	77.1	75.3	**Severe**[3]	**Severe**[3]	**Severe**[3]
R124	701 2nd Street NE	Station House Apartments		61	58.4	63.9	61.3	59.1	54.8	Moderate	Moderate	
R138	603-607 2nd Street NE	Residential	Yes	58.3	56.9	62.6	59.2	56.4	49.2	Moderate		
R143	521-527 2nd Street NE	Residential	Yes	59.4	57.5	63.1	59.5	56.5	48.1	Moderate		
R165-1	100 F Street NE - Mid	US Securities and Exchange Commission (Mid-level)		65.6	66.2	71.6	69.4	68.3	66.6	Moderate[3]	Moderate[3]	Moderate[3]
R165-2	100 F Street NE - Top	US Securities and Exchange Commission (Top-level)		64.5	65.5	70.9	72.0	70.9	69.1	**Severe**	**Severe**	Moderate
R166	2 Mass Avenue NE	Postal Museum - Construction Side	Yes	58.4	61.9	67.6	66.0	64.8	63.1	Moderate	Moderate	Moderate
R167	10 G Street NE	US Printing Warehouse - Construction Si	Yes	61.6	63.7	69.2	65.8	64.5	62.9	Moderate	Moderate	
R168	750 First Street NE	Union Station Redevelopment Corp		62.9	64.5	70.0	65.8	64.5	62.8	Moderate	Moderate	
R172	111 K Street NE	NASPA		74.4	70.0	77.7	74.9	73.8	72.2	Moderate	Moderate	Moderate
R173	Union Station	WUS - Tracks 25-28	Yes	61.2	63.5	69.0	64.3	63.2	61.6	Moderate[3]		
R174	Union Station	WUS - Tracks 22-25	Yes	53.7	59.7	65.7	70.3	69.2	67.4	**Severe**	**Severe**	**Severe**
R175	Union Station	WUS - Tracks 10-12	Yes	54.5	60.1	66.0	81.1	80.0	78.2	**Severe**[3]	**Severe**[3]	**Severe**[3]
R176	Union Station	WUS - Tracks 1-10	Yes	53.9	59.8	65.8	79.7	78.6	77.0	**Severe**[3]	**Severe**[3]	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. 3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Noise levels would exceed the long-term construction noise Impact criteria for severe or moderate impacts at much fewer locations than at the start of excavation. There would be major (severe) adverse impacts at five locations in the All Truck and Mixed Scenarios: at the north side of the historic station building; the REA Building; the Kaiser Permanente Medical Center; the US Securities and Exchange Commission Building; and the Senate Square Apartments on I (Eye) Street NE. Impacts at the US Securities and Exchange Commission Building would be moderate in the Work Train Scenario. The criteria for moderate impact would be exceeded at one location with a planned development in all three scenarios. There would be a moderate impact at this location if it has been developed with or permitted for sensitive uses by the time construction occurs.

Construction Vibration

In Alternative A, there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, and the Union Station historic station building due to potential risk of structural damage. There would be moderate adverse impacts from truck-generated vibration at 12 locations due to annoyance.

Vibration generated by construction equipment has the potential to cause structural damage to buildings close to the construction site and to annoy persons in nearby buildings. Activities that would generate vibration in Alternative A includes drilling during secant pile wall construction; vibratory sheet pile driving; use of hoe rams and jackhammers during concrete removal; use of excavators, back hoes, and loaded trucks during excavation; and use of vibratory rollers used for track re-construction. As shown in **Table 10-6** above, vibratory pile driving associated with the sheet pile wall SOE has the potential to cause structural damage within 31 feet of the most fragile buildings and within 13 feet of buildings with reinforced concrete, steel, or timber frames. Drilling associated with secant pile wall SOE has the potential to cause structural damage within 20 feet of the most fragile buildings and within 8 feet of buildings with reinforced concrete, steel, or timber frames.

Figure 10-17 and **Table 10-11** present the results of the construction equipment vibration assessment for Alternative A. There would be major adverse impacts on the REA Building, the Kaiser Permanente Medical Center, and the Union Station historic station building because vibratory pile driving would occur within 10 to 16 feet of these structures, resulting in vibration levels of approximately 0.33 to 0.67 in/s. In its initial stages, the beginning of the column removal work may generate vibration impacts within the eastern part of the historic station building if jackhammers are to break the existing flooring and access girders and column from above. Such impacts would be of brief duration.

Vibration levels at the three buildings may exceed the criterion for increased risk of structural damage but this would depend on building sensitivity, which in turn is a function of the type of construction (see **Table 10-5** above). All three buildings were designed within the context of an active rail terminal and are all large masonry structures. Therefore, they can be expected to have low sensitivity, reducing the risk of structural impact. However, as historic structures, the REA Building and the historic station building may warrant the application of a lower criterion than the one applicable to buildings of similar construction but more recent. The sensitivity of the buildings would have to be assessed in the Construction Noise and Vibration Plan that would be prepared for the Project (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*).

Interior vibration conditions at the same three receptors may range from 80 to 90 VdB, which would exceed the threshold for human annoyance. This would only occur when vibration-generating work is conducted near the buildings, however. Vibration annoyance typically would not occur beyond 50 feet of the vibration source.

Vibration from truck traffic would cause moderate adverse impacts by exceeding the threshold for annoyance at 12 other locations close to New York Avenue, North Capitol Street and 2nd Street NE. These locations include UDC Community College; the C&P Telephone Company/NPR Studio building; the Hecht Warehouse lofts (R58); residential units in the Square 750 block 203-219 K Street NE, 917-923 2nd Street NE); residential and institutional receptors on the edge of the Capitol Hill Historic District (603-607 2nd Street NE, 205 F Street NE, 521-527 2nd Street NE); and Landmark Lofts (R118) in the historic St. Joseph's Home building. One planned development location at 411 New York Ave NE also would be moderately impacted if the development has been completed at the time of construction. These impacts would occur in the All Truck and Mixed Scenarios. Vibration in the Work Train Scenario would be much less noticeable.

WASHINGTON UNION STATION
STATION EXPANSION

Figure 10-17. Alternative A Construction Vibration Impact

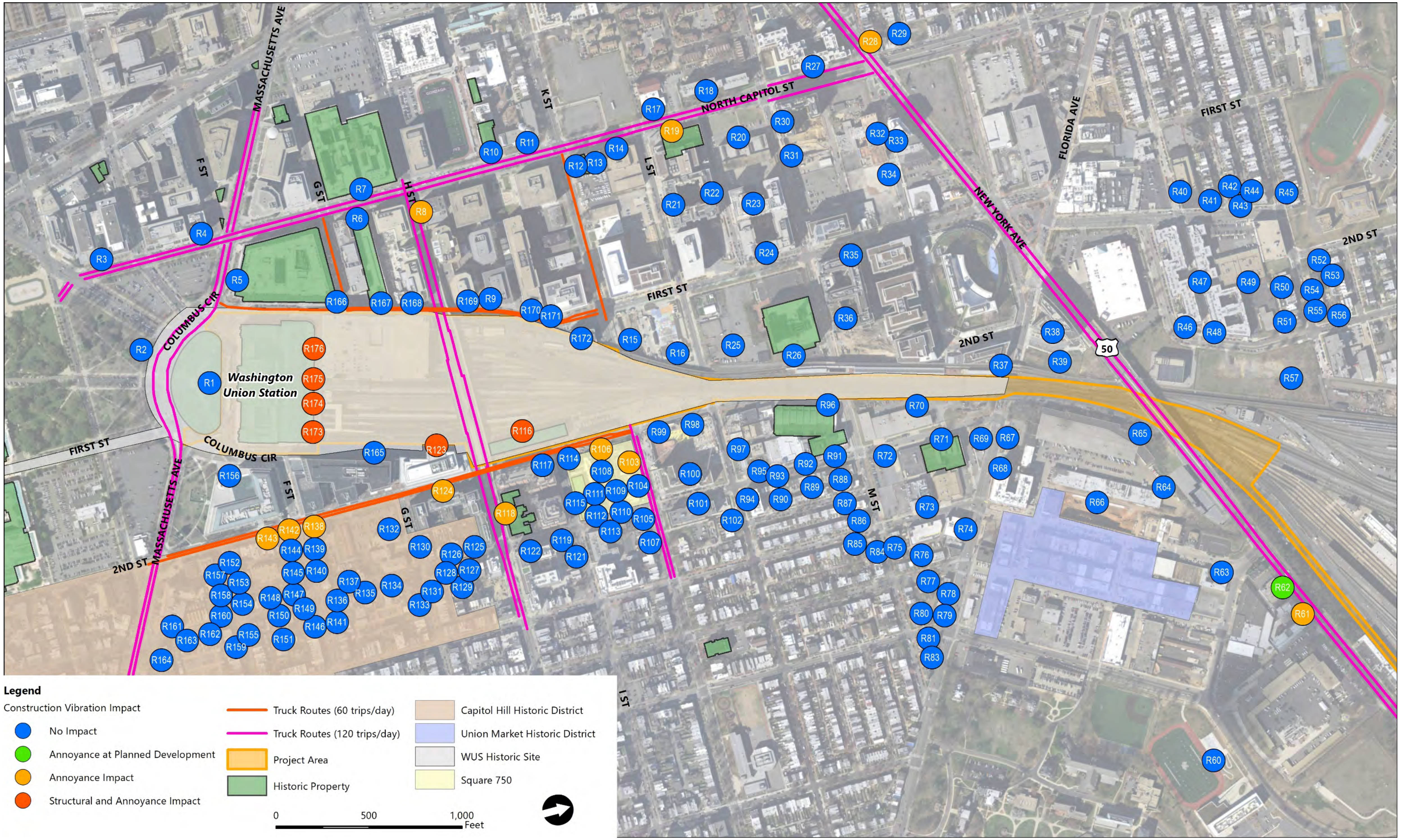


Table 10-11. Construction Vibration Impact Assessment, Alternative A

Receptor	Address	Land Description	Historic	Equipment	Distance (feet)	PPV (in/s)	Exterior Vibration Level (VdB)	Building Coupling Loss (VdB)	Interior Vibration Level (VdB)	Impact Criteria for Annoyance (VdB)	Impact
R8	**801 N Capitol Street NE**	**UDC Community College**	-	Trucks	15	0.16	93.7	13	81	75	Annoyance
R19	**1111 N Capitol Street NE**	**C&P Telephone Company / NPR Studio**	Yes	Trucks	34	0.05	83.0	13	70	65	Annoyance
R28	**3-9 New York Avenue NW**	**Residential**	-	Trucks	30	0.06	84.8	7	78	72	Annoyance
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	-	Trucks	25	0.08	87.0	13	74	72	Annoyance
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	-	Trucks	25	0.07	86.9	13	74	72	Annoyance
R62	**411 New York Avenue NE**	**Hotel Development (Planned)**	-	Trucks	19	0.12	90.7	13	78	72	N/A[1]
R103	**203-219 K Street NE**	**Square 750 / Residential**	Yes	Trucks	45	0.03	79.5	7	72	72	Annoyance
R106	**917-923 2nd Street NE**	**Square 750 / Residential**	Yes	Trucks	38	0.04	81.4	7	74	72	Annoyance
R116	**900 2nd Street NE**	**REA Building/Center City Public Charter School**	Yes	Vibratory Pile Driver	16	0.33	99	13	86	75	**Structural**/ Annoyance
				Drill Rig	16	0.17	93	13	80	75	Structural/ Annoyance
R118	**211 I Street NE**	**St Joseph's Home (Former) / Landmark Lofts**	Yes	Trucks	25	0.08	87.2	13	74	72	Annoyance
R123	**700 2nd Street NE**	**Kaiser Permanente**	-	Drill Rig	10	0.35	99	13	86	75	**Structural**/ Annoyance
R124	**701 2nd Street NE**	**Station House Apartments**	-	Trucks	25	0.07	86.8	13	74	72	Annoyance
R138	**603-607 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	28	0.06	85.6	7	79	72	Annoyance
R142	**205 F Street NE**	**Capitol Hill District / National Community Church**	Yes	Trucks	24	0.08	87.3	7	80	75	Annoyance
R143	**521-527 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	25	0.08	87.2	7	80	72	Annoyance
R173-176	**Union Station**	**Washington Union Station**	Yes	Vibratory Pile Driver	10	0.67	105	13	92	75	**Structural**/ Annoyance
				Drill Rig	10	0.35	99	13	86	75	**Structural**/ Annoyance

1. N/A: Not applicable. Planned developments are evaluated for vibration effects but are not assessed for impact.

10.5.2.4 Comparison to Existing Conditions

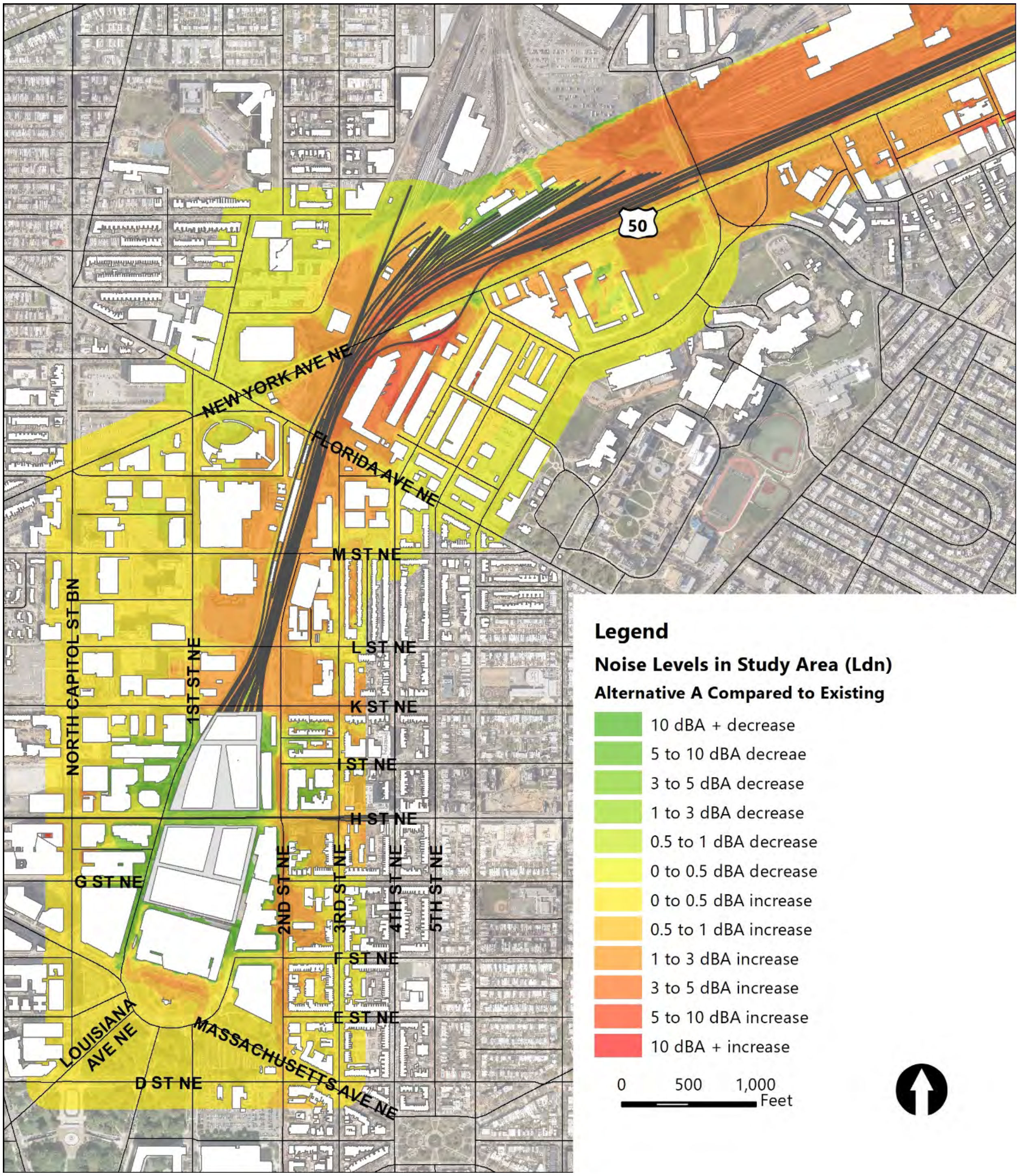
Figure 10-18 shows changes in noise levels in Alternative A relative to existing conditions. In most locations, Alternative A would result in negligible adverse operational impacts from increase in noise levels not exceeding 3 dBA (Ldn). Changes less 3 dBA are commonly considered imperceptible. These negligible impacts would be the result of increases in street traffic and rail operations.

In locations closest to the rail terminal south of K Street NE, Alternative A would have a beneficial impact on noise levels relative to existing conditions. Noise would decrease substantially (from approximately 5 to 10 dBA) because the Project elements and the private air-rights development would cover the currently open rail terminal. Reductions in traffic volumes on First Street NE, which would become a one-way road, would also contribute to the reduction.

There also would be minor adverse operational impacts due to increases in vibration in Alternative A relative to existing conditions. The greatest potential for increase in vibration would come from the re-introduction of Track 43 along with the re-introduction of the VRE MSRF tracks (under a separate project). Re-introducing Track 43 would shift the easternmost track up to 10 feet closer to receptors on the east side of WUS. For the closest receptors, which are approximately 50 feet away from the nearest track, the introduction of Track 43 would increase vibration by approximately up to 2 VdB, a minor impact.

Given the track improvements proposed in Alternative A, all vibration-sensitive receptors would be below the FTA vibration impact criteria in all areas, except the Union Market area. At the planned Kettler development (300 Morse Street NE), interior vibration levels would be 77 VdB (maximum in any 1/3-octave band) due to the new VRE MSRF tracks, which exceeds the FTA vibration criteria. Since this development is still in the planning phase, the receptor is not eligible for mitigation. The developer is working with VRE, which is re-introducing this track, to address potential noise and vibration effects.

Figure 10-18. Comparison of Alternative A and Existing Noise Conditions



10.5.3 Alternative B

10.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative B, noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative B would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Figure 10-19 and **Table 10-12** present the results of the operational noise impact assessment for Alternative B. Impacts would generally be the same as Alternative A. (see **Section 10.5.2.1,** *Direct Operational Impacts, Operational Noise*). Noise levels would range from 60 to 75 dBA (Ldn), which is typical for an urban setting. This is because rail operations would be the same in all Action Alternatives, as would be the overall increase in road traffic relative to the No-Action Alternative. Because in Alternative B, the parking entrance would be on K Street NE rather than H Street NE, traffic volumes on these streets would be different in Alternative A and Alternative B. However, the resulting difference in noise levels would be within 0.2 dBA, which would be imperceptible.

Similarly, stationary noise sources would be the same in Alternative B as in Alternative A (**Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*). Their impacts on noise levels would be negligible. Predominant sources of noise would include the rail terminal and tracks and traffic on New York Avenue NE, Florida Avenue NE, K Street NE, and Massachusetts Avenue NE.

Operational Vibration

Operational vibration impacts in Alternative B would be the same as in Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Vibration*). Alternative B includes the same improvements to the track infrastructure of the rail terminal and the throat. The number of trains, train types operating on each track, and train speeds would be the same.

Figure 10-19. Alternative B Noise Levels

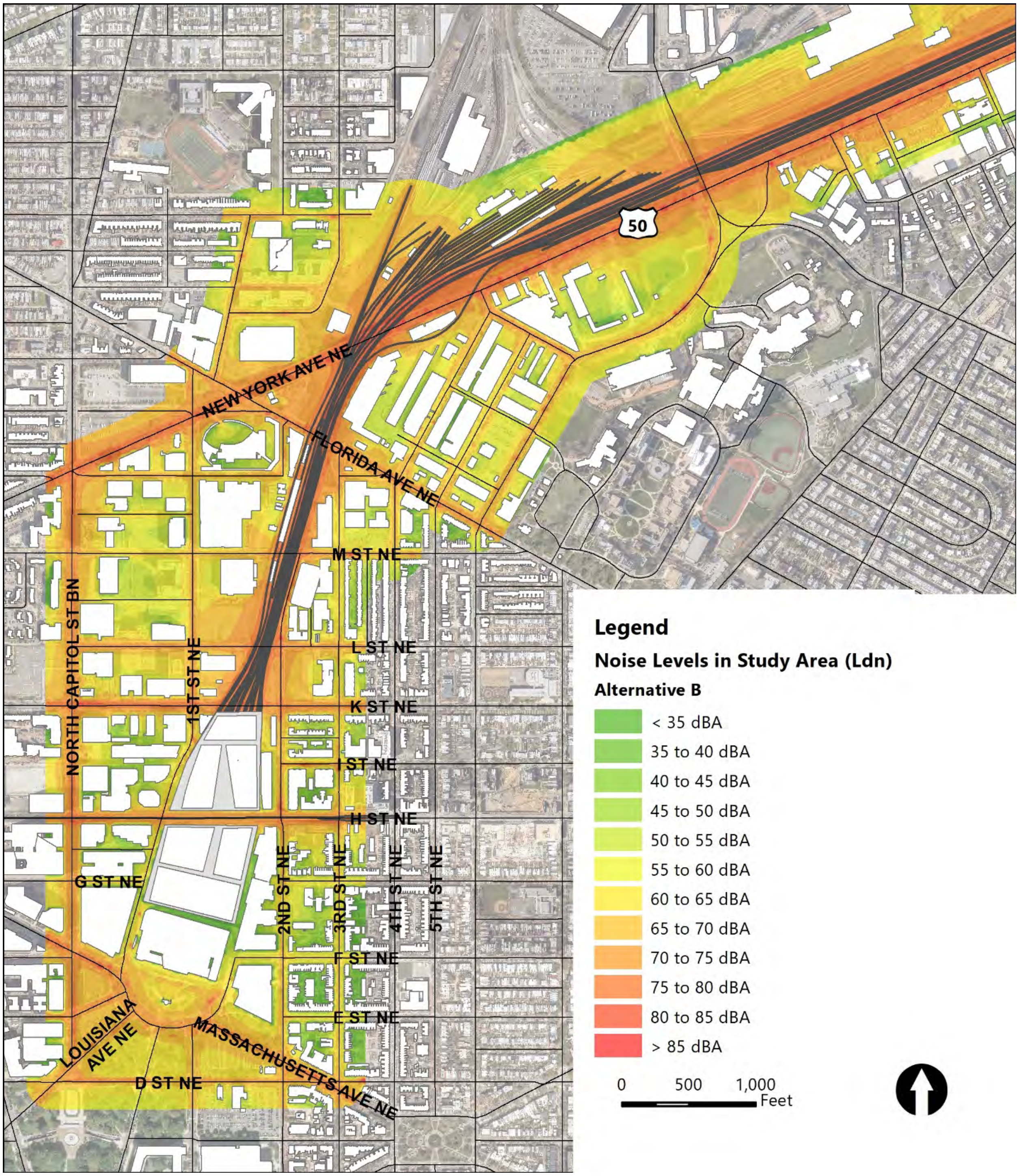


Table 10-12. Operational Noise Impact Assessment, Alternative B

Receptor[1]	Address	Land Description	Noise Level (Ldn, dBA) Existing	Future Impact Criteria (re: Existing) Moderate	Future Impact Criteria (re: Existing) Severe	No-Action	Future Impact Criteria (re: No-Action) Moderate	Future Impact Criteria (re: No-Action) Severe	Alt. B	FTA Noise Impact Assessment
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73	N/A[2]
R58[3]	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse Street Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[4]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.5	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.2	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.8	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments were evaluated for noise effects but are not assessed for impact. 3. For the map to remain on a legible scale, this receptor is not shown in Figure 10-10. It is located to the northeast of R61. 4. Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both Existing and No-Action noise level criteria.

10.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, there would be no indirect noise or vibration operational impacts in Alternative B.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.3.3 Construction Impacts

Support of Excavation Noise

In Alternative B, construction of the SOE structures would result in major adverse noise impacts at 28 locations and moderate adverse noise impacts at nine locations.

The Alternative B SOE would include a slurry wall down to bedrock around the Phase 2, 3 and 4 construction areas; secant pile walls 64 feet deep around the easternmost edge of the project area (Phase 1); and interior sheet pile walls up to 100 feet deep. Construction of the SOE structures would involve the use of clam shovels during slurry wall construction; drill rigs during secant pile wall construction; vibratory pile driving during sheet pile wall construction; and cranes, dump trucks, and excavators in all phases.

Modeling indicates that in Alternative B, the noise generated by SOE construction activities would exceed applicable District or FTA criteria at multiple receptors adjacent to WUS and along 2nd Street NE north of H Street, resulting in major adverse noise impacts at 28 locations and moderate adverse impacts at nine locations (**Figure 10-20**)[14]. The sites of three planned developments would experience noise levels in excess of the threshold for severe impacts. Noise levels would also exceed the 65 dBA (Lmax) District noise ordinance limit for nighttime construction. **Table 10-13** identifies the affected receptors and the corresponding modeled noise levels.

Locations where there would be major adverse noise impacts from SOE construction include: WUS at the south end of the rail terminal; the REA Building; the US Securities and Exchange Commission building; and the Kaiser Permanente Medical Center as well as several residential and commercial building along First, 2nd Street NE, I (Eye) Street NE, and Parker Street, NE.

[14] Some locations include multiple modeled receptors.

WASHINGTON UNION STATION STATION EXPANSION

Figure 10-20. Alternative B Support of Excavation Noise Impacts

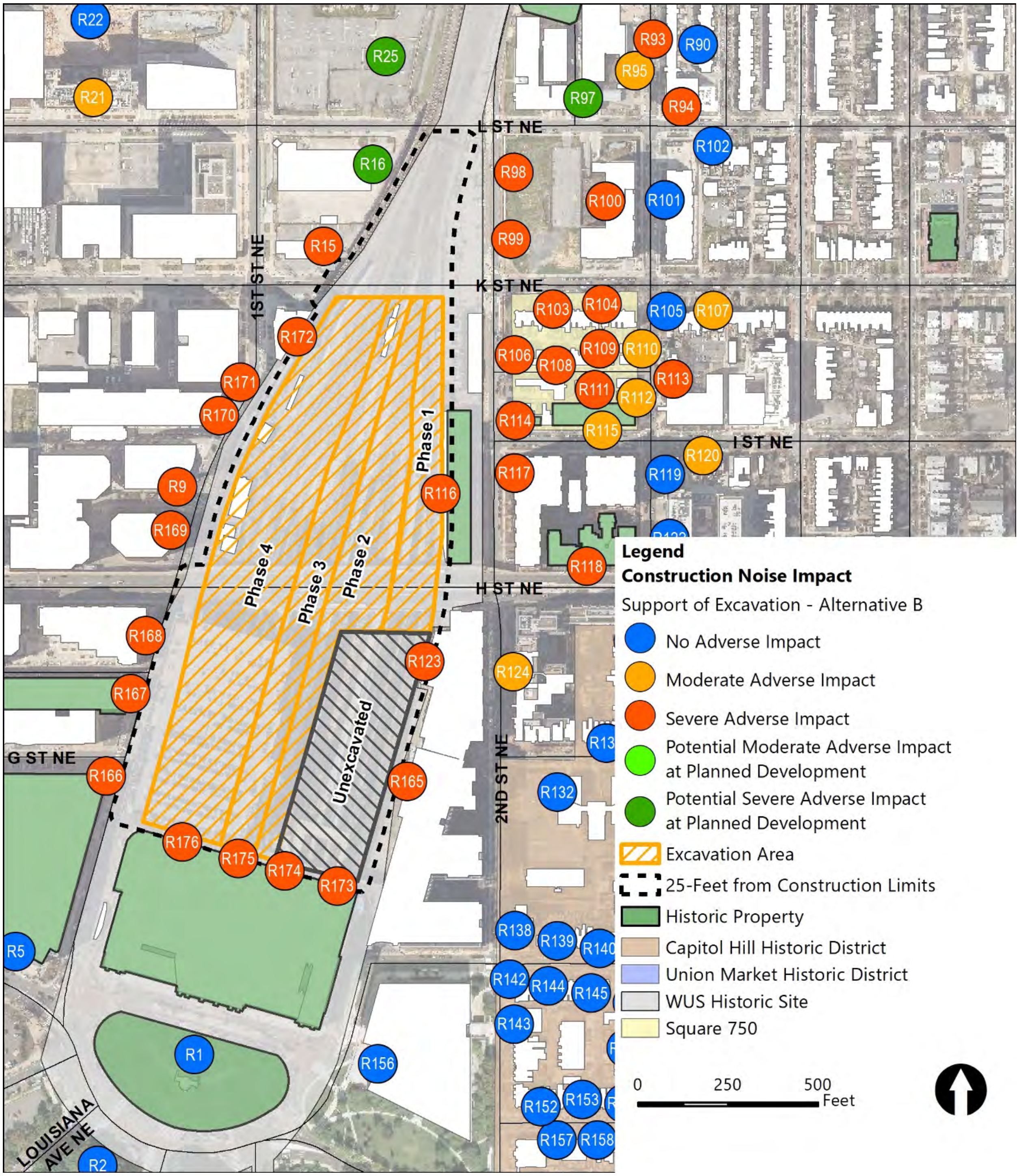


Table 10-13. Support of Excavation Construction Noise Impact Assessment, Alternative B

Receptor	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R9	**First Street NE**	**CNN TV Studio**		61.2	58.5	64.0	74.9	**Severe**
R15	**100 K Street**	**Equity Residential**		69.3	63.8	69.0	80.3	**Severe**
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development (Planned)**		70.4	64.7	69.8	75.0	N/A[2]
R21	**61 Pierce Street NE**	**Camden Apartments - A**		63.4	59.8	65.2	60.6	Moderate
R25	**170 L Street NE**	**NoMA Station - Bristol Development (Planned)**		68.6	63.3	68.5	76.9	N/A[2]
R93	**1111-1139 3rd Street NE**	**Residential**		57.7	56.6	62.3	70.2	**Severe**
R94	**300 L Street**	**The Aria on L (First-level)**		64	60.2	65.6	64.5	Moderate[3]
R94-1	**300 L Street**	**The Aria on L (Mid-level)**		63.5	59.9	65.3	64.4	Moderate[3]
R94-2	**300 L Street**	**The Aria on L (Top-level)**		63.4	59.8	65.2	69.5	**Severe**
R95	**1106-1118 3rd Street NE**	**Residential**		58.7	57.1	62.8	59.6	Moderate
R97	**1109 Congress Street NE**	**J St Developers Co. Residences (Planned)**		59.7	57.6	63.2	78.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**		68.9	63.5	68.7	82.1	**Severe**
R99	**230 K Street NE II**	**Toll Brothers City Living Phase II**		67.9	62.8	68.1	78.8	**Severe**
R100	**250 K Street NE**	**Loree Grand Apartments (First-level)**		57.9	56.7	62.4	70.8	**Severe**
R100-1	**250 K Street NE**	**Loree Grand Apartments (Mid-level)**		61.4	58.6	64.1	77.3	**Severe**[3]
R100-2	**250 K Street NE**	**Loree Grand Apartments (Top-level)**		61.5	58.6	64.2	77.8	**Severe**[3]
R103	**203-219 K Street NE**	**Residential**	Yes	65.3	61.0	66.4	68.9	**Severe**
R104	**221-243 K Street NE**	**Residential**	Yes	64.4	60.4	65.8	67.8	**Severe**
R106	**917-923 2nd Street NE**	**Residential**	Yes	64.7	60.6	66.0	85.0	**Severe**
R107	**301-319 K Street NE**	**Residential**		62.9	59.5	65.0	63.1	Moderate
R108	**208-224 Parker Street NE**	**Residential**	Yes	53.6	54.7	60.7	74.9	**Severe**
R109	**226-242 Parker Street NE**	**Residential**	Yes	49.8	53.3	59.5	71.2	**Severe**
R110	**916-922 3rd Street NE**	**Residential**	Yes	57.7	56.6	62.3	57.0	Moderate
R111	**219-231 Parker Street NE**	**Residential**	Yes	49.3	53.1	59.4	70.7	**Severe**
R112	**908-914 3rd Street NE**	**Residential**	Yes	56.8	56.1	61.9	57.3	Moderate
R113	**907-913 3rd Street NE**	**Residential**		57.7	56.6	62.3	66.9	**Severe**
R114	**220 I Street NE**	**Intern Housing**	Yes	62.5	59.2	64.7	78.1	**Severe**
R115	**210 I Street NE**	**Washington Intern Housing (Historic)**	Yes	58.5	57.0	62.7	58.9	Moderate
R116	**900 2nd Street NE**	**Center City Public Charter School**	Yes	72.1	70.0	76.0	92.9	**Severe**

Receptor	Address	Land Description	Historic	Noise Level (Ldn, dBA) Existing	Long-Term Construction Noise Impact Criteria Moderate	Long-Term Construction Noise Impact Criteria Severe	Construction Noise	Impact
R117	**201 I Street NE**	**Senate Square Apartments (First-level)**		60.2	57.9	63.5	70.9	**Severe**
R117-1	**201 I Street NE**	**Senate Square Apartments (Mid-level)**		59.9	57.7	63.3	77.0	**Severe**[3]
R117-2	**201 I Street NE**	**Senate Square Apartments (Top-level)**		63.4	59.8	65.2	83.5	**Severe**[3]
R118	**211 I Street NE**	**Landmark Lofts**	Yes	68	62.9	68.1	71.3	**Severe**
R120	**307-313 I Street NE**	**Residential**		58.7	57.1	62.8	59.9	Moderate
R121	**307-313 I Street NE**	**Residential (Balcony)**		58.2	56.8	62.5	60.3	Moderate[3]
R123	**700 2nd Street NE**	**Kaiser Permanente Medical Center (First-level)**		70.5	69.7	74.8	92.2	**Severe**
R123-1	**700 2nd Street NE-Mid**	**Kaiser Permanente Medical Center (Mid-level)**		69	68.6	73.8	88.6	**Severe**[3]
R123-2	**700 2nd Street NE-Top**	**Kaiser Permanente Medical Center (Top-level)**		67.4	67.5	72.7	85.8	**Severe**[3]
R124	**701 2nd Street NE**	**Station House Apartments**		61	58.4	63.9	63.1	Moderate
R129	**731-745 3rd Street NE**	**Residential**	Yes	48.2	52.8	59.2	53.3	Moderate
R165	**100 F Street NE**	**US Securities and Exchange Commission (First-level)**		66.3	66.7	72.0	88.5	**Severe**
R165-1	**100 F Street NE - Mid**	**US Securities and Exchange Commission (Mid-level)**		65.6	66.2	71.6	87.2	**Severe**[3]
R165-2	**100 F Street NE - Top**	**US Securities and Exchange Commission (Top-level)**		64.5	65.5	70.9	85.3	**Severe**[3]
R166	**2 Mass Avenue NE**	**Postal Museum - Construction Side**	Yes	58.4	61.9	67.6	76.3	**Severe**
R167	**10 G Street NE**	**US Printing Warehouse - Construction Side**	Yes	61.6	63.7	69.2	77.4	**Severe**
R168	**750 First Street NE**	**Union Station Redevelopment Corp**		62.9	64.5	70.0	77.4	**Severe**
R169	**810 First Street NE**	**Davita Union Plaza**		62.5	64.2	69.7	74.9	**Severe**
R170	**888 First Street NE**	**Federal Energy Reg Commission**		62.5	64.2	69.7	74.8	**Severe**
R171	**77 K Street NE**	**IRS Taxpayer Assistance Center**		66	66.5	71.8	77.0	**Severe**
R172	**111 K Street NE**	**NASPA**		74.4	70.0	77.7	87.9	**Severe**
R173	**Union Station**	**WUS - Tracks 25-28**	Yes	61.2	63.5	69.0	90.1	**Severe**
R174	**Union Station**	**WUS - Tracks 22-25**	Yes	53.7	59.7	65.7	92.4	**Severe**[3]
R175	**Union Station**	**WUS - Tracks 10-12**	Yes	54.5	60.1	66.0	92.4	**Severe**[3]
R176	**Union Station**	**WUS - Tracks 25-28**	Yes	53.9	59.8	65.8	88.5	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at the same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact.
3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Excavation Noise

<u>**Start of Excavation**</u>

In Alternative B, at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck and Mixed Scenarios) or eight locations (Work Train Scenario).

At the beginning of excavation, there would be no difference between the Action Alternatives. The same equipment would perform the same activities, resulting in similar noise levels. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, Start of Excavation*. The primary difference among Action Alternatives would regard to excavation noise would be the duration and the potential for impact at the end of excavation.

<u>**End of Excavation**</u>

In Alternative B, at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario) or four locations (Mixed Scenario and Work Train Scenario). There would be moderate adverse noise impacts at 13 locations (All Truck Scenario), seven locations (Mixed Scenario) or two locations (Work Train Scenario).

In Alternative B, the rail terminal would be excavated down to approximately 62 feet below existing grade. As excavation proceeds, noisy equipment would be located closer to the bottom of the excavation, resulting in greater sound attenuation from the SOE structures and surrounding buildings, and lower noise levels at nearby receptors. By the end of the excavation work, noise levels would be significantly lower than at the start. In the All Truck Scenario, they would range from 56 to 86 dBA (Ldn); in the Mixed Scenario, they would range from 55 to 85 dBA (Ldn); and in the Work Train Scenario, they would range from 48 to 83 dBA (Ldn). Noise levels would be approximately 4 dBA (Ldn) higher in the All Truck Scenario than in the Work Train Scenario. **Figure 10-21** and **Figure 10-22** illustrate impacts in the All Truck Scenario and in the Work Train Scenario, respectively. **Table 10-14** identifies the receptors that where noise levels would exceed the criteria for severe or moderate impact in any of the three scenarios.

Noise levels would exceed the long-term construction noise Impact criteria for severe or moderate impacts at much fewer locations than at the start of excavation. There would be major (severe) adverse impacts at five locations in the All Truck Scenario: at the north side of the historic station building; the REA Building; the Kaiser Permanente Medical Center; the US Securities and Exchange Commission Building; and the Senate Square Apartments on I (Eye) Street NE. In the other scenarios, the impact at the US Securities and Exchange Commission Building would be moderate instead. The criteria for moderate impact would be exceeded at one location with a planned development in the All Truck Scenario. There would be a moderate impact at this location if it has been developed with or permitted for sensitive uses by the time construction occurs.

Figure 10-21. Alternative B End of Excavation Noise Impacts (All Truck Scenario)

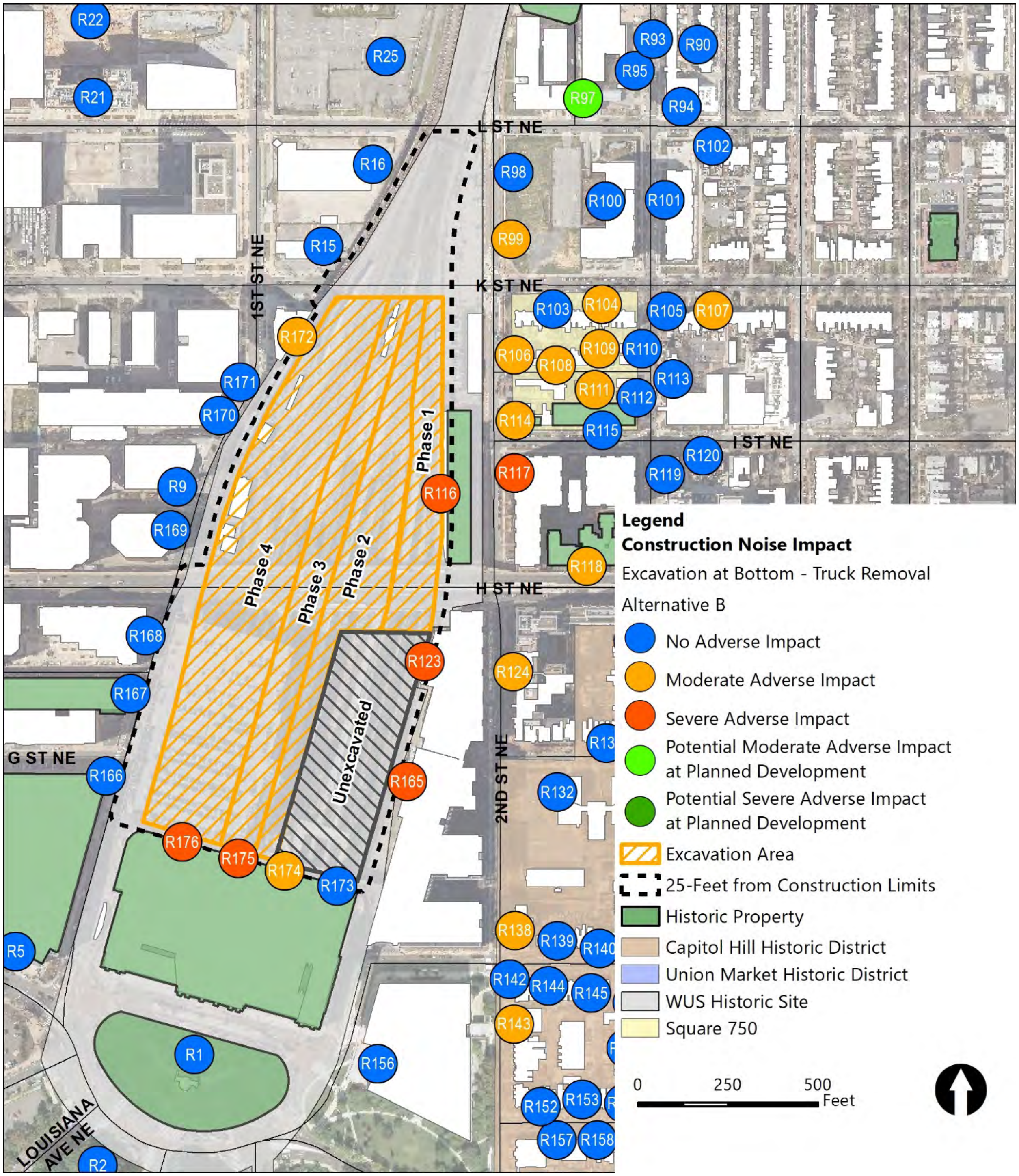


Figure 10-22. Alternative B End of Excavation Noise Impacts (Work Train Scenario)

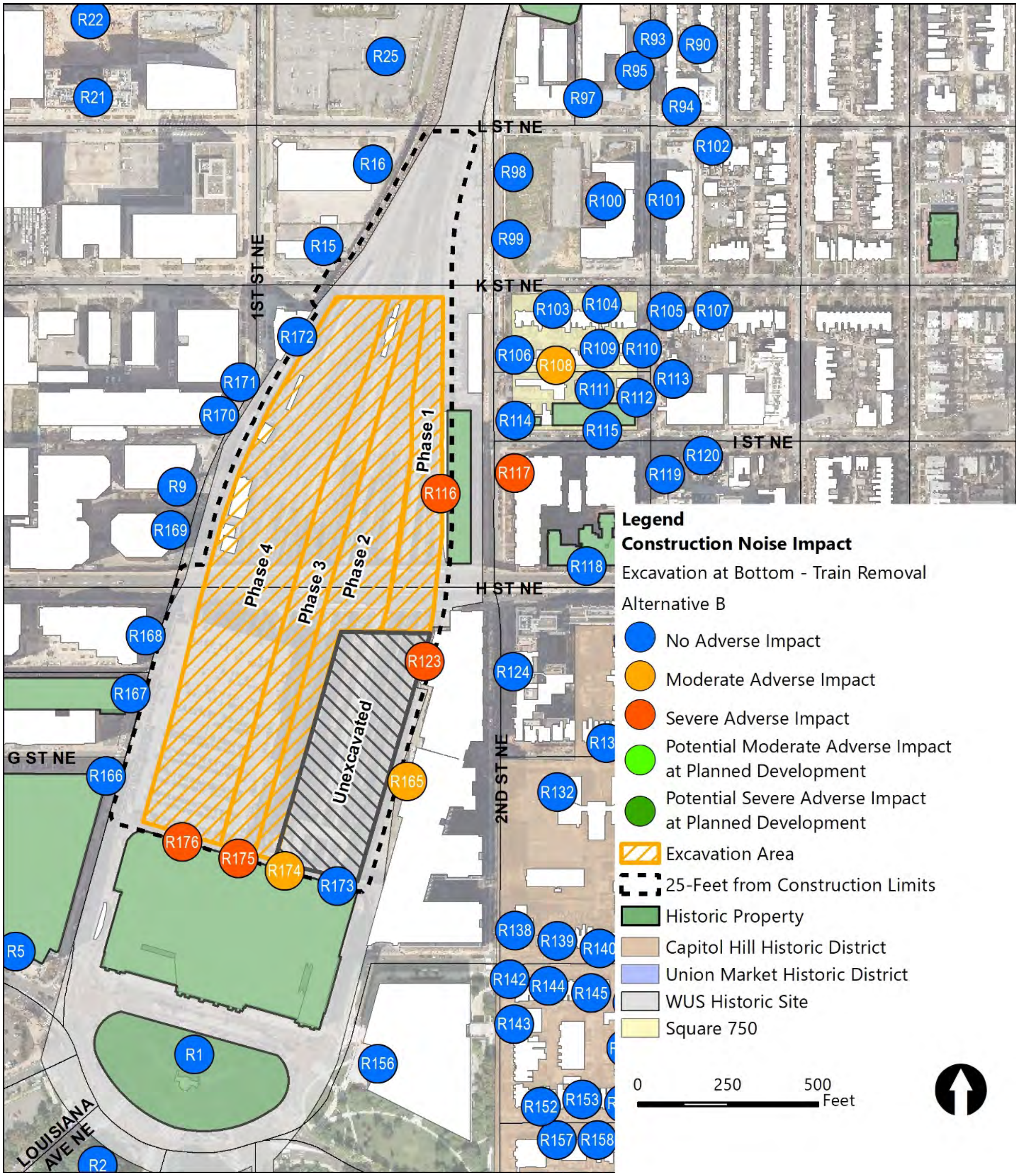


Table 10-14. End of Excavation Noise Impact Assessment, Alternative B

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA)						Impact		
				Existing	(Long-Term) Mobile Source Project Noise Impact Criteria		Construction Noise (Removal by 120 Trucks per Day)	Construction Noise (Removal by 60 Trucks and 1 Train per Day)	Construction Noise (Removal by 2 Trains per Day)	120 Trucks	60 Trucks and 1 Train	2 Trains
					Moderate	Severe						
R97	1109 Congress Street NE	J St Developers Co. Residences (Planned)		59.7	57.6	63.2	58.1	57.0	55.3	N/A[2]	N/A[2]	N/A[2]
R99	230 K Street NE II	Toll Brothers City Living Phase II		67.9	62.8	68.1	63.5	62.2	60.6	Moderate		
R104	221-243 K Street NE	Residential	Yes	64.4	60.4	65.8	60.8	58.4	55.6	Moderate		
R106	917-923 2nd Street NE	Residential	Yes	64.7	60.6	66.0	63.7	62.2	59.9	Moderate	Moderate	
R107	301-319 K Street NE	Residential		62.9	59.5	65.0	59.8	57.2	54.0	Moderate		
R108	208-224 Parker Street NE	Residential	Yes	53.6	54.7	60.7	57.7	56.6	54.7	Moderate	Moderate	Moderate
R109	226-242 Parker Street NE	Residential	Yes	49.8	53.3	59.5	56.0	54.9	53.0	Moderate	Moderate	
R111	219-231 Parker Street NE	Residential	Yes	49.3	53.1	59.4	56.0	54.8	53.0	Moderate	Moderate	
R114	220 I Street NE	Intern Housing	Yes	62.5	59.2	64.7	63.2	61.7	59.2	Moderate	Moderate	
R116	900 2nd Street NE	REA Building/Center City Public Charter School	Yes	72.1	70.0	76.0	86.3	85.2	83.4	**Severe**	**Severe**	**Severe**
R117	201 I Street NE	Senate Square Apartments (First-level)		60.2	57.9	63.5	62.1	60.4	57.5	Moderate[3]	Moderate[3]	
R117-1	201 I Street NE	Senate Square Apartments (Mid-level)		59.9	57.7	63.3	65.1	63.7	61.5	**Severe**[3]	**Severe**[3]	Moderate[3]
R117-2	201 I Street NE	Senate Square Apartments (Top-level)		63.4	59.8	65.2	70.8	69.6	67.8	**Severe**	**Severe**	**Severe**
R118	211 I Street NE	Landmark Lofts	Yes	68	62.9	68.1	63.0	60.8	58.0	Moderate		
R123-1	700 2nd Street NE - Mid	Kaiser Permanente Medical Center (Mid-level)		69	68.6	73.8	77.9	76.8	75.0	**Severe**	**Severe**	**Severe**
R123-2	700 2nd Street NE - Top	Kaiser Permanente Medical Center (Top-level)		67.4	67.5	72.7	77.2	76.1	74.3	**Severe**[3]	**Severe**[3]	**Severe**[3]
R124	701 2nd Street NE	Station House Apartments		61	58.4	63.9	61.3	59.0	54.7	Moderate	Moderate	
R138	603-607 2nd Street NE	Residential	Yes	58.3	56.9	62.6	59.2	56.4	49.2	Moderate		
R143	521-527 2nd Street NE	Residential	Yes	59.4	57.5	63.1	59.5	56.5	48.1	Moderate		
R165-1	100 F Street NE	US Securities and Exchange Commission (Mid-level)		65.6	66.2	71.6	67.0	65.9	64.1	Moderate[3]		
R165-2	100 F Street NE	US Securities and Exchange Commission (Top-level)		64.5	65.5	70.9	70.9	69.8	68.0	**Severe**	Moderate	Moderate
R172	111 K Street NE	National Association of Student Personnel Administrators		74.4	70.0	77.7	70.9	69.8	68.2	Moderate		
R174	Union Station	WUS - Tracks 22-25	Yes	53.7	59.7	65.7	64.6	63.5	61.8	Moderate[3]	Moderate[3]	Moderate[3]
R175	Union Station	WUS - Tracks 10-12	Yes	54.5	60.1	66.0	76.8	75.7	73.9	**Severe**	**Severe**	**Severe**
R176	Union Station	WUS - Tracks 1-10	Yes	53.9	59.8	65.8	75.8	74.7	73.1	**Severe**[3]	**Severe**[3]	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. 3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Construction Vibration

In Alternative B, there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, the National Association of Student Personnel Administrators (NASPA) building, and the Union Station historic station building due to potential risk of structural damage. There would be moderate adverse impact from truck generated vibration at 12 locations due to annoyance.

Activities that would generate vibration in Alternative B would include the use of clam shovels during slurry wall construction; drilling during secant pile wall construction; vibratory sheet pile driving; hoe rams and jackhammers operations during concrete removal; use of excavators, back hoes, and loaded trucks during excavation; and vibratory rollers use for track reconstruction.

Figure 10-23 and **Table 10-15** present the results of the construction equipment vibration assessment for Alternative B. There would be major adverse impacts on the Union Station historic station building and NASPA building because clam shovel drops associated with slurry wall construction may occur within 10 feet of the former and within 35 feet of the latter, resulting in vibration levels of approximately 0.12 to 0.8 in/s. Drilling for secant pile walls may occur within 10 to 16 feet of the REA building and Kaiser Permanente Medical Center, resulting in vibration levels of approximately 0.17 to 0.35 in/s. Vibratory sheet pile driving may occur within 10 to 16 feet of the REA building and Union Station historic station building, resulting in vibration levels of 0.33 to 0.67 in/s. As in all Action Alternatives, in its initial stages, the beginning of the column removal work may generate vibration impacts within the eastern part of the historic station building if jackhammers are to break the existing flooring and access girders and column from above. Such impacts would be of brief duration.

Vibration levels at the four buildings may exceed the criterion for increased risk of structural damage but this would depend on building sensitivity, which in turn is a function of the type of construction (see **Table 10-5** above). All four buildings were designed within the context of an active rail terminal and are all large masonry structures. Therefore, they can be expected to have low sensitivity, reducing the risk of structural impact. However, as historic structures, the REA Building and the historic station building may warrant the application of a lower criterion than the one applicable to buildings of similar construction but more recent. The sensitivity of the buildings would have to be assessed in the Construction Noise and Vibration Plan that would be prepared for the Project (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*).

Interior vibration conditions at the same receptors may exceed 75 VdB, which would be above the threshold for human annoyance. This would only occur when vibration-generating work is conducted near the buildings, however. Vibration annoyance typically would not occur beyond 50 feet of the vibration source.

Figure 10-23. Alternative B Construction Vibration Impacts

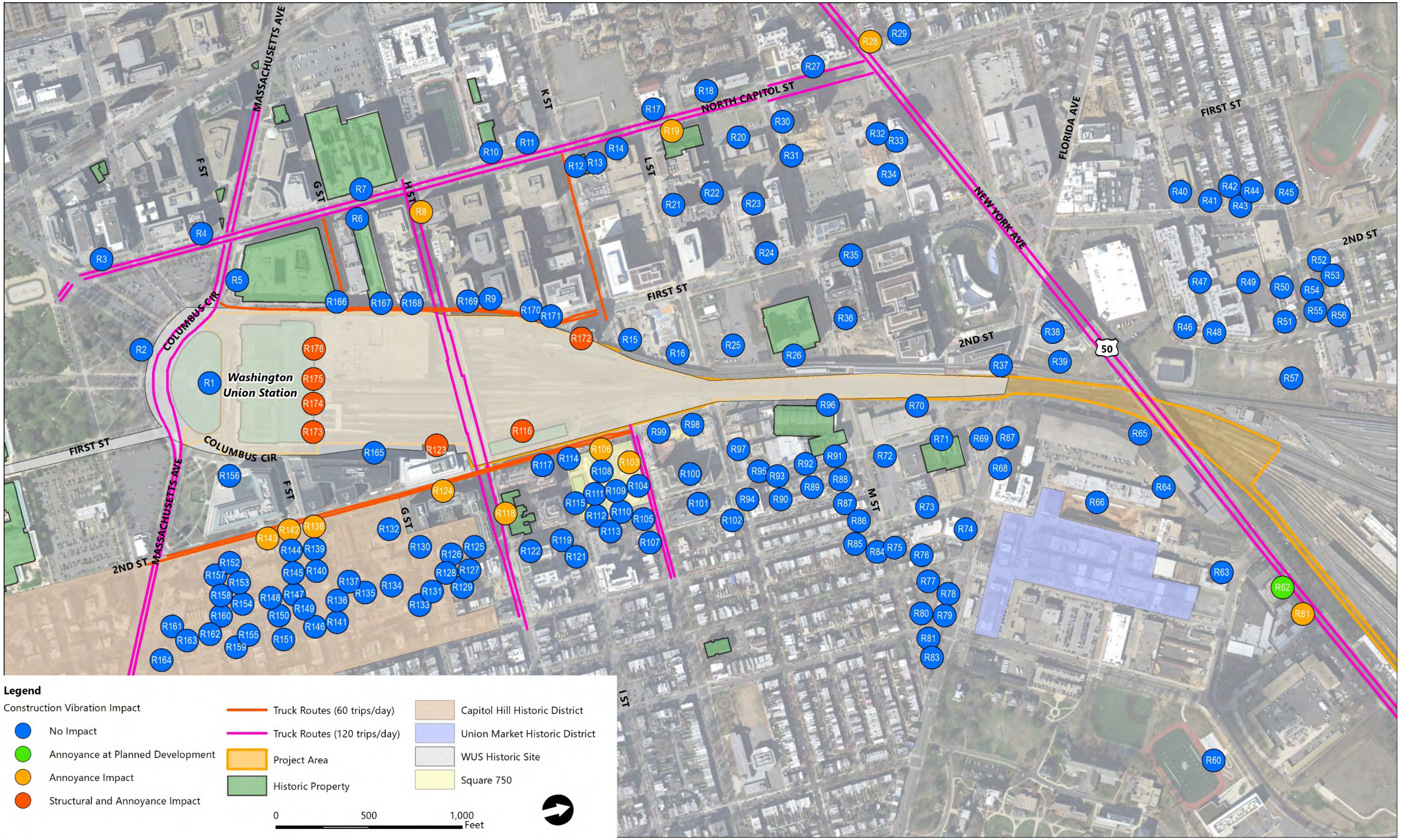


Table 10-15. Construction Vibration Impact Assessment, Alternative B

Receptor	Address	Land Description	Historic	Equipment	Distance (feet)	PPV (in/s)	Exterior Vibration Level (VdB)	Building Coupling Loss (VdB)	Interior Vibration Level (VdB)	Impact Criteria for Annoyance (VdB)	Impact
R8	**801 N Capitol Street NE**	**UDC Community College**		Trucks	15	0.16	93.7	13	81	75	Annoyance
R19	**1111 N Capitol Street NE**	**C&P Telephone Company / NPR Studio**	Yes	Trucks	34	0.05	83.0	13	70	65	Annoyance
R28	**3-9 New York Avenue NW**	**Residential**		Trucks	30	0.06	84.8	7	78	72	Annoyance
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**		Trucks	25	0.08	87.0	13	74	72	Annoyance
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**		Trucks	25	0.07	86.9	13	74	72	Annoyance
R62	**411 New York Avenue NE**	**Hotel Development (Planned)**		Trucks	19	0.12	90.7	13	78	72	N/A[1]
R103	**203-219 K Street NE**	**Square 750 / Residential**	Yes	Trucks	45	0.03	79.5	7	72	72	Annoyance
R106	**917-923 2nd Street NE**	**Square 750 / Residential**	Yes	Trucks	38	0.04	81.4	7	74	72	Annoyance
R116	**900 2nd Street NE**	**REA Building/Center City Public Charter School**	Yes	Vibratory Pile Driver	16	0.33	99	13	86	75	**Structural**/ Annoyance
				Drill Rig	16	0.17	93	13	80	75	**Structural**/ Annoyance
R118	**211 I Street NE**	**St Joseph's Home (Former) / Landmark Lofts**	Yes	Trucks	25	0.08	87.2	13	74	72	Annoyance
R123	**700 2nd Street NE**	**Kaiser Permanente**		Drill Rig	10	0.35	99	13	86	75	**Structural**/ Annoyance
R124	**701 2nd Street NE**	**Station House Apartments**		Trucks	25	0.07	86.8	13	74	72	Annoyance
R138	**603-607 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	28	0.06	85.6	7	79	72	Annoyance
R142	**205 F Street NE**	**Capitol Hill District / National Community Church**	Yes	Trucks	24	0.08	87.3	7	80	75	Annoyance
R143	**521-527 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	25	0.08	87.2	7	80	72	Annoyance
R172	**111 K Street NE**	**National Association of Student Personnel Administrators (NASPA)**		Clam Shovel	35	0.12	90	13	77	75	**Structural**/ Annoyance
R173-176	**Union Station**	**Washington Union Station**	Yes	Vibratory Pile Driver	10	0.67	105	13	92	75	**Structural**/ Annoyance
				Clam Shovel	10	0.80	106	13	93	75	**Structural**/ Annoyance

1. Not applicable. Planned developments are evaluated for vibration effects but are not assessed for impact.

In Alternative B as in Alternative A (see **Section 10.5.2.3**, *Construction Impacts, Construction Vibration*), vibration from truck traffic would cause moderate adverse impacts exceeding the threshold for annoyance at 12 locations close to New York Avenue, North Capitol Street and 2nd Street NE. Truck traffic would also generate vibration levels in excess of the threshold at one planned development location (411 New York Ave NE). These impacts would occur in the All Truck and Mixed Scenarios. The Work Train Scenario would have much lesser vibration impacts.

10.5.3.4 Comparison to Existing Conditions

Because the operational noise impacts of Alternative B on noise and vibration levels relative to the No-Action Alternative would be indistinguishable from those of Alternative A, it impacts relative to existing conditions would also be the same. **Section 10.5.2.4**, *Comparison to Existing Conditions*, characterizes these impacts.

10.5.4 Alternative C

10.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative C (either option), noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative C (either option) would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Figure 10-24 and **Table 10-16** present the results of the operational noise impact assessment for Alternative C with the East Option. **Figure 10-25** and **Table 10-17** present the results of the operational noise impact assessment for Alternative C with the West Option. Modeling showed no measurable differences between the two options.

Noise levels would range from 60 to 75 dBA (Ldn), which is typical for an urban setting. Impacts would generally be the same as Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*) because rail operations would be the same in all Action Alternatives, as would be the overall increase in road traffic relative to the No-Action Alternative. Because in Alternative C, access to parking would be split between K Street NE and H Street NE, traffic volumes on these streets would be different in Alternative A and Alternative C. However, the corresponding difference in noise levels would be within 0.2 dBA, which would be imperceptible. Predominant sources of noise would include the rail terminal and tracks and traffic on New York Avenue NE, Florida Avenue NE, K Street NE, and Massachusetts Avenue NE.

Figure 10-24. Alternative C East Option Noise Levels

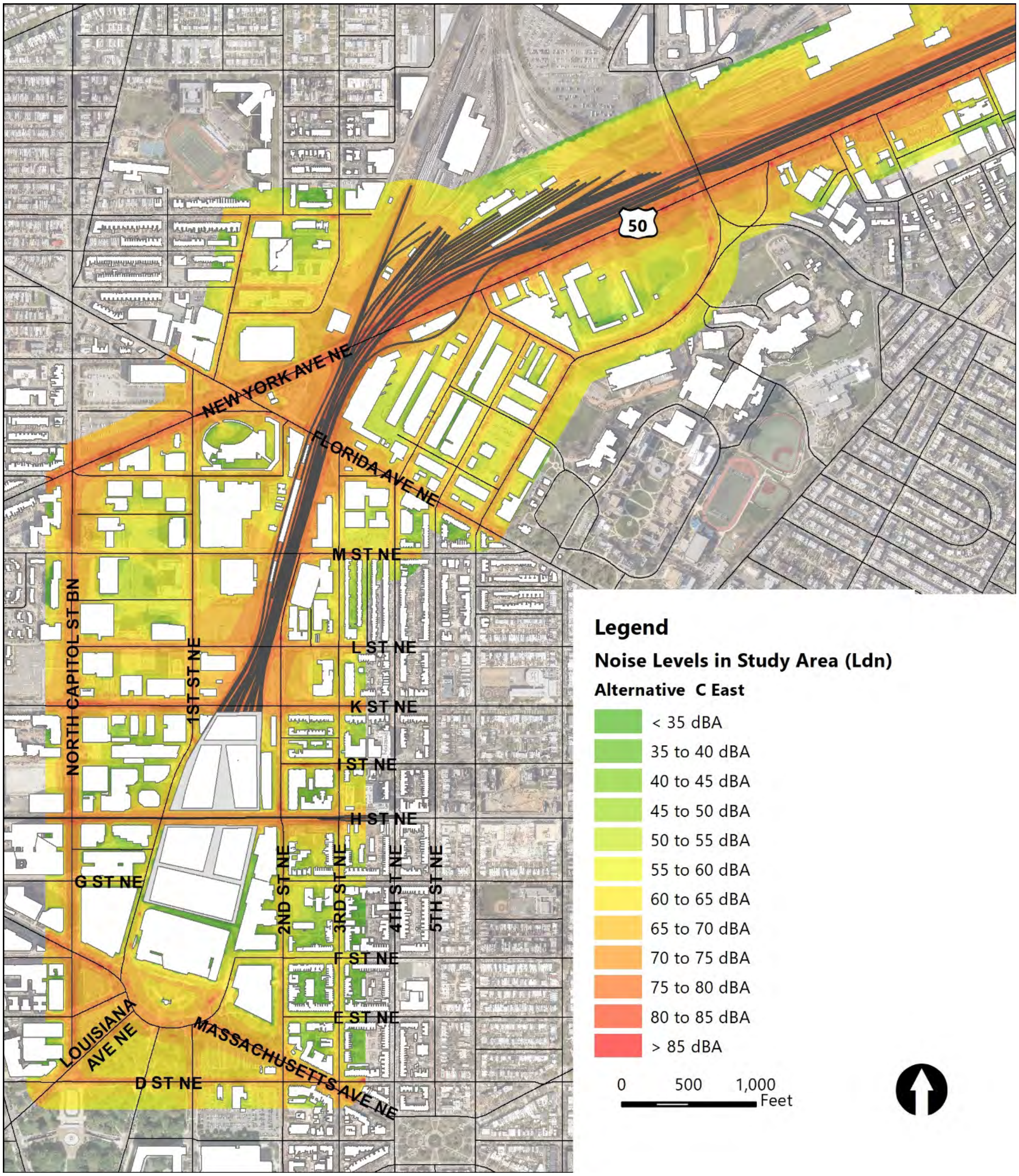


Figure 10-25. Alternative C West Option Noise Levels

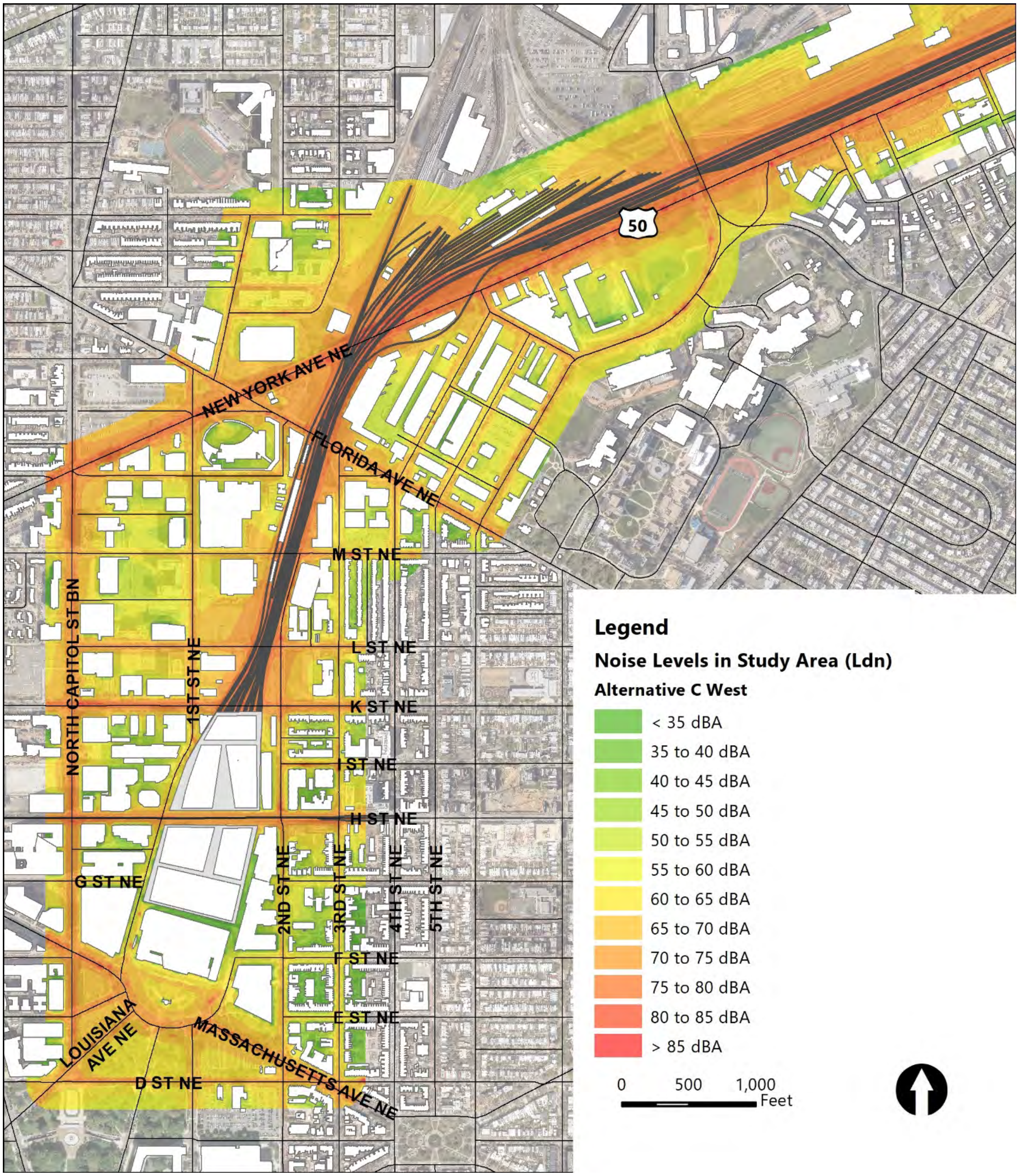


Table 10-16. Operational Noise Impact Assessment, Alternative C East Option

Receptor[1]	Address	Land Description	Noise Level (Ldn, dBA)							FTA Noise Impact Assessment
			Existing	Future Impact Criteria (re: Existing)		No-Action	Future Impact Criteria (re: No-Action)		Alt. C East	
				Moderate	Severe		Moderate	Severe		
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73	N/A[2]
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse St Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[3]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.4	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.1	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.8	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments were evaluated for noise effects but are not assessed for impact.
3. Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both existing and No-Action noise level criterion.

Table 10-17. Operational Noise Impact Assessment, Alternative C West Option

Receptor[1]	Address	Land Description	Noise Level (Ldn, dBA) Existing	Future Impact Criteria (re: Existing)		No-Action	Future Impact Criteria (re: No-Action)		Action Alt. C West	FTA Noise Impact Assessment
				Moderate	Severe		Moderate	Severe		
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73	N/A[2]
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse Street Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[3]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.4	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.1	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.8	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments were evaluated for noise effects but are not assessed for impact. 3. Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both existing and No-Action noise level criterion.

Similarly, stationary noise sources would be the same in Alternative C as in Alternative A (**Section 10.5.2.1,** *Direct Operational Impacts, Operational Noise*). Their impacts on noise levels would be negligible.

Operational Vibration

Operational vibration impacts in Alternative C (either option) would be the same as in Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Vibration*). Alternative C includes the same improvements to the track infrastructure of the rail terminal and the throat. The number of trains, train types operating on each track, and train speeds would be the same.

10.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, there would be no indirect noise or vibration operational impacts in Alternative C.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.4.3 Construction Impacts

Support of Excavation Noise

In Alternative C (either option), construction of the SOE structures would result in major adverse noise impacts at 25 locations and moderate adverse noise impacts at four locations.

In either option, the Alternative C SOE would include sheet pile walls 100 feet deep around the Phase 2, 3, and 4 construction areas; sheet pile walls 64 feet deep around the easternmost edge of the project area (Phase 1); and interior sheet pile walls up to 100 feet deep.

Construction of the SOE structures would involve the use of vibratory sheet pile drivers; cranes; drill rigs; and cranes, dump trucks, and excavators in all phases.

Modeling indicates that in Alternative C, the noise generated by SOE construction activities would exceed applicable District or FTA criteria at multiple receptors adjacent to WUS and along 2nd Street NE north of H Street, resulting in major adverse noise impacts at 25 locations and moderate impacts at four locations (**Figure 10-26**). The site of three planned developments (Storey Park, 170 L Street NE, 1109 Congress Street NE) would also experience noise levels in excess of the threshold for severe impacts. Noise levels would exceed the 65 dBA (Lmax) District noise ordinance limit for nighttime construction. **Table 10-18** identifies the affected receptors and the corresponding modeled noise levels.

Figure 10-26. Alternative C Support of Excavation Noise Impacts

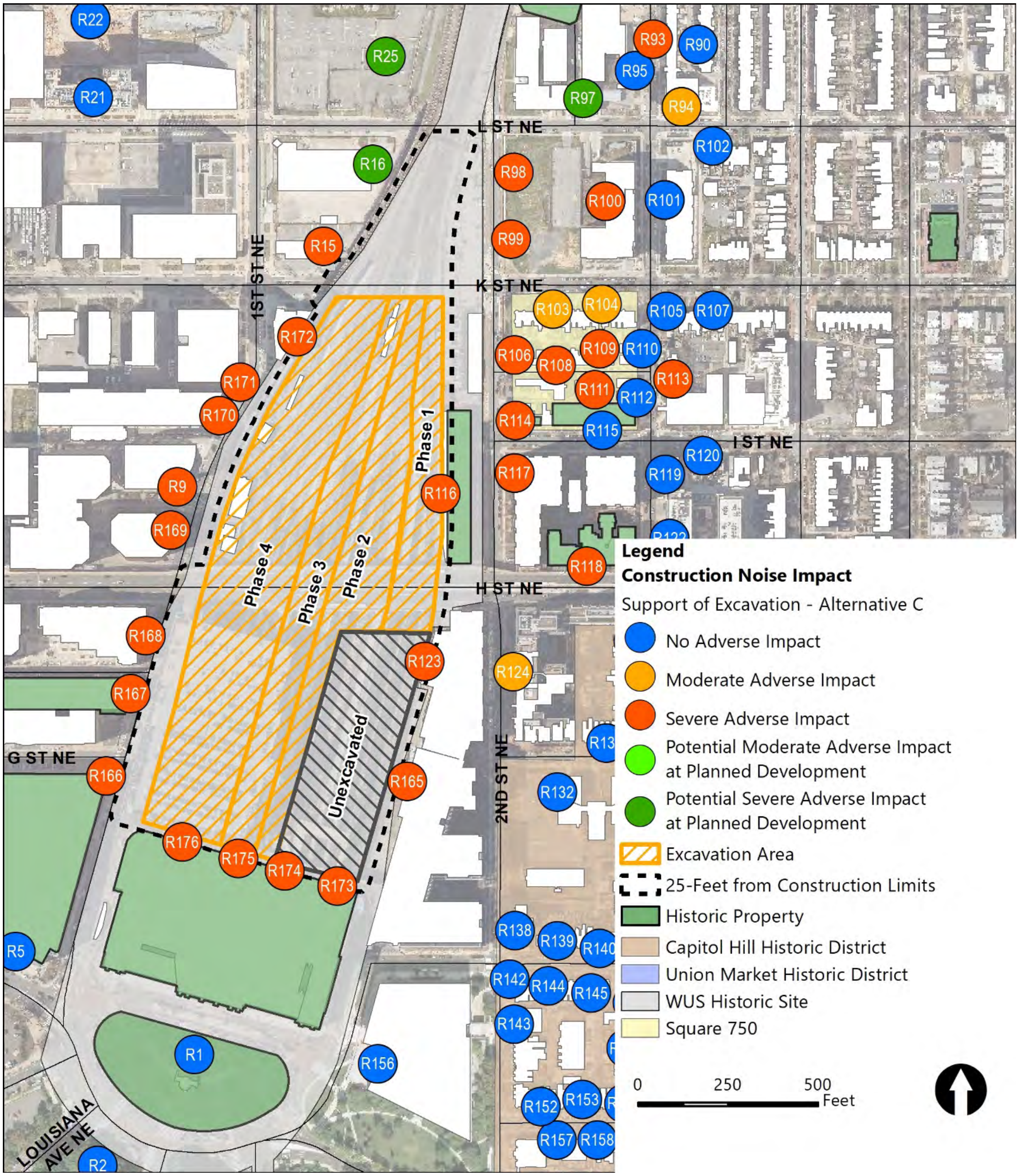


Table 10-18. Support of Excavation Construction Noise Impact Assessment, Alternative C

Receptor	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R9	**First Street NE**	**CNN TV Studio**		61.2	58.5	64.0	72.5	**Severe**
R15	**100 K Street**	**Equity Residential**		69.3	63.8	69.0	77.8	**Severe**
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development (Planned)**		70.4	64.7	69.8	70.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station - Bristol Development (Planned)**		68.6	63.3	68.5	72.4	N/A[2]
R93	**1111-1139 3rd Street NE**	**Residential**		57.7	56.6	62.3	65.7	**Severe**
R94	**300 L Street**	**The Aria on L (First-level)**		64	60.2	65.6	62.0	Moderate
R94-1	**300 L Street**	**The Aria on L (Mid-level)**		63.5	59.9	65.3	61.9	Moderate[3]
R94-2	**300 L Street**	**The Aria on L (Top-level)**		63.4	59.8	65.2	65.0	Moderate[3]
R97	**1109 Congress Street NE**	**J St Developers Co. Residences (Planned)**		59.7	57.6	63.2	74.4	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**		68.9	63.5	68.7	77.8	**Severe**
R99	**230 K Street NE II**	**Toll Brothers City Living Phase II**		67.9	62.8	68.1	76.6	**Severe**
R100	**250 K Street NE**	**Loree Grand Apartments (First-level)**		57.9	56.7	62.4	66.3	**Severe**
R100-1	**250 K Street NE**	**Loree Grand Apartments (Mid-level)**		61.4	58.6	64.1	72.8	**Severe[3]**
R100-2	**250 K Street NE**	**Loree Grand Apartments (Top-level)**		61.5	58.6	64.2	73.3	**Severe[3]**
R103	**203-219 K Street NE**	**Residential**	Yes	65.3	61.0	66.4	64.6	Moderate
R104	**221-243 K Street NE**	**Residential**	Yes	64.4	60.4	65.8	63.6	Moderate
R106	**917-923 2nd Street NE**	**Residential**	Yes	64.7	60.6	66.0	81.9	**Severe**
R108	**208-224 Parker Street NE**	**Residential**	Yes	53.6	54.7	60.7	71.4	**Severe**
R109	**226-242 Parker Street NE**	**Residential**	Yes	49.8	53.3	59.5	67.0	**Severe**
R111	**219-231 Parker Street NE**	**Residential**	Yes	49.3	53.1	59.4	66.7	**Severe**
R113	**907-913 3rd Street NE**	**Residential**		57.7	56.6	62.3	62.9	**Severe**
R114	**220 I Street NE**	**Intern Housing**	Yes	62.5	59.2	64.7	76.8	**Severe**
R116	**900 2nd Street NE**	**Center City Public Charter School**	Yes	72.1	70.0	76.0	91.8	**Severe**

Receptor	Address	Land Description	Historic	Noise Level (Ldn, dBA)				Impact
				Existing	Long-Term Construction Noise Impact Criteria		Construction Noise	
					Moderate	Severe		
R117	**201 I Street NE**	**Senate Square Apartments (First-level)**		60.2	57.9	63.5	69.8	**Severe**
R117-1	**201 I Street NE**	**Senate Square Apartments (Mid-level)**		59.9	57.7	63.3	73.9	**Severe**[3]
R117-2	**201 I Street NE**	**Senate Square Apartments (Top-level)**		63.4	59.8	65.2	79.0	**Severe**[3]
R118	**211 I Street NE**	**Landmark Lofts**	Yes	68	62.9	68.1	69.2	**Severe**
R123	**700 2nd Street NE**	**Kaiser Permanente Medical Center (First-level)**		70.5	69.7	74.8	91.1	**Severe**
R123-1	**700 2nd Street NE-Mid**	**Kaiser Permanente Medical Center (Mid-level)**		69	68.6	73.8	87.5	**Severe**[3]
R123-2	**700 2nd Street NE-Top**	**Kaiser Permanente Medical Center (Top-level)**		67.4	67.5	72.7	84.7	**Severe**[3]
R124	**701 2nd Street NE**	**Station House Apartments**		61	58.4	63.9	62.0	Moderate
R165	**100 F Street NE**	**US Securities and Exchange Commission (First-level)**		66.3	66.7	72.0	87.4	**Severe**
R165-1	**100 F Street NE - Mid**	**US Securities and Exchange Commission (Mid-level)**		65.6	66.2	71.6	86.1	**Severe**[3]
R165-2	**100 F Street NE - Top**	**US Securities and Exchange Commission (Top-level)**		64.5	65.5	70.9	84.2	**Severe**[3]
R166	**2 Mass Avenue NE**	**Postal Museum - Construction Side**	Yes	58.4	61.9	67.6	73.8	**Severe**
R167	**10 G Street NE**	**US Printing Warehouse - Construction Side**	Yes	61.6	63.7	69.2	75.0	**Severe**
R168	**750 First Street NE**	**Union Station Redevelopment Corp**		62.9	64.5	70.0	75.0	**Severe**
R169	**810 First Street NE**	**Davita Union Plaza**		62.5	64.2	69.7	72.4	**Severe**
R170	**888 First Street NE**	**Federal Energy Reg Commission**		62.5	64.2	69.7	72.4	**Severe**
R171	**77 K Street NE**	**IRS Taxpayer Assistance Center**		66	66.5	71.8	74.5	**Severe**
R172	**111 K Street NE**	**NASPA**		74.4	70.0	77.7	85.4	**Severe**
R173	**Union Station**	**WUS - Tracks 25-28**	Yes	61.2	63.5	69.0	89.0	**Severe**
R174	**Union Station**	**WUS - Tracks 22-25**	Yes	53.7	59.7	65.7	87.9	**Severe**[3]
R175	**Union Station**	**WUS - Tracks 10-12**	Yes	54.5	60.1	66.0	87.9	**Severe**[3]
R176	**Union Station**	**WUS - Tracks 25-28**	Yes	53.9	59.8	65.8	86.0	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at the same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. |
3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Locations where there would be major adverse noise impacts from SOE construction include: WUS at the south end of the rail terminal; the REA Building; the US Securities and Exchange Commission building; and the Kaiser Permanente Medical Center as well as several residential and commercial building along First, 2nd Street NE, and Parker Street NE.

<u>Start of Excavation</u>

In Alternative C (either option), at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck and Mixed Scenarios) or eight locations (Work Train Scenario).

At the beginning of excavation, there would be no difference between the Action Alternatives. The same equipment would perform the same activities, resulting in similar noise levels. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, Start of Excavation*. The primary difference among Action Alternatives would regard to excavation noise would be the duration and the potential for impact at the end of excavation.

<u>End of Excavation</u>

In Alternative C (either option), at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario) or four locations (Mixed Scenario and Work Train Scenario). There would be moderate adverse noise impacts at 17 locations (All Truck Scenario), 11 locations (Mixed Scenario) or five locations (Work Train Scenario).

In Alternative C, the rail terminal would be excavated down to approximately 49 feet below existing grade. As excavation proceeds, noisy equipment would be located closer to the bottom of the excavation, resulting in greater sound attenuation from the SOE structures and surrounding buildings, and lower noise levels at nearby receptors. By the end of the excavation work, noise levels would be significantly lower than at the start. In the All Truck Scenario, they would range from 56 to 86 dBA (Ldn); in the Mixed Scenario, they would range from 55 to 85 dBA (Ldn); and in the Work Train Scenario, they would range from 49 to 83 dBA (Ldn). Noise levels would be approximately 4 dBA (Ldn) higher in the All Truck Scenario than in the Work Train Scenario.

Figure 10-27 and **Figure 10-28** illustrate impacts in the All Truck Scenario and in the Work Train Scenario, respectively. **Table 10-19** identifies the receptors that where noise levels would exceed the criteria for severe or moderate impact in any of the three scenarios.

Noise levels would exceed the long-term construction noise Impact criteria for severe or moderate impacts at much fewer locations than at the start of excavation. There would be major (severe) adverse impacts at five locations in the All Truck Scenario: at the north side of the historic station building; the REA Building; the Kaiser Permanente Medical Center; the U.S. Securities and Exchange Commission Building; and the Senate Square Apartments on I (Eye) Street NE. In the other scenarios, the impact at the US Securities and Exchange Commission Building would be moderate only.

Figure 10-27. Alternative C End of Excavation Noise Impacts (All Truck Scenario)

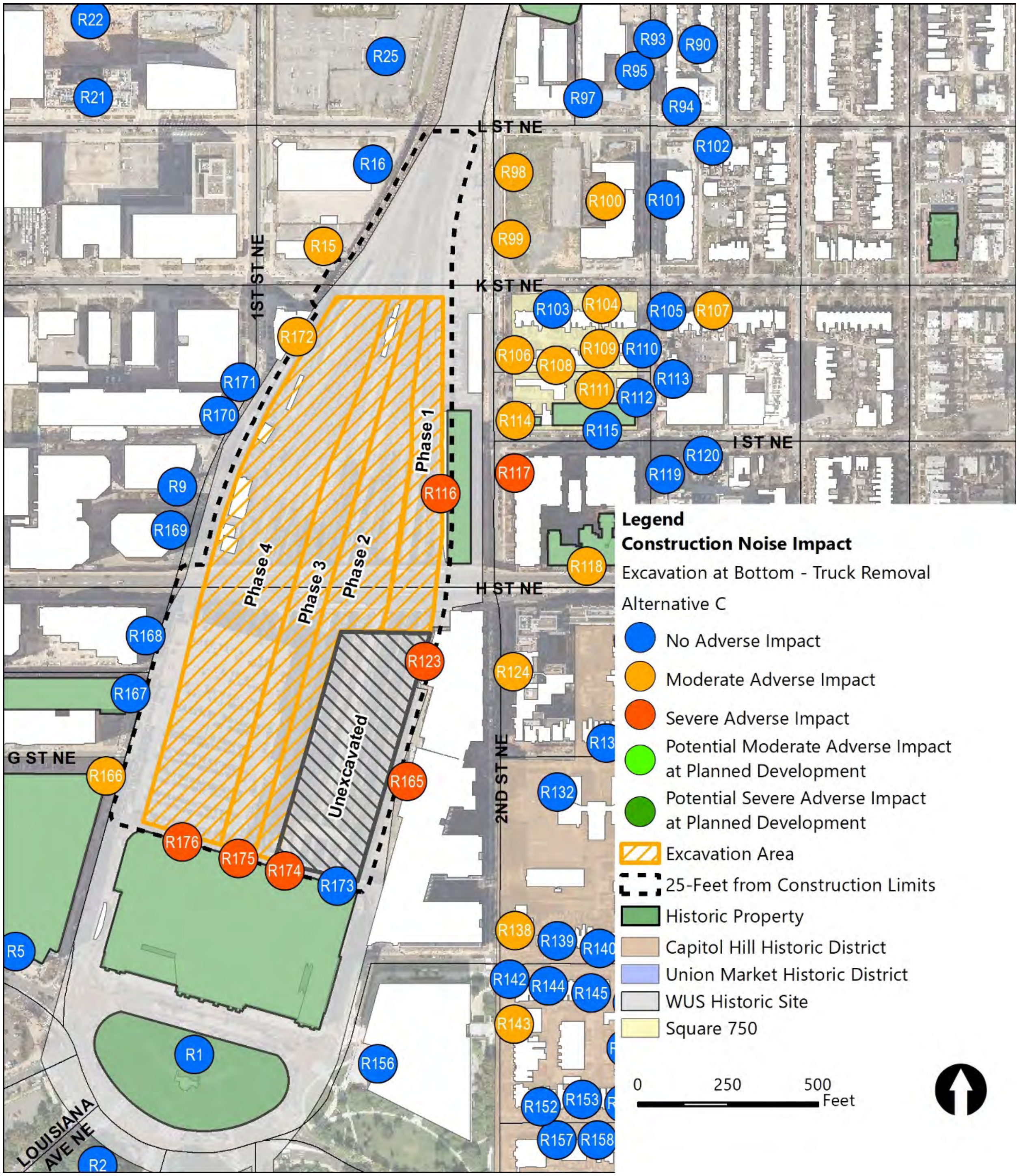


Figure 10-28. Alternative C End of Excavation Noise Impacts (Work Train Scenario)

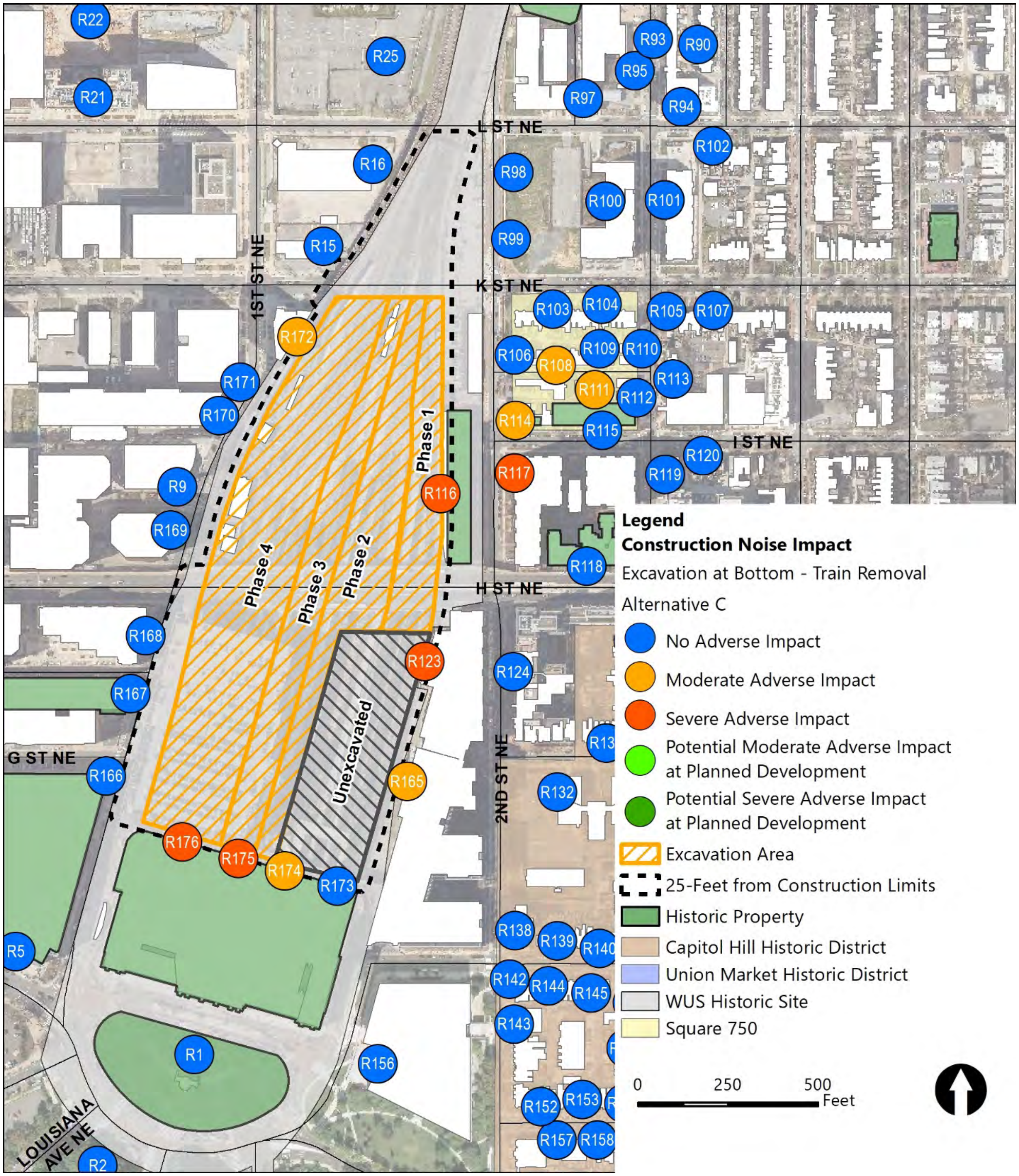


Table 10-19. End of Excavation Noise Impact Assessment, Alternative C

Receptor[1]	Address	Land Description	Historic	Noise Level (Ldn, dBA) Existing	(Long-Term) Mobile Source Project Noise Impact Criteria Moderate	(Long-Term) Mobile Source Project Noise Impact Criteria Severe	Construction Noise (Removal by 120 Trucks per Day)	Construction Noise (Removal by 60 Trucks and 1 Train per Day)	Construction Noise (Removal by 2 Trains per Day)	Impact 120 Trucks	Impact 60 Trucks and 1 Train	Impact 2 Trains
R15	**100 K Street**	**Equity Residential**		69.3	58.5	64.0	62.1	61.0	59.6	Moderate		
R98	**230 K Street NE**	**Toll Brothers City Living**		68.9	57.6	63.2	63.0	61.8	60.4	Moderate	Moderate	
R99	**230 K Street NE II**	**Toll Brothers City Living Phase II**		67.9	63.5	68.7	63.5	62.2	60.6	Moderate	Moderate	
R100-2	**250 K Street NE**	**Loree Grand Apartments (Top-level)**		61.5	62.8	68.1	57.3	56.1	54.7	Moderate	Moderate	
R104	**221-243 K Street NE**	**Residential**	Yes	64.4	58.6	64.1	60.8	58.4	55.6	Moderate		
R106	**917-923 2nd Street NE**	**Residential**	Yes	64.7	58.6	64.2	63.7	62.2	59.9	Moderate	Moderate	
R107	**301-319 K Street NE**	**Residential**		62.9	60.4	65.8	59.8	57.2	54.0	Moderate		
R108	**208-224 Parker Street NE**	**Residential**	Yes	53.6	60.6	66.0	57.7	56.6	54.7	Moderate	Moderate	Moderate
R109	**226-242 Parker Street NE**	**Residential**	Yes	49.8	59.5	65.0	56.0	54.9	53.0	Moderate	Moderate	
R111	**219-231 Parker Street NE**	**Residential**	Yes	49.3	54.7	60.7	56.0	54.8	53.0	Moderate	Moderate	Moderate
R114	**220 I Street NE**	**Intern Housing**	Yes	62.5	53.3	59.5	63.2	61.7	59.2	Moderate	Moderate	Moderate
R116	**900 2nd Street NE**	**Center City Public Charter School**	Yes	72.1	58.1	64.4	86.3	85.2	83.4	**Severe**	**Severe**	**Severe**
R117	**201 I Street NE**	**Senate Square Apartments (First-level)**		60.2	59.2	64.7	62.1	60.4	57.5	Moderate[3]	Moderate[3]	
R117-1	**201 I Street NE**	**Senate Square Apartments (Mid-level)**		59.9	65.0	71.0	65.1	63.7	61.5	**Severe**[3]	**Severe**[3]	Moderate[3]
R117-2	**201 I Street NE**	**Senate Square Apartments (Top-level)**		63.4	57.9	63.5	70.8	69.6	67.8	**Severe**	**Severe**	**Severe**
R118	**211 I Street NE**	**Landmark Lofts**	Yes	68	57.7	63.3	63.0	60.8	58.0	Moderate		
R123-1	**700 2nd Street NE - Mid**	**Kaiser Permanente Medical Center (Mid-level)**		69	64.8	70.2	77.9	76.8	75.0	**Severe**[3]	**Severe**[3]	**Severe**[3]
R123-2	**700 2nd Street NE - Top**	**Kaiser Permanente Medical Center (Top-level)**		67.4	67.9	73.1	77.2	76.1	74.3	**Severe**	**Severe**	**Severe**
R124	**701 2nd S Street t NE**	**Station House Apartments**		61	63.6	68.8	61.3	59.0	54.7	Moderate	Moderate	
R138	**603-607 2nd Street NE**	**Residential**	Yes	58.3	62.5	67.7	59.2	56.4	49.2	Moderate		
R143	**521-527 2nd Street NE**	**Residential**	Yes	60.6	63.4	68.9	55.5	52.5	49.6	Moderate		
R165-1	**100 F Street NE - Mid**	**US Securities and Exchange Commission (Mid-level)**		65.6	61.9	67.6	67.0	65.9	64.1	Moderate[3]	Moderate[3]	
R165-2	**100 F Street NE - Top**	**US Securities and Exchange Commission (Top-level)**		62.2	57.5	63.1	75.2	74.1	72.3	**Severe**	Moderate	Moderate
R166	**2 Mass Avenue NE**	**Postal Museum - Construction Side**	Yes	60.7	61.2	66.6	65.4	64.0	61.8	Moderate		
R172	**111 K Street NE**	**NASPA**		75.6	60.5	65.9	75.2	74.1	72.5	Moderate	Moderate	Moderate
R174	**Union Station**	**WUS - Tracks 22-25**	Yes	53.7	61.9	67.6	64.6	63.5	61.8	**Severe**[3]	Moderate[3]	Moderate[3]
R175	**Union Station**	**WUS - Tracks 10-12**	Yes	54.5	63.7	69.2	76.8	75.7	73.9	**Severe**	**Severe**	**Severe**
R176	**Union Station**	**WUS - Tracks 1-10**	Yes	53.9	64.5	70.0	75.8	74.7	73.1	**Severe**[3]	**Severe**[3]	**Severe**[3]

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments are evaluated for noise effects but are not assessed for impact. 3. Receptors with multiple heights are assessed at each level but are considered a single impact.

Construction Vibration

In Alternative C (either option), there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, and the Union Station historic station building due to potential risk of structural damage. There would be moderate adverse impact from truck generated vibration at 12 locations due to annoyance.

Activities that would generate vibration in Alternative C would include vibratory sheet pile driving; use of hoe rams and jackhammers during concrete removal; use of excavators, back hoes, and loaded trucks during excavation; and use of vibratory rollers for track re-construction.

Table 10-20 and **Figure 10-29** present the results of the construction equipment vibration assessment for Alternative C. There would be major adverse impacts on the Union Station historic station building, REA Building, and Kaiser Permanent Medical Center because sheet pile driving may occur within 10 to 16 feet of these buildings, resulting in vibration levels of approximately 0.33 to 0.67 in/s. As in all Action Alternatives, in its initial stages, the column removal work may generate vibration impacts within the eastern part of the historic station building if jackhammers are to break the existing flooring and access girders and column from above. Such impacts would be of brief duration.

Vibration levels at the three buildings may exceed the criterion for increased risk of structural damage but this would depend on building sensitivity, which in turn is a function of the type of construction (see **Table 10-5** above). All three buildings were designed within the context of an active rail terminal and are all large masonry structures. Therefore, they can be expected to have low sensitivity, reducing the risk of structural impact. However, as historic structures, the REA Building and the historic station building may warrant the application of a lower criterion than the one applicable to buildings of similar construction but more recent. The sensitivity of the buildings would have to be assessed in the Construction Noise and Vibration Plan that would be prepared for the Project (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*).

Interior vibration conditions at the same receptors may exceed 75 VdB, which would be above the threshold for human annoyance. This would only occur when vibration-generating work is conducted near the buildings, however. Vibration annoyance typically would not occur beyond 50 feet of the vibration source

In Alternative C, vibration from truck traffic would cause moderate adverse impacts exceeding the threshold for annoyance at the 12 locations close to New York Avenue, North Capitol Street and 2nd Street NE that would experience similar impacts in Alternative A (see **Section 10.5.2.3**, *Construction Impacts, Construction Vibration*). It would also exceed the threshold at one planned development location (411 New York Ave NE). These impacts would occur in the All Truck and Mixed Scenarios. The Work Train Scenario would have much lesser vibration impacts.

Figure 10-29. Alternative C Construction Vibration Impacts

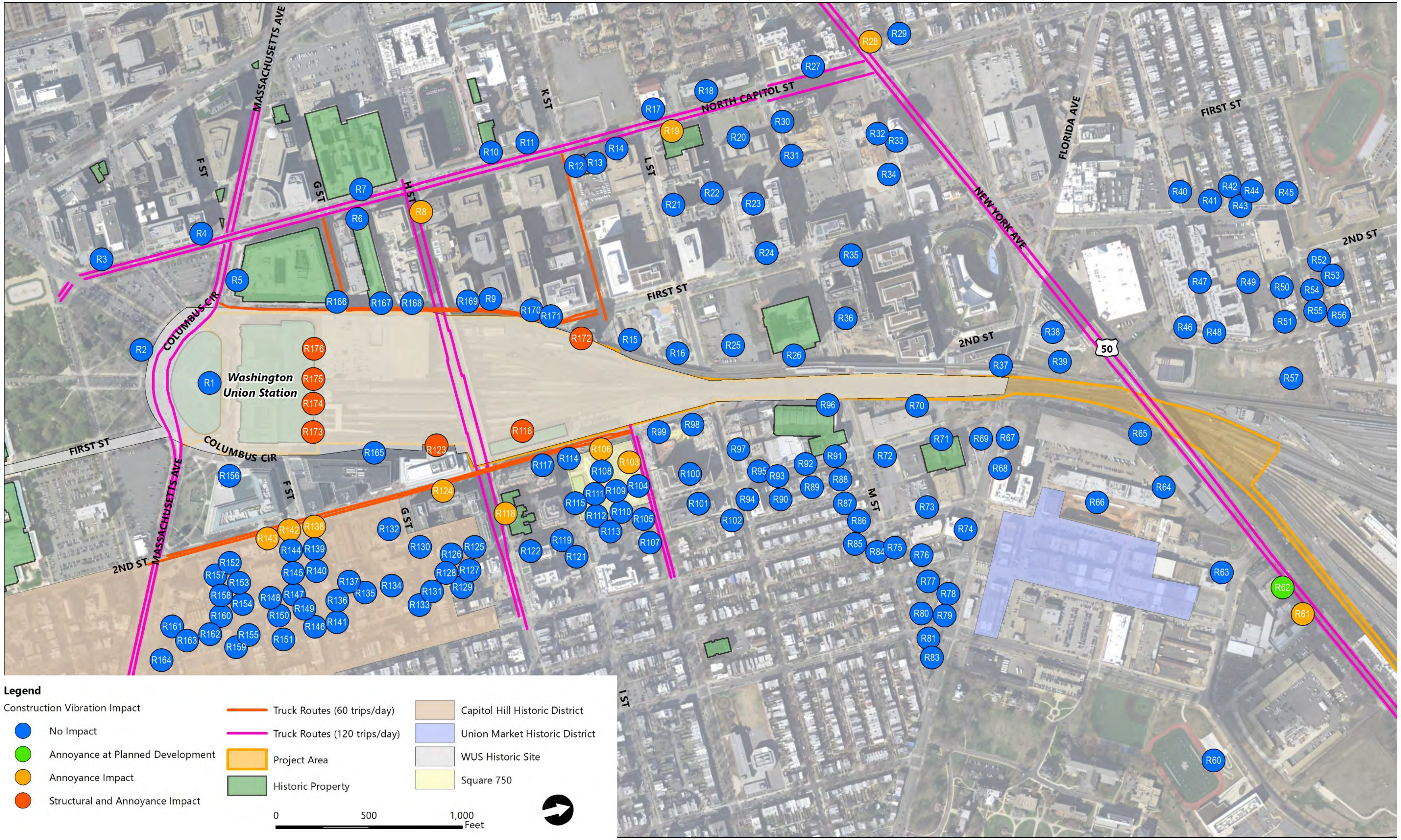


Table 10-20. Construction Vibration Impact Assessment, Alternative C

Receptor	Address	Land Description	Historic	Equipment	Distance (feet)	PPV (in/s)	Exterior Vibration Level (VdB)	Building Coupling Loss (VdB)	Interior Vibration Level (VdB)	Impact Criteria for Annoyance (VdB)	Impact
R8	**801 N Capitol Street NE**	**UDC Community College**	-	Trucks	15	0.16	93.7	13	81	75	Annoyance
R19	**1111 N Capitol Street NE**	**C&P Telephone Company / NPR Studio**	Yes	Trucks	34	0.05	83.0	13	70	65	Annoyance
R28	**3-9 New York Avenue NW**	**Residential**	-	Trucks	30	0.06	84.8	7	78	72	Annoyance
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	-	Trucks	25	0.08	87.0	13	74	72	Annoyance
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	-	Trucks	25	0.07	86.9	13	74	72	Annoyance
R62	**411 New York Avenue NE**	**Hotel Development (Planned)**	-	Trucks	19	0.12	90.7	13	78	72	N/A[1]
R103	**203-219 K Street NE**	**Square 750 / Residential**	Yes	Trucks	45	0.03	79.5	7	72	72	Annoyance
R106	**917-923 2nd Street NE**	**Square 750 / Residential**	Yes	Trucks	38	0.04	81.4	7	74	72	Annoyance
R116	**900 2nd Street NE**	**REA Building/Center City Public Charter School**	Yes	Vibratory Pile Driver	16	0.33	99	13	86	75	**Structural/** Annoyance
R118	**211 I Street NE**	**St Joseph's Home (Former) / Landmark Lofts**	Yes	Trucks	25	0.08	87.2	13	74	72	Annoyance
R123	**700 2nd Street NE**	**Kaiser Permanente**	-	Vibratory Pile Driver	10	0.67	104.9	13	91.9	75	**Structural/** Annoyance
R124	**701 2nd Street NE**	**Station House Apartments**	-	Trucks	25	0.07	86.8	13	74	72	Annoyance
R138	**603-607 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	28	0.06	85.6	7	79	72	Annoyance
R142	**205 F Street NE**	**Capitol Hill District / National Community Church**	Yes	Trucks	24	0.08	87.3	7	80	75	Annoyance
R143	**521-527 2nd Street NE**	**Capitol Hill District / Residential**	Yes	Trucks	25	0.08	87.2	7	80	72	Annoyance
R173-176	**50 Massachusetts Avenue NE**	**Washington Union Station**	Yes	Vibratory Pile Driver	10	0.67	105	13	92	75	**Structural/** Annoyance

1. Planned developments are evaluated for vibration effects but are not assessed for impact.

10.5.4.4 Comparison to Existing Conditions

Because the operational noise impacts of Alternative C on noise and vibration levels relative to the No-Action Alternative would be indistinguishable from those of Alternative A, it impacts relative to existing conditions would also be the same. **Section 10.5.2.4**, *Comparison to Existing Conditions*, characterizes these impacts.

10.5.5 Alternative D

10.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative D, noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative D would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Figure 10-30 and **Table 10-21** present the results of the operational noise impact assessment for Alternative D.

Noise levels would range from 60 to 75 dBA (Ldn), which is typical for an urban setting. Impacts would generally be the same as Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*) because rail operations would be the same in all Action Alternatives, as would be the overall increase in road traffic relative to the No-Action Alternative. Because in Alternative D, access to parking would be split between K Street NE and H Street NE, traffic volumes on these streets would be different in Alternative A and Alternative D. However, the corresponding difference in noise levels would be within 0.2 dBA, which would be imperceptible. Predominant sources of noise would include the rail terminal and tracks and traffic on New York Avenue NE, Florida Avenue NE, K Street NE, and Massachusetts Avenue NE.

Similarly, stationary noise sources would be the same in Alternative D as in Alternative A (**Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*). Their impacts on noise levels would be negligible.

Operational Vibration

Operational vibration impacts in Alternative D would be the same as in Alternative A (see **Section 10.5.2.1,** *Direct Operational Impacts, Operational Vibration*). Alternative D includes the same improvements to the track infrastructure of the rail terminal and the throat. The number of trains, train types operating on each track, and train speeds would be the same.

Figure 10-30. Alternative D Noise Levels

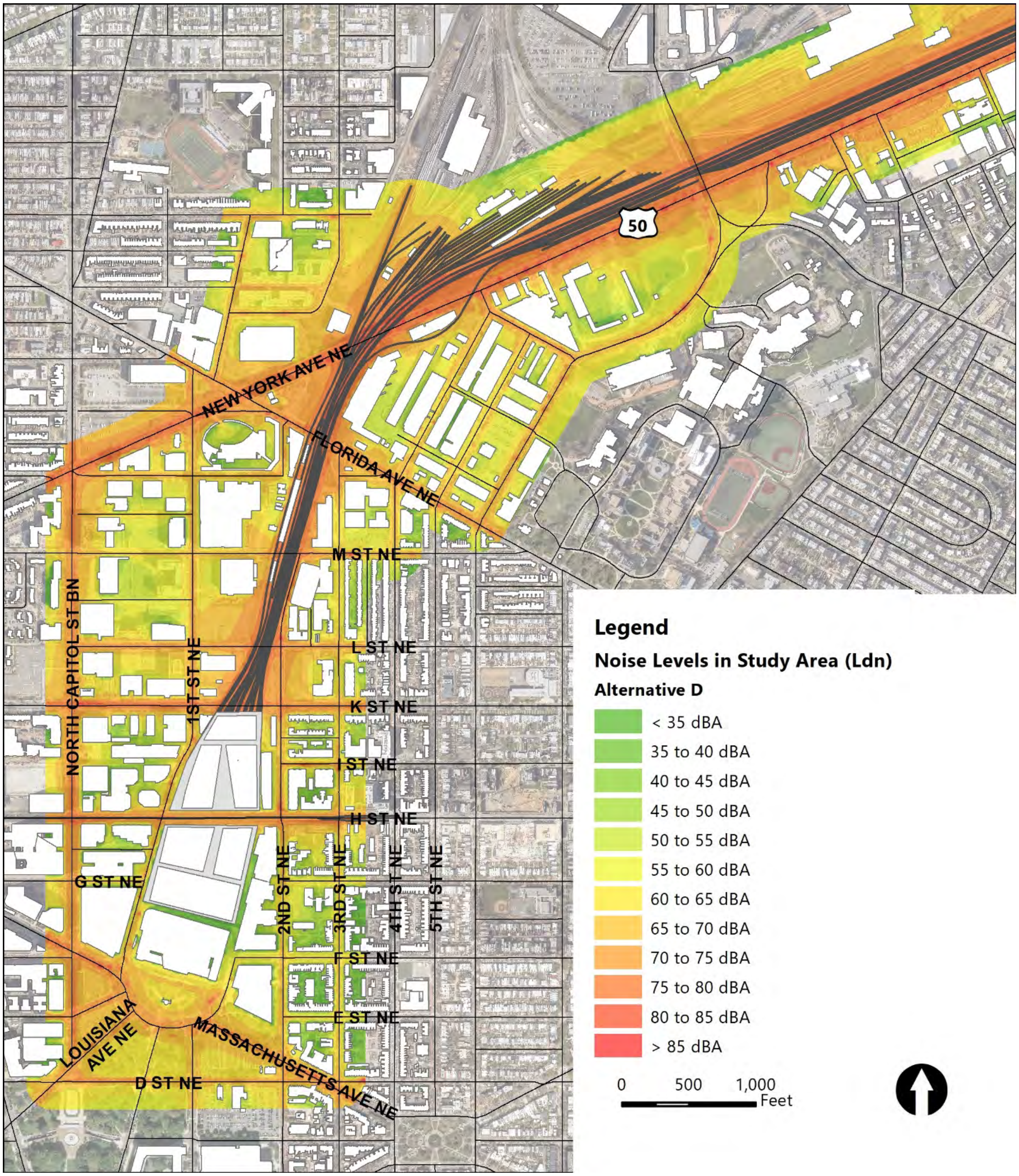


Table 10-21. Operational Noise Impact Assessment, Alternative D

Receptor[1]	Address	Land Description	Noise Level (Ldn, dBA)							FTA Noise Impact Assessment
			Existing	Future Impact Criteria (re: Existing)		No-Action	Future Impact Criteria (re: No-Action)		Alt. D	
				Moderate	Severe		Moderate	Severe		
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73	N/A[2]
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse Street Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[3]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.4	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.1	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.8	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments were evaluated for noise effects but are not assessed for impact.
3. Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both existing and No-Action noise level criterion.

10.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, there would be no indirect noise or vibration operational impacts in Alternative D.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.5.3 Construction Impacts

Support of Excavation Noise

In Alternative D, construction of the SOE structures would result in major adverse noise impacts at 25 locations and moderate adverse noise impacts at four locations.

Construction of Alternative D would involve the same SOE as construction of Alternative C. Impacts would be the same (see **Section 10.5.4.3**, *Construction Impacts, Support of Excavation Noise*).

Excavation Noise

<u>**Start of Excavation**</u>

In Alternative D, at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck and Mixed Scenarios) or eight locations (Work Train Scenario)

At the beginning of excavation, there would be no difference between the Action Alternatives. The noise impacts of Alternative D would be the same as those of Alternative A. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, Start of Excavation*.

<u>**End of Excavation**</u>

In Alternative D, at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario) or four locations (Mixed Scenario and Work Train Scenario). There would be moderate adverse noise impacts at 17 locations (All Truck Scenario), 11 locations (Mixed Scenario) or five locations (Work Train Scenario).

The depth of excavation in Alternative D would be the same as in Alternative C. Therefore, noise impacts at the end of excavation in this alternative would be the same as in Alternative C. See **Section 10.5.4.3**, *Construction Impacts, Excavation Noise, End of Excavation*.

Construction Vibration

In Alternative D, there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, and the Union

Station historic station building due to potential risk of structural damage. There would be moderate adverse impact from truck generated vibration at 12 locations due to annoyance.

Construction of Alternative D would involve the same vibration-generating activities as construction of Alternative C. Impacts would be the same. See **Section 10.5.4.3,** *Construction Impacts, Construction Vibration*.

10.5.5.4 Comparison to Existing Conditions

Because the operational noise impacts of Alternative D on noise and vibration levels relative to the No-Action Alternative would be indistinguishable from those of Alternative A, it impacts relative to existing conditions would also be the same. **Section 10.5.2.4**, *Comparison to Existing Conditions*, characterizes these impacts.

10.5.6 Alternative E

10.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative E, noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative E would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Figure 10-31 and **Table 10-22** presents the results of the operational noise impact assessment for Alternative E.

Noise levels would range from 60 to 75 dBA (Ldn), which is typical for an urban setting. Impacts would generally be the same as Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*) because rail operations would be the same in all Action Alternatives, as would be the overall increase in road traffic relative to the No-Action Alternative. Because in Alternative E, access to parking would be via K Street NE instead of H Street NE, traffic volumes on these streets would be different in Alternative A and Alternative E. However, the corresponding difference in noise levels would be within 0.2 dBA, which would be imperceptible. Predominant sources of noise would include the rail terminal and tracks and traffic on New York Avenue NE, Florida Avenue NE, K Street NE, and Massachusetts Avenue NE.

Similarly, stationary noise sources would be the same in Alternative E as in Alternative A (**Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*). Their impacts on noise levels would be negligible.

Figure 10-31. Alternative E Noise Levels

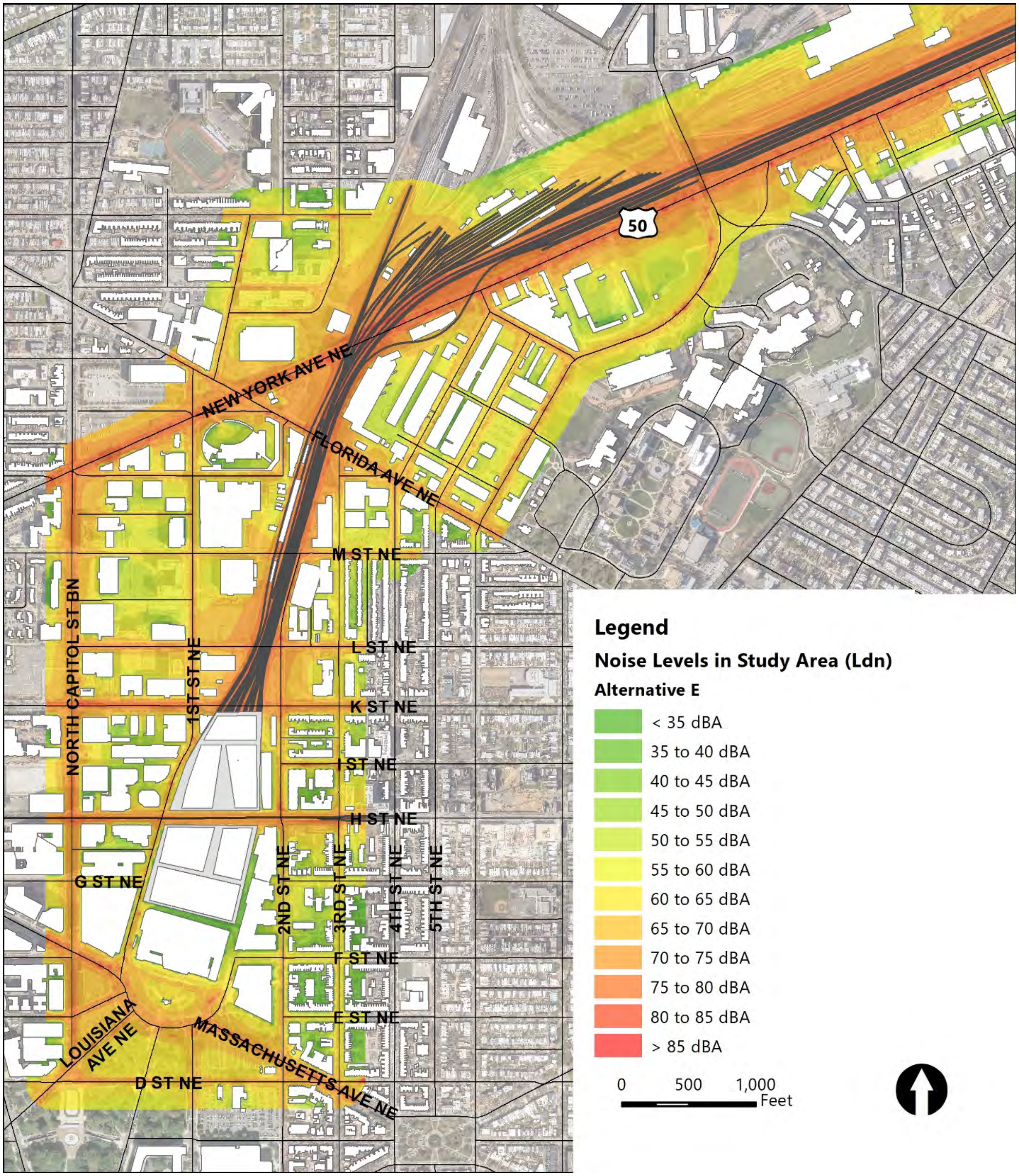


Table 10-22. Operational Noise Impact Assessment, Alternative E

Receptor[1]	Address	Land Description	Noise Level (Ldn, dBA)							FTA Noise Impact Assessment
			Existing	Future Impact Criteria (re: Existing)		No-Action	Future Impact Criteria (re: No-Action)		Alt. E	
				Moderate	Severe		Moderate	Severe		
R15	**100 K Street**	**Equity Residential**	69.3	70.4	72.2	69.3	70.4	72.2	71.4	Moderate
R16	**Storey Park**	**Perseus Realty/Four Points LLC Development**	70.4	71.4	73.1	70.8	71.8	73.5	72.5	N/A[2]
R25	**170 L Street NE**	**NoMA Station Development**	68.6	69.7	71.6	69.2	70.3	72.1	70.7	N/A[2]
R36	**130 M Street NE**	**TIAA Flats Apartments**	62.8	64.4	67.0	63.3	64.9	67.4	64.9	Moderate
R38	**100 Florida Avenue NE**	**Washington Gateway Elevation Apartments**	68.8	69.9	71.7	69.4	70.5	72.2	70.5	Moderate
R39	**102 Florida Avenue NE**	**Washington Gateway**	70.5	71.5	73.2	71.1	72.1	73.7	73	N/A[2]
R58	**1404 New York Avenue NE**	**Hecht Warehouse Lofts**	73.3	73.9	75.7	73.0	73.6	75.4	73.9	Moderate
R61	**501 New York Avenue NE**	**Homewood Suites and Hampton**	73.2	73.8	75.6	73.8	74.3	76.1	74.4	Moderate
R62	**411 New York Avenue**	**Hotel Development**	73.7	74.2	76.0				74.6	N/A[2]
R64	**300 Morse Street Building**	**Kettler Development**	60.1	62.1	65.1	61.6	63.4	66.1	65.1	N/A[2]
R65	**300 Morse Street Building**	**Kettler Development**	70.5	71.5	73.2	71.3	72.2	73.9	75.9	N/A[2]
R67	**320 Florida Avenue NE**	**The Highline Apartments**	67.9	69.1	71.0	68.5	69.6	71.5	69.9	N/A[2]
R68	**340 Florida Avenue NE**	**The Edison**	66.6	67.9	69.9				67.9	Moderate (Existing)[3]
R69	**301 Florida Avenue NE**	**Ditto Development**	67.7	68.9	70.8	68.3	69.4	71.3	69.6	N/A[2]
R70	**1200 3rd Street**	**CAW Development**	71.7	72.5	74.2	72.3	73.0	74.8	75	N/A[2]
R71	**301 N Street NE**	**Press House Development**	65.2	66.6	68.8	66.0	67.3	69.4	67.9	N/A[2]
R98	**230 K Street NE**	**Toll Brothers City Living**	68.9	70.0	71.8	69.4	70.5	72.2	71	Moderate
R99	**230 K Street NE II**	**Toll Brothers City Living II**	67.9	69.1	71.0	68.3	69.4	71.3	69.9	Moderate
R100	**250 K Street NE**	**Loree Grand Apartments**	57.9	60.3	63.7	57.9	60.3	63.7	60.5	Moderate
R103	**203-219 K Street NE**	**Residential**	65.3	66.7	68.9	65.8	67.1	69.3	67.4	Moderate
R104	**221-243 K Street NE**	**Residential**	64.4	65.9	68.2				66.1	Moderate (Existing)
R106	**917-923 2nd Street NE**	**Residential**				62.7	64.4	66.9	64.4	Moderate (No-Action)
R107	**301-319 K Street NE**	**Residential**	62.9	64.5	67.1				64.8	Moderate (Existing)
R118	**211 I Street NE**	**Landmark Lofts**	68.0	69.2	71.1				69.4	Moderate (Existing)

Notes: 1. Addresses with multiple receptor ID's include multiple elevations at same location. 2. Planned developments were evaluated for noise effects but are not assessed for impact.
3. Receptors exceed noise impact criterion based on noise levels from parentheses. Impacts without parentheses exceed both existing and No-Action noise level criterion.

Operational Vibration

Operational vibration impacts in Alternative E would be the same as in Alternative A (see **Section 10.5.2.1,** *Direct Operational Impacts, Operational Vibration*). Alternative E includes the same improvements to the track infrastructure of the rail terminal and the throat. The number of trains, train types operating on each track, and train speeds would be the same

10.5.6.2 Indirect Operational Impacts

There would be no indirect noise or vibration operational impacts in Alternative E. All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.6.3 Construction Impacts

Support of Excavation Noise

In Alternative E, construction of the SOE structures would result in major adverse noise impacts at 28 locations and moderate adverse noise impacts at nine locations.

Construction of Alternative E would involve the same SOE as construction of Alternative B. Impacts would be the same. See **Section 10.5.3.3**, *Construction Impacts, Support of Excavation Noise*.

Excavation Noise

<u>**Start of Excavation**</u>

In Alternative E, at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck and Mixed Scenarios) or eight locations (Work Train Scenario).

At the beginning of excavation, there would be no difference between the Action Alternatives. The noise impacts of Alternative E would be the same as those of Alternative A. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, Start of Excavation*.

<u>**End of Excavation**</u>

In Alternative E, at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario) or four locations (Mixed Scenario and Work Train Scenario). There would be moderate adverse noise impacts at 17 locations (All Truck Scenario), 7 locations (Mixed Scenario), or two locations (Work Train Scenario).

The depth of excavation in Alternative E would be the same as in Alternative B. Therefore, noise impacts at the end of excavation in this alternative would be the same as in Alternative B. See **Section 10.5.3.3,** *Construction Impacts, Excavation Noise, End of Excavation*.

Construction Vibration

In Alternative E, there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, the NASPA building, and the Union Station historic station building due to potential risk of structural damage. There would be moderate adverse impact from truck generated vibration at 12 locations due to annoyance.

Construction of Alternative E would involve the same vibration-generating activities as construction of Alternative B. Impacts would be the same. See **Section 10.5.3.3,** *Construction Impacts, Construction Vibration*.

10.5.6.4 Comparison to Existing Conditions

Because the operational noise impacts of Alternative E on noise and vibration levels relative to the No-Action Alternative would be indistinguishable from those of Alternative A, it impacts relative to existing conditions would also be the same. **Section 10.5.2.4**, *Comparison to Existing Conditions,* characterizes these impacts.

10.5.7 Alternative A-C (Preferred Alternative)

10.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, in Alternative A-C, noise levels would increase by no more than 3 dBA. This would result in moderate adverse operational direct impacts at 14 locations in the Study Area. Alternative A-C would have a minor localized adverse direct operational impact on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere.

Operational Noise

Operational noise impacts in Alternative A-C would be the same as in Alternative A (see **Section 10.5.2.2**, *Direct Operational Impacts*). The location of the relevant Project elements (such as the parking facility) and the vehicular routes to and from those elements would be the same under both alternatives. Vehicular volumes along those routes may vary slightly due to differences in parking facility size and pick-up and drop-off locations. However, this has no potential to result in perceptibly different noise levels, as evidenced by the lack of perceptible differences among Alternatives A through E in spite of the different locations and sizes of the Project elements in those alternatives.

Operational Vibration

Operational vibration impacts in Alternative A-C would be the same as in Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts, Operational Vibration*). Alternative A-C includes the same improvements to the track infrastructure of the rail terminal and the throat. The number of trains, train types operating on each track, and train speeds would be the same.

10.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, there would be no indirect noise or vibration operational impacts in Alternative A-C.

All noise and vibration impacts would take place at the same time as the action and none would occur beyond the Operational Noise and Vibration Study Area.

10.5.7.3 Construction Impacts

Support of Excavation Noise

In Alternative A-C, construction of the SOE structures would result in major adverse noise impacts at 26 locations and moderate adverse noise impacts at six locations.

Construction of Alternative A-C would involve the same SOE as construction of Alternative A. Impacts would be the same. See **Section 10.5.2.3**, *Construction Impacts, Support of Excavation Noise*.

Excavation Noise

<u>Start of Excavation</u>

In Alternative A-C, at the start of excavation, there would be major adverse noise impacts at 25 locations (All Truck Scenario), 24 locations (Mixed Scenario), or 20 locations (Work Train Scenario). There would be moderate adverse noise impacts at seven locations (All Truck and Mixed Scenarios) or eight locations (Work Train Scenario).

At the beginning of excavation, there would be no difference between the Action Alternatives. The noise impacts of Alternative A-C would be the same as those of Alternative A. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, Start of Excavation*.

<u>End of Excavation</u>

In Alternative A-C, at the end of excavation, there would be major adverse noise impacts at five locations (All Truck Scenario and Mixed Scenario) or four locations (Work Train Scenario). There would be moderate adverse noise impacts at 19 locations (All Truck Scenario), 15 locations (Mixed Scenario) or 12 locations (Work Train Scenario).

The depth of excavation in Alternative A-C would be the same as in Alternative A. Therefore, noise impacts at the end of excavation in this alternative would be the same as in Alternative A. See **Section 10.5.2.3**, *Construction Impacts, Excavation Noise, End of Excavation*.

Construction Vibration

In Alternative A-C, there would be a major adverse impact from vibration during SOE construction on the REA Building, the Kaiser Permanente Medical Center, and the Union Station historic station building due to potential risk of structural damage. There would be moderate adverse impact from truck generated vibration at 12 locations due to annoyance.

Construction of Alternative A-C would involve the same vibration-generating activities as Alternative A's construction. Impacts would be the same. See **Section 10.5.2.3,** *Construction Impacts, Construction Vibration*.

10.5.7.4 Comparison to Existing Conditions

Because the operational noise impacts of Alternative A-C on noise and vibration levels relative to the No-Action Alternative would be the same as those of Alternative A, it impacts relative to existing conditions would also be the same. **Section 10.5.2.4**, *Comparison to Existing Conditions*, characterizes these impacts.

10.6 Comparison of Alternatives

The following sections and **Table 10-23** compare the No-Action and the Action Alternatives with respect to operational and construction-related noise and vibration impacts.

10.6.1 Operational Noise and Vibration

10.6.1.1 Noise

All Action Alternatives would result in moderate adverse operational noise impacts on 14 locations. Noise levels would also exceed the threshold for a moderate impact at 10 planned development locations. Ambient noise levels in the Operational Noise and Vibration Study Area would range from 60 to 75 dBA (Ldn) at most receptor locations. Such noise levels are typical of a dense urban area.

In all Action Alternatives, relative to the No-Action Alternative, operational noise levels south of K Street NE would generally increase by less than 1 dBA. North of K Street NE, they would increase by 1 to 3 dBA. Changes of 3dBA or smaller are generally not perceptible. The primary sources of noise would be vehicular traffic and, near the tracks north of K Street NE, train operations. Along First Street NE, which would become a one-way street in all Action Alternatives, traffic volumes and associated noise would decrease.

Table 10-23. Noise and Vibration Impacts, Comparison of Alternatives

<table>
<tr><th>Type of Impact[1]</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred)</th></tr>
<tr><td>Direct Operational Noise Impacts</td><td>Beneficial impacts: Decreases in noise south of K Street NE due to private air-rights development.
Negligible Adverse impacts: Noise increases typically less than 1 dBA further away from private air-rights development</td><td colspan="6">Moderate adverse impacts at 14 locations
Potential moderate or severe impacts at ten planned development locations
Increases up to 3 dBA over existing due to projected increase of train operations and traffic conditions</td></tr>
<tr><td rowspan="2">Construction Noise Impacts during SOE</td><td rowspan="2">N/A</td><td>Major adverse impacts at 26 commercial and residential receptors. Moderate adverse impacts at six receptors. Potential severe impact at three planned developments</td><td>Major adverse impacts at 28 commercial and residential receptors. Moderate adverse impacts at nine receptors. Potential severe impact at three planned developments</td><td>Major adverse impacts at 25 commercial and residential receptors. Moderate adverse impacts at four receptors. Potential severe impact at three planned developments</td><td>Major adverse impacts at 25 commercial and residential receptors. Moderate adverse impacts at four receptors. Potential severe impact at three planned developments</td><td>Major adverse impacts at 28 commercial and residential receptors. Moderate adverse impacts at nine receptors. Potential severe impact at three planned</td><td>Major adverse impacts at 26 commercial and residential receptors. Moderate adverse impacts at six receptors. Potential severe impact at three planned developments</td></tr>
<tr><td colspan="6">All Action Alternatives would exceed:
- 80 dBA (Leq) 25 feet from the outermost limits of the construction site along the east side of the site during Phase 1; and
- the 65 dBA (Lmax) District noise ordinance limit for nighttime construction</td></tr>
<tr><td>Construction Noise Impacts at Start of Excavation</td><td>N/A</td><td colspan="6">Major adverse impacts at 25/24/20 residential and commercial receptors. Moderate impacts at 7/7/8 Potential severe impacts at 3/1/2 planned developments[2]

In all Action Alternatives, construction noise would:
- Be approximately 4 dBA (Ldn) higher removing excavation by trucks than by trains;
- Exceed 80 dBA (Leq) 25 feet from the outermost limits of the construction site along the east side of the site during Phase 1 of construction; and
- Exceed the 65 dBA (Lmax) District noise ordinance limit for nighttime construction.</td></tr>
<tr><td rowspan="2">Construction Noise Impacts at End of Excavation</td><td rowspan="2">N/A</td><td>Major adverse impacts at 5/5/4 residential and commercial receptors. Moderate adverse impacts at 19/15/12 Potential moderate impacts at 1/1/1 planned development[2]</td><td>Major adverse impacts at 5/4/4 residential and commercial receptors. Moderate adverse impacts at 13/7/2 Potential moderate impacts at 1/0/0 planned development[2]</td><td>Major adverse impacts at 5/4/4 residential and commercial receptors. Moderate adverse impacts at 17/11/5[2]</td><td>Major adverse impacts at 5/4/4 residential and commercial receptors. Moderate adverse impacts at 17/11/5[2]</td><td>Major adverse impacts at 5/4/4 residential and commercial receptors. Moderate adverse impacts at 13/7/2 Potential moderate impacts at 1/0/0 planned development[2]</td><td>Major adverse impacts at 5/5/4 residential and commercial receptors. Moderate adverse impacts at 19/15/12 Potential moderate impacts at 1/1/1 planned development[2]</td></tr>
<tr><td colspan="6">In all Action Alternatives, construction noise levels:
- would be approximately 4 dBA (Ldn) higher for removing excavation by trucks compared to trains;
- would exceed 80 dBA (Leq) 25 feet from the outermost limits of the construction site along the east side of the site during Phase 1; and
- would exceed the 65 dBA (Lmax) District noise ordinance limit for nighttime construction</td></tr>
<tr><td>Direct Operational Vibration Impacts</td><td>Negligible adverse impacts: Vibration would be similar to existing conditions at most locations and would remain below the FTA criteria
Vibration may exceed the FTA vibration criteria at the planned Kettler development associated with the re-introduction of tracks for the proposed VRE MSRF</td><td colspan="6">Minor adverse impacts: The number of vibration events would increase throughout due to increased train operations, but vibration levels would remain below the FTA criteria</td></tr>
</table>

Type of Impact[1]	No-Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative A-C (Preferred)
Construction Vibration Impacts	N/A	**Major adverse impacts** from potential risk of structural damage and annoyance at three buildings: REA Building, Kaiser Permanente Medical Center, and Union Station. Vibration levels 0.17 to 0.67 in/s during SOE	**Major adverse impacts** from potential risk of structural damage and annoyance at four buildings: REA Building, Kaiser Permanente Medical Center, NASPA, and Union Station. Vibration levels 0.12 to 0.8 in/s during SOE	**Major adverse impacts** from potential risk of structural damage and annoyance at three buildings: REA Building, Kaiser Permanente Medical Center, and Union Station. Vibration levels 0.33 to 0.67 in/s during SOE	**Major adverse impacts** from potential risk of structural damage and annoyance at three buildings: REA Building, Kaiser Permanente Medical Center, and Union Station. Vibration levels 0.33 to 0.67 in/s during SOE	**Major adverse impacts** from potential risk of structural damage and annoyance at four buildings: REA Building, Kaiser Permanente Medical Center, NASPA, and Union Station. Vibration levels 0.12 to 0.8 in/s during SOE	**Major adverse impacts** from potential risk of structural damage and annoyance at three buildings: REA Building, Kaiser Permanente Medical Center, and Union Station. Vibration levels 0.17 to 0.67 in/s during SOE
		Moderate adverse impacts from truck-generated vibration that may cause annoyance at 12 receptors and one planned development close to the routes along New York Avenue, North Capitol Street, and 2nd Street					

Notes: 1. None of the alternatives would have indirect operational impacts. 2. All Truck Scenario/Mixed Scenario/Work Train Scenario.

Ambient noise levels would also increase in the No-Action Alternative relative to existing conditions except in the vicinity of the rail terminal south of K Street NE. There, construction of the private air-rights development would enclose the terminal and reduce noise from train operations. At locations adjacent to the rail terminal such as the REA Building Kaiser Permanente Medical Center, the reduction would exceed 10 dBA, which is generally perceived as a halving of the noise level. At most other locations in the Operational Noise and Vibration Study Area, the No-Action Alternative would see increases in traffic that would cause increases in noise level that would remain within 1 dBA. In the area of Union Market, because of the new VRE MSRF facility, increases would be up to 3 dBA. As noted above, changes of 3dBA or smaller are generally not perceptible.

10.6.1.2 Vibration

All Action Alternatives would have minor localized adverse operational impacts on vibration near the throat of the rail terminal and negligible adverse operational direct elsewhere in the Operational Noise and Vibration Study Area. Improvements to the track infrastructure in all Action Alternatives would not affect the specific train types operating on each track or train speeds and vibration conditions would be similar to the No-Action Alternative levels with one partial exception. Vibration is associated with the re-introduction of Track 43 would shift the easternmost track up to 10 feet closer to receptors on the east side of WUS, which could increase vibration by approximately up to 2 VdB, a minor impact.

The No-Action Alternative would have negligible adverse operational impacts on vibration levels at receptors in the Union Market Area near the new track leading to the proposed VRE MSRF. Vibration levels elsewhere Operational Noise and Vibration Study Area would not change in the No-Action Alternative.

10.6.2 Construction Noise and Vibration

10.6.2.1 Construction Noise

All Action Alternatives would cause major adverse noise impacts at several locations during SOE construction. The number of locations affected would depend on the type of SOE used. In Alternatives A and A-C, there would be major SOE construction noise impacts at 26 locations and moderate SOE construction noise impacts at six locations. In Alternatives B and E, there would be major SOE construction noise impacts at 28 locations and moderate SOE construction noise impacts at nine locations. In Alternatives C (either option) and D, there would be major construction SOE noise impacts at 25 locations and moderate SOE construction noise impacts at four locations.

All Action Alternatives would cause major and moderate adverse noise impacts at multiple locations at the start of excavation. The number of affected locations would depend on the method used to transport excavation spoil from the Project Area. In all Action Alternatives, transport by trucks (the most conservative estimate of 120 trucks per day) only would cause major adverse noise impacts at 25 locations and moderate adverse noise impacts at seven. Mixed transport by train and trucks would cause major adverse noise impacts at 24 locations and moderate adverse noise impacts at seven; transport by work trains only would cause major adverse noise impacts at 20 locations and moderate adverse noise impacts at eight. Use of work trains would be a mitigation measure.

At the end of excavation, noise impacts would be much reduced in all Action Alternatives. In Alternatives A and A-C, there would be major adverse impacts at five or four locations and moderate adverse impacts at 12 to 19 locations depending on how spoil would be transported. In Alternatives B and E, there would be major adverse impacts at five or four locations and moderate adverse impacts at two to 13 locations. In Alternatives C and D, there would be major adverse impacts at the same number of locations and moderate adverse impacts at five to 17 locations.

In the No-Action Alternative, the Project would not be constructed and would not cause any construction noise impacts. The construction of other projects included in the No-Action Alternative would generate noise. Information is insufficient to estimate the resulting impacts.

10.6.2.2 Construction Vibration

In all Action Alternatives, construction vibration would result in a potential risk of structural damage at three locations, a major adverse impact: the WUS historic station building, the REA Building, and the Kaiser Permanent Medical Center. In Alternatives B and E, there would additionally be a similar major adverse impact on a fourth location, the NASPA building. Alternatives B and E would have greater adverse impacts than the other Action Alternatives because of the type of SOE (slurry wall construction instead of secant pile or sheet pile wall in the other Action Alternatives).

In all Action Alternatives, construction vibration would be high enough to cause annoyance at 12 locations near New York Avenue, North Capitol Street and 2nd Street NE, a moderate adverse impact.

In the No-Action Alternative, the Project would not be constructed and would not cause any construction vibration impacts. The construction of other projects included in the No-Action Alternative would generate vibration but, as with noise, information is insufficient to estimate the resulting impacts.

10.7 Avoidance, Minimization, and Mitigation Evaluation

All Action Alternatives would result in moderate operational noise impacts from increased train operations and traffic. The potential for permanent noise impacts warrants a consideration of avoidance, minimization measures, and mitigation measures. None of the

Action Alternatives would result in operational vibration impacts requiring the consideration of such measures.

All Action Alternatives would also cause major and moderate construction noise and vibration impacts. These impacts would cease when construction is complete but they would occur at various times during a long period, from approximately 11 years and 5 months to approximately 14 years and 4 months (including the 12-month Intermediate Phase of reduced activity between Phases 1 and 2, when only column removal work would be conducted) depending on the Action Alternative. Mitigation measures and best management practices would be warranted to reduce major noise and vibration impact due to construction.

Noise mitigation depends on the need, feasibility, reasonableness, and effectiveness of the potential options. Moderate impacts are caused by changes in the cumulative noise level that are noticeable to most people but may not be sufficient to generate strong, adverse reactions. Severe impacts are expected to highly annoy a significant percentage of the local population. The anticipated level of noise impact is an important factor in determining the need for mitigation. Severe noise impacts create the most compelling need for mitigation, though moderate noise impacts should also be considered for mitigation, especially when they are anticipated to last for a significant period.

For severe noise impacts, most rail infrastructure projects implement mitigation measures that account for safety, constructability, acoustical effectiveness, and cost effectiveness. For moderate noise impacts, mitigation is implemented accounting for the same factors but also considering where the impacts stand within the range of moderate noise impact criteria and the sensitivity of the affected receptors. The following sections describe mitigation measures FRA is considering for severe and moderate adverse impacts.

10.7.1 Operational Noise and Vibration

In all Action Alternatives, there would be moderate noise impacts at 14 locations and noise levels would increase to moderate or severe at 10 planned development locations. These impacts would primarily be caused by increases in train operations and traffic. Future noise levels would typically be within 3 dBA or less of existing and No-Action Alternative levels, which is at the lower end of the moderate impact range.

Options for mitigating increases in traffic noise in an urban setting are very limited. Speed restrictions would not substantially reduce traffic noise and further truck route restrictions are generally not warranted. Noise barriers along the railroad corridor to reduce train noise would be ineffective at most upper-floor receptors and would conflict with planned developments and urban design considerations.

When developments within the Study Area are planned, developers would be able to design their buildings to incorporate noise reducing features such as providing windows and walls that attenuate sound in interior spaces; placing outdoor spaces away from the tracks; and using the building or other architectural features to provide acoustic shielding. Based on these considerations, FRA is not proposing to mitigate the moderate operational noise impacts of the Action Alternatives.

10.7.2 Construction Noise and Vibration

Construction noise impacts would occur during SOE construction and throughout excavation in all Action Alternatives. Construction noise levels would exceed the District's noise ordinance and FTA's long-term construction noise impact criteria. Without mitigation, this would result in major adverse impacts. Construction vibration would potentially create a risk of structural damage at up to four buildings adjacent to SOE activities, depending on the Action Alternative, resulting in a major adverse impact without mitigation. All Action Alternatives would cause moderate vibration impacts from truck traffic, potentially causing human annoyance at 12 receptors and one planned development close to New York Avenue, North Capitol Street, and 2nd Street NE.

Given the long duration of construction activities in all Action Alternatives and the proximity of sensitive receptors to the Project Area, the construction contractor would be required to prepare and implement a Construction Noise and Vibration Control Plan. This plan would include detailed predictions of construction noise and vibration levels; requirements for conducting construction noise and vibration monitoring; and, if necessary, detailed approaches to mitigate potential construction-period noise and vibration impacts. The plan would set acceptable vibration limits and address the need to conduct pre-construction crack surveys, install crack detection monitors, and conduct vibration monitoring. It would define a process to alert the contractor of any limit exceedances and implement corrective actions. The Construction Noise and Vibration Plan would also contain a public engagement plan specifying measures that would be implemented to inform neighbors of anticipated noisy activities, noise or vibration level exceedances, and measures to be taken to remedy these exceedances.

The following are typical construction noise mitigation measures known to be effective in minimizing noise from both stationary equipment and truck traffic. At a minimum, these measures would be included in the Construction Noise and Vibration Control Plan unless equivalent but more Project-or location-specific measures are identified during the preparation of the plan:

- Ensuring equipment is properly functioning and equipped with mufflers and other noise-reducing features.
- Locating especially noisy equipment as far from sensitive receptors as possible.
- Using quieter construction equipment and methods, as feasible.
- Using path noise control measures such as temporary noise barriers, portable enclosures for small equipment (such as, jackhammers and concrete saws).

- Replacing back up alarms with strobes, if and as allowed by Occupational Safety and Health Administration (OSHA) regulations.
- Maintaining smooth truck route surfaces within and next to the Project Area.
- Establishing and implementing procedures to maintain strong communications with neighbors.

If warranted by the projections in the Construction Noise and Vibration Control Plan, a temporary noise wall approximately 12 feet tall would be constructed along the perimeter of the project area where there are no adjacent buildings. Such a wall would be effective in reducing construction noise at ground level by up to 10 dBA at receptors close to the Project Area as shown in **Figure 10-32**.

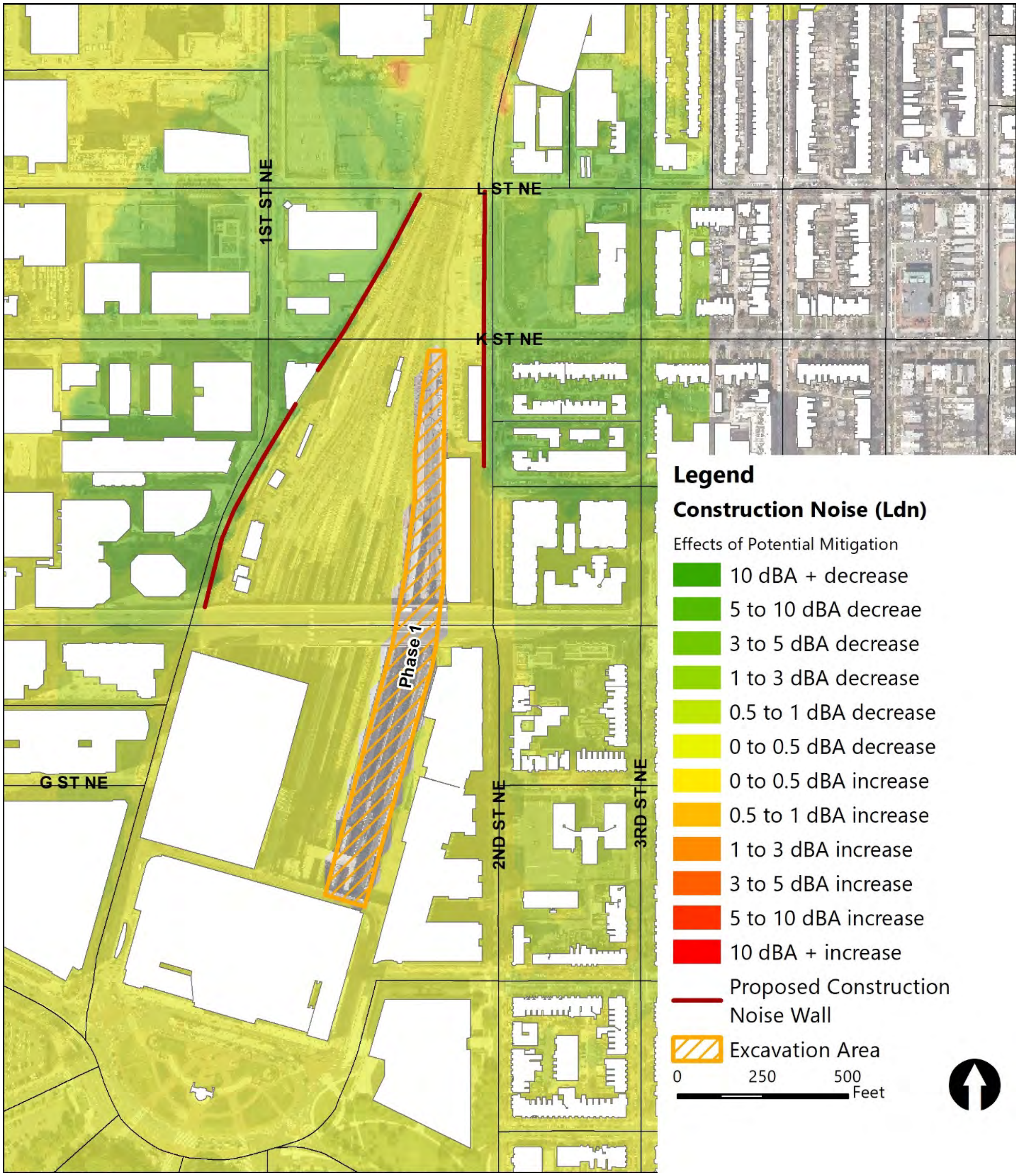
Construction vibration from drilling during secant pile wall construction, vibratory sheet pile driving, and clam shovel operation during slurry wall construction may increase the risk of structural damage at three to four buildings, including the historic station building and the REA Building. As part of the preparation of the Construction Noise and Vibration Control Plan, the buildings at risk would be assessed to determine the appropriate threshold applicable to each based on its type of construction and condition. The plan would define measures to be taken to minimize the risk of damage based on these thresholds. As warranted by the assessment and projections in the Construction Noise and Vibration Control Plan, and as technically feasible, alternative construction methods would be implemented, including but not limited to:

- Using a hydromill instead of a clam shovel for slurry wall construction when working close to a building. A clam shovel may increase the risk of damage to fragile buildings within 34 feet, as opposed to eight feet for a hydromill.
- Using push-in type sheeting equipment rather than vibratory equipment to install sheet-pile walls.
- Using sonic drill rigs instead of traditional drill rigs. Sonic rigs help break up the soil, can speed up the drilling process, and reduce vibration levels at nearby buildings.

If possible without major disruptions to rail operations, work trains rather than trucks would be used to haul away excavation spoils to reduce noise and vibration from passing trucks. Construction trucks would not generate sufficient vibration to risk causing structural damage but there is a potential for human annoyance at 12 receptors and one planned development. Other measures that would be included in the Construction Noise and Vibration Control Plan and implemented to minimize annoyance from truck traffic if warranted and practicable include:

- Among the potential truck routes to and from the Project Area, using those routes with fewer residential receptors.
- Limiting truck speeds or directing trucks to use travel lanes farther from receptors on multi-lane roads such as New York Avenue.

Figure 10-32. Noise Reduction from Potential Perimeter Wall During Excavation



10.8 Permits and Regulatory Compliance

There are no formal permits required to demonstrate regulatory compliance with regard to operational noise and vibration impact assessment. Since construction of the proposed Project may result in exceedances of the District's noise ordinance limits, a variance may be required.

11 Aesthetics and Visual Quality

11.1 Overview

This section addresses the potential impacts of the No-Action and Action Alternatives on aesthetics and visual quality. Because of its size and high visibility, the Project has the potential to affect the visual quality and character of the Project Area and surrounding views and vistas. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and it identifies relevant permitting and regulatory compliance requirements.

11.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to aesthetics and visual quality and are relevant to the Project include:

- National Capital Planning Commission (NCPC), *The Comprehensive Plan for the National Capital*: *Federal Elements, Urban Design Element;*[1]
- Executive Order (EO) 1259, *Commission of Fine Arts (CFA) Review of Public Buildings in the District of Columbia Proposed by the Federal or DC governments*;[2]
- Shipstead-Luce Act of 1930 (Public Law [PL] 71-231, PL 76-248);[3]
- EO 1862, *CFA Review of New Structures and Matters of Art Proposed by the Federal Government in DC*;[4]
- EO 11593, *Protection and Enhancement of the Cultural Environment*;[5] and

1 National Capital Planning Commission. 2016. *The Comprehensive Plan for the National Capital: Federal Elements*. Accessed from https://www.ncpc.gov/plans/compplan/. Accessed on January 24, 2019.

2 EO 1259. Accessed from https://www.cfa.gov/about-cfa/legislative-history/executive-order-1259-october-25-1910. Accessed on April 11, 2019.

3 Shipstead-Luce Act. 40 USC 121. Accessed from https://www.cfa.gov/about-cfa/legislative-history/shipstead-luce-act-public-law-231-71. Accessed on April 11, 2019.

4 EO 1862. Accessed from https://www.cfa.gov/about-cfa/legislative-history/executive-order-1862. Accessed on April 11, 2019.

5 EO 11593. Accessed from https://www.archives.gov/federal-register/codification/executive-order/11593.html. Accessed on April 11, 2019.

- The Height of Buildings Act of 1910.

District policies, regulations, and guidance that may pertain to aesthetics and visual quality include:

- The Historic Landmark and Historic District Protection Act of 1978 (DC Law 2-144, as amended through October 1, 2016); and
- District of Columbia Municipal Regulations (DCMR), *Zoning Regulations Special Purpose Zones*, 11K DCMR § 305.[6]

11.3 Study Area

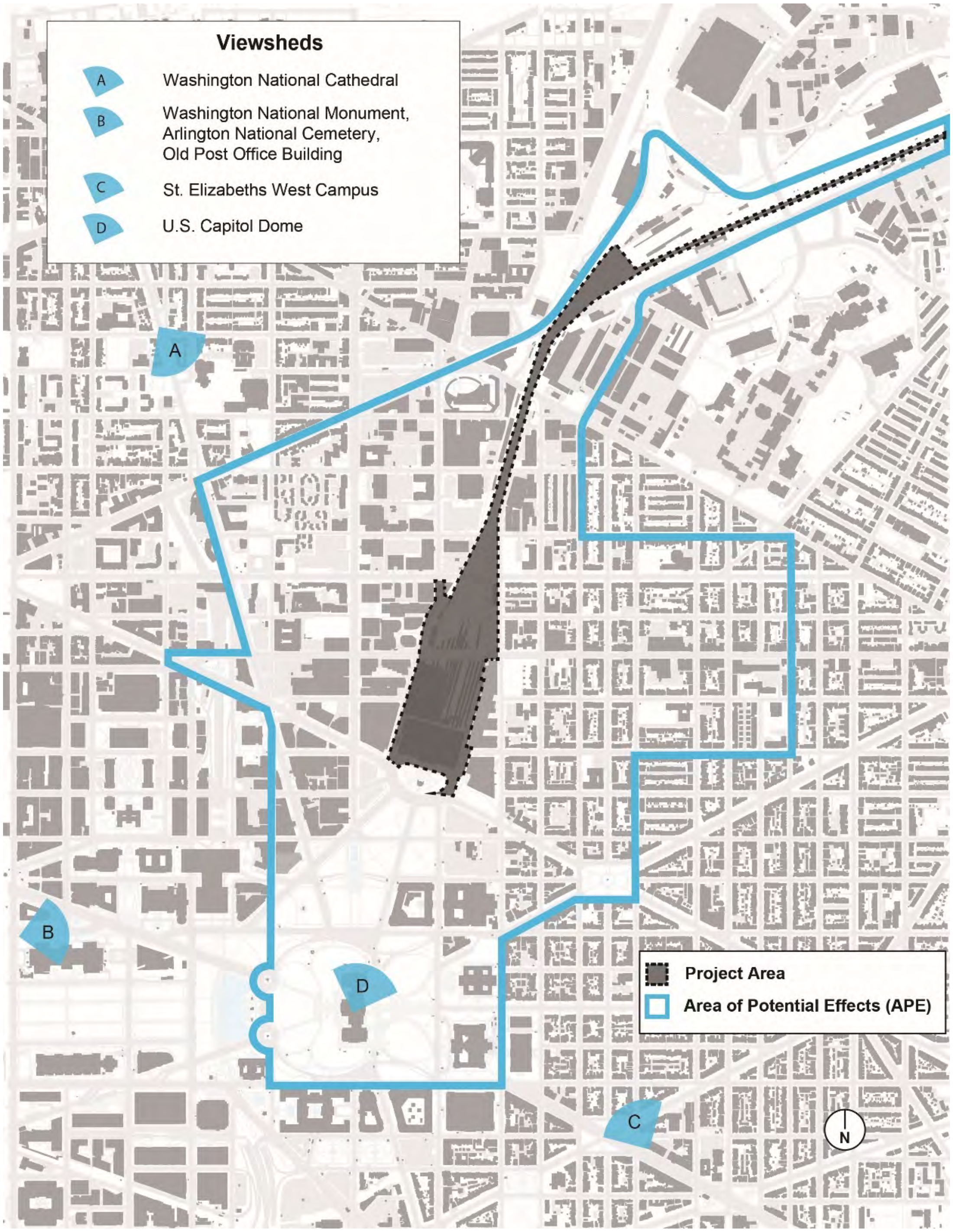
Figure 11-1 shows the Local Study Area for aesthetic and visual impacts. It is the same as the Study Area for cultural resources (**Section 12**, *Cultural Resources)*. Both are identical to the Area of Potential Effects (APE) defined as part of the Section 106 review process for the Project. This is because of the close connection between impacts on visual quality and impacts on historic properties, as the visual setting of a historic property is often an important part of its historic integrity. Using a common study area allows the evaluation of aesthetic and visual impacts to inform the Section 106 evaluation and cultural resources impact assessment.

Like the APE, in addition to the surroundings of WUS, the Local Study Area also includes culturally significant viewsheds from Arlington National Cemetery, the Old Post Office Building, the Washington Monument, the U.S. Capitol Dome, the Washington National Cathedral, and St. Elizabeths West Campus. Views from these locations are important elements of the District's visual and cultural identity.

There is no Regional Study Area for this resource because there is no potential for visual impacts outside the Local Study Area as defined above.

[6] District of Columbia Municipal Regulations (DCMR) 11-K305, *Special Purpose Zones*. Accessed from https://dcregs.dc.gov/Common/DCMR/SectionList.aspx?SectionNumber=11-K305. Accessed on January 24, 2019.

Figure 11-1. Aesthetics and Visual Quality Study Area and Significant Viewsheds



11.4 Methodology

Section 11 of the *Washington Union Station Expansion Project Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the general approach used to assess the impacts of the No-Action and Action Alternatives on aesthetics and visual quality. A more detailed description is below.

The assessment of impacts on aesthetics and visual quality was conducted based on 22 significant street views and six culturally significant viewsheds with views to the Project Area (viewsheds A, C, and D contain one view each and viewshed B containing three views). A total of 28 views, as shown in **Figure 11-2,** were assessed. The significant views were identified and documented through field visits. They took into account the Study Area's topography, parks, open space, and the cultural environment. To assess the visual impacts of the various alternatives, visual simulations were developed by superimposing building volumes onto photographs of the 28 views using three-dimensional modeling and post-production techniques. These simulations convey building mass, height, and setback. Building volumes reflect the anticipated size of the Project elements or maximum allowable zoning volumes (for the Federal and private air-rights developments). They do not incorporate specific design elements, which are not known at this time.

Based on the simulations, the analysis consisted of an evaluation of anticipated visual changes by considering two factors: compatibility and sensitivity. Compatibility is the ability of the environment to visually absorb the changes given the visual character of the affected view as defined by massing, form, or materials. Compatibility measures how much the new element would stand out. Because no information on design and materials is currently available, compatibility could not be fully assessed. Instead, it was determined based on visibility. Because of this limitation, all impacts described in this section should be considered potential impacts.

Sensitivity refers to how much the anticipated change would affect defining elements of the view in a way that would change a viewer's experience. For instance, a view characterized by open space would be more sensitive to the addition of a multi-story, mixed use development than a view already defined by multi-story developments. Sensitivity measures how much the massing and height of new elements would change the general visual and cultural character of the environment.

The intensity of visual impacts for each of the 28 views were measured by the degree of visibility and sensitivity, according to **Table 11-1**. A finding of No Impact was made if the visual assessment found that the alternative would not be visible or had little to no visibility and no sensitivity. A finding of negligible adverse impact, minor adverse impact, moderate adverse impact, or major adverse impact was made if the alternative would have low to high visibility and low to high sensitivity. A finding of beneficial impact was made if the alternatives returned an impacted view to its original state or if the impact would be less sensitive than the existing conditions. Intensity definitions are below.

WASHINGTON UNION STATION
STATION EXPANSION

Figure 11-2. Significant street views towards Project Area and significant viewsheds

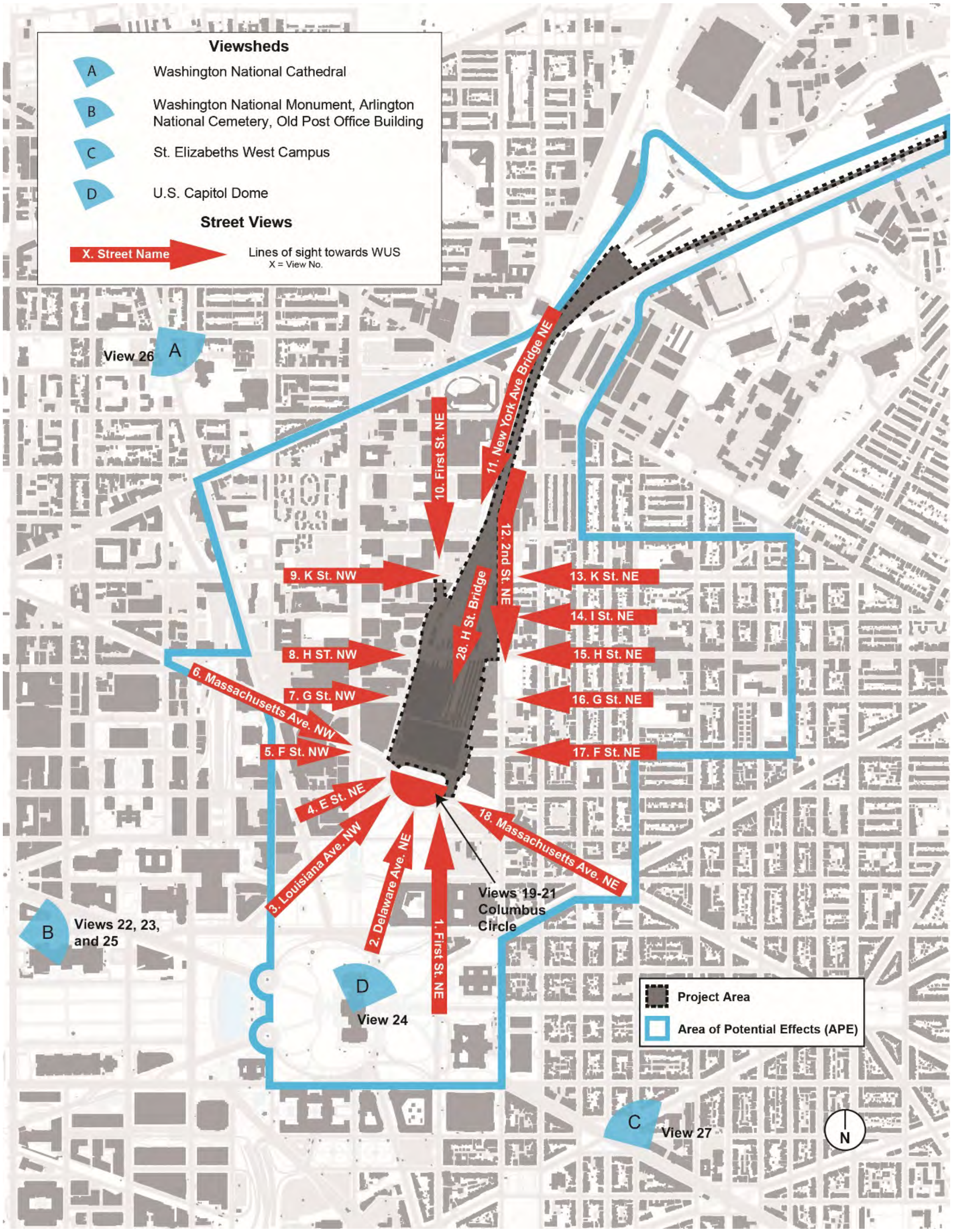


Table 11-1. Intensity of Visual Impacts

Visibility[1]	Sensitivity	Intensity of Impact
Low	Low	Negligible
Low	High	Minor
Low	Moderate	Minor
High	Low	Minor
Moderate	Low	Minor
High	Moderate	Moderate
Moderate	Moderate	Moderate
Moderate	High	Moderate
High	High	Major

1. Low Visibility = High compatibility; High visibility = Low compatibility.

- **No Impact:** Changes would not be visible and have no potential to alter the visual or cultural character of the view.
- **Negligible Impact:** Changes would be just noticeable but have little to no potential to alter the visual or cultural character of the view.
- **Minor Impact**: Changes would be readily noticeable but would alter the visual and cultural character of the view to only a low degree.
- **Moderate Impact:** Changes would be very noticeable but would alter the visual and cultural character of the view to only a low or moderate degree.
- **Major Impact:** Changes would be very noticeable and alter the visual and cultural character of the view to a high degree.
- **Beneficial Impact:** Changes would be noticeable but would alter the visual character of a view in such a way as to return an impacted view to its original state or change the view to be less impactful than the existing condition.

11.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. The operational impacts of the No-Action and Action Alternatives were evaluated using the approach outlined above. Once the visual simulations were conducted for each of the 28 views, the visibility and sensitivity of the various alternatives were assessed, and an intensity of impact determination was made.

11.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts were evaluated based on the anticipated visibility of the construction site and equipment such trailers, machinery, and material stockpiles. Steps for evaluating construction impacts included: understanding constructability phases and processes; assessing the visibility of construction activities and how they would change the character or quality of the affected views; and characterizing the sensitivity of the affected views.

11.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on aesthetics and visual quality. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

Tables 11-8, 11-13, 11-16, and **11-20** below offer a summary of the impacts. A full explanation of the impact designation for each view is available in **Appendix C3a,** *Aesthetic and Visual Quality: Visual Assessment*.

11.5.1 No-Action Alternative

11.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would result in adverse direct operational visual impacts on 21 views, as shown in Table 11-2.

Table 11-2. Summary of Direct Operational Impacts, No-Action Alternative

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	6	First Street NE (#1), Delaware Avenue NE (#2), Louisiana Avenue NE (#3), New York Avenue Bridge (#11), 2nd Street NE (#12), H Street Bridge (#28)
Moderate Adverse	6	E Street NE (#4), First Street NE (#10), K Street NE (#13), I (eye) Street NE (#14), view from Columbus Circle Drive, east side (#20), view from U.S. Capitol Dome (#24)
Minor Adverse	5	H Street NW (#8), K Street NW (#9), H Street NE (#15), G Street NE (#16), view from Columbus Plaza (#19)
Negligible Adverse	4	F Street NE (#17), Massachusetts Avenue NE (#18), view from Washington Monument (#22), view from Old Post Office Building (#25)

1. # refers to the number assigned to the view in **Table 11-6**.

In the No-Action Alternative, aesthetics and visual quality in the Study Area would be primarily affected by the construction of the private air-rights development above the rail terminal north and south of the H Street Bridge. As the design of this development is not defined, its impacts can only be assessed based on the maximum allowed buildable volumes consistent with applicable zoning regulations. The private air rights are within the Union Station North (USN) Zoning District, which establishes maximum heights for buildings ranging from 90 feet above the height of the H Street Bridge near the station to 130 feet in areas close to bridge on the south side and in all areas north of the bridge.[7] The USN Zoning District also allows for 20-foot penthouses with a minimum of 20-foot setback on the primary elevation and 10-foot setbacks on the secondary elevations. The visualizations developed to assess the impacts of the development assume the largest possible penthouse level.

The private air-rights development would stand on a deck constructed over the entire rail terminal between H and K Streets NE and over the eastern part of the terminal between H Street and the back of the station. The deck and the development would connect the neighborhoods to the west and east of WUS visually and functionally. It would reestablish a continuous streetscape along H Street between First and 2nd Streets NE. The new development would extend the dense urban commercial, residential, and institutional built environment characteristic of the area to the west of the Project Area across the rail terminal to 2nd Street NE. There, it would merge with the small scale residential, commercial, and institutional environment found to the east of WUS.

Specific impacts on the views from the east and the west sides of WUS would vary. **Tables 11-6, 11-10, and 11-21** provide a summary assessment of the anticipated impacts on the 28 views included in the visual impact analysis, with visualizations. A more detailed description of anticipated impacts on each view can be found in **Appendix C3a,** *Aesthetic and Visual Quality: Visual Assessment*.

The views most affected would be those looking directly onto the rail terminal and those along the corridors adjacent to the terminal. This includes: the view looking south from New York Avenue, where the private air-rights deck and development would replace the currently open view of the terminal and back of WUS; the view south along First Street NE, where new building elevations between H and K Streets would replace the currently open space above the Burnham Wall; and the view south along 2nd Street NE, where building elevations would replace open space and Substation 25A. The view along H Street would also be affected and the perceived openness beyond the barrier wall looking south towards the station would be changed. The private development facing the bridge would be highly visible. These highly visible changes would alter the character of the views and result in major and moderate adverse impacts.

Views from the east toward WUS would also be affected. Many of these views currently terminate on an open space or a low-rise building, which new high-rise building elevations

[7] DCMR, Title 11 Zoning Regulations, Chapter 11-29 Union Station North, Section 11-2905 Height.

would replace. The most noticeable change would be to the view along I (Eye) Street NE, which currently terminates at the low-rise Railway Express Agency (REA) Building. The private air-rights development would close out the view and result in moderate adverse impacts. Other adverse impacts on east-west views from either side of WUS, north of the historic station building, would range from minor to moderate, depending on how much the new development would be visible. The visible changes to the H Street Corridor from both the east and the west, where the existing gap on both sides of the H Street Bridge would be replaced with new streetscape, would result in a minor adverse impact. Views from the east, along Massachusetts Avenue and F Street, would experience barely visible changes and negligible adverse impacts. Seen from these directions, the historic station building would hide most of the development to its north.

Views from the south of WUS toward the historic station building would be affected as well. Louisiana Avenue, Delaware Avenue, and First Street NE provide direct views to WUS, visually connecting it with the U.S. Capitol and Capitol Grounds, a relationship that played an important role in determining the site and design of WUS. The uninterrupted silhouette of the barrel-vault roof and wide tree-lined streets currently used for U.S. government parking characterize the existing view. The private air-rights development would be visible from various points along Louisiana Avenue, Delaware Avenue, and First Street, in addition to views from E Street NE and from the east and west sides of Columbus Circle Drive. Views where the development would interrupt the silhouette of WUS at the barrel vault would cause major or moderate adverse impacts depending on how much of the development would be seen above the station's roofline.

The private air-rights development would have very low visibility and no sensitivity on the views from the Washington Monument and Old Post Office Building, resulting in a negligible impact. The private air-rights development would have high visibility and moderate sensitivity on the view from the U.S. Capitol Dome, which would result in a moderate adverse impact.

Because of distance or obstruction, several views would remain unchanged because no part of the private air-rights development would be visible. This is the case for views from Arlington National Cemetery, National Cathedral, and St. Elizabeths West Campus. A few closer views from the west (F Street, Massachusetts Avenue, and G Street) would also be unaffected because the masses of the historic station building or existing parking garage would mask the new development.

11.5.1.2 Indirect Operational Impacts

Relative to existing conditions, there would be no indirect operational visual impacts in the No-Action Alternative.

Indirect impacts are reasonably foreseeable impacts that occur later in time or are further removed in distance from the proposed action. All visual impacts are direct impacts. The projects included in the No-Action Alternative would not cause visual impacts after their completion or outside the areas from which they would be visible.

11.5.1.3 Construction Impacts

In the No-Action Alternative, there would be negligible adverse construction-related visual impacts on nine views and minor adverse impacts on 10 views. One view would have a moderate construction-related visual impact.

Construction of several of the projects included in the No-Action Alternative would change the appearance of the rail terminal and its immediate surroundings for the duration of each project's construction. Features typical of a large construction site such as perimeter fencing, cranes and other large pieces of equipment, stockpiles of materials or debris, and partially built structures would be fully or partially visible. This would affect the visual quality of several views around WUS.

The primary cause of visual impacts would be construction of the private air-rights development above the rail terminal. Distance, perspective, and the location and height of heavy construction equipment and activities would influence the character and intensity of the impacts.

Based on an assessment of the photographs in **Table 11-8**, nine views would experience negligible impacts, including Views #2, 3, 4, 16, 18, 19, 20, 22, and 25. Although construction would be visible from these locations, distance or intervening structures (including the historic station building) would hide or mask most of it.

Construction would be more noticeable from 10 locations (Views #1, 8, 9, 10, 11, 12, 13, 14, 15, and 24). Impacts on these views would be minor for the following reasons. The function of the Project Area as a rail terminal already gives it a semi-industrial appearance. Visually, construction activities would accentuate this aspect rather than represent a major change in visual quality. Although construction would take place over several years, the focus of activities, and the corresponding impacts, would change over time as the different projects are constructed. Visual impacts would remain within the range of those typically caused by large-scale construction projects in the District. Construction would have a moderate impact on one view from the H Street Bridge (#28). This is due to the proximity of the construction relative to the bridge and passersby.

11.5.2 Alternative A

11.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A would result in adverse direct operational visual impacts on three views and a beneficial direct operational visual impact on one view, as shown in Table 11-3.

Table 11-3. Summary of Direct Operational Impacts, Alternative A

Impact	Number of Views Affected	Views Affected[1]
Moderate Adverse	1	Delaware Avenue NE (#2)
Negligible Adverse	2	First Street NE (#10), H Street NE (#15)
Beneficial	1	View from Columbus Circle Drive, west side (#21)

1 # refers to the number assigned to the view in **Table 11-8**.

Louisiana Avenue, Delaware Avenue, and First Street NE are the radial streets providing direct views to WUS, visually connecting it with the U.S. Capitol and Capitol Grounds. This relationship played an important role in determining the site and design of WUS. The existing view is dominated by the uninterrupted silhouette of the barrel-vault roof and wide tree-lined streets currently used for U.S. government parking. The views are characterized by the prominence of the historic station building and Columbus Plaza, designed by D.H. Burnham and Company and completed in 1908 and 1912, respectively. Alternative A would not change views from the south except View #2, from Delaware Avenue NE, where the Project would rise above the roofline of the west pavilion adjacent to the headhouse, resulting in a moderate adverse impact.

Alternative A would have a negligible impact on two other views (listed in **Table 11-3** above) because it would barely be visible or because the mass of the private air-rights development would obscure or encompass it. Alternative A would not change the character of these views.

Alternative A features a north-south train hall that would cover the rail terminal at the center of the Project Area. The proposed parking facility and bus facility would occupy a similar footprint to the existing parking garage, but the portion projecting over the service roadway on the west side would be eliminated, re-establishing views along First Street NE. This would amount to a beneficial impact on the view from the west side of Columbus Circle Drive (View #21).

11.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would result in adverse indirect operational impacts on seven views, as shown in Table 11-4.

Table 11-4. Summary of Indirect Operational Impacts, Alternative A

Impact	Number of Views Affected	Views Affected[1]
Moderate Adverse	2	Louisiana Avenue NE (#3), E Street NE (#4)
Minor Adverse	3	First Street NE (#1), G Street NW (#7), view from Columbus Plaza (#19)
Negligible Adverse	2	F Street NW (#5), Massachusetts Avenue NE (#18)

1. # refers to the number assigned to the view in **Table 11-8**.

Indirect impacts would be caused by the mass and height of the potential Federal air-rights development. Until the design of this potential development is more defined, its compatibility and degree of impact can only be assessed based on the maximum allowed buildable volume consistent with the USN zoning that would apply to the area. The maximum buildable volume for the potential Federal air-rights development is shown in the visual assessment images of **Table 11-8**.

The potential Federal air-rights development would be most noticeable from Views #3 and #4, as it would rise above the roofline of the west pavilion. Adverse impacts would be moderate because the views would remain dominated by the parking facility and the private air-rights development, limiting the resulting change in their respective characters. From the other affected views, the development would be less visible against the background of the existing station and the private air-rights development, resulting in minor or negligible impacts.

11.5.2.3 Construction Impacts

Construction of Alternative A would result in negligible adverse impacts on eight views and minor adverse impacts on nine views. One view would have a moderate construction-related visual impact.

Construction of Alternative A would change the appearance of the rail terminal and its immediate surroundings for the duration of the construction period, approximately 11 years and 5 months. Features typical of a large construction site such as perimeter fencing, cranes and other large equipment, stockpiles of materials or debris, and partially built structures would be fully or partially visible from outside the Project Area. This would affect the visual quality of several views around WUS.

Based on distance, perspective, and the anticipated location and height of heavy construction equipment and activities, construction of Alternative A would result in negligible adverse impacts on the following views: Views #2, 3, 8, 16, 18, 19, 20, and 22. Distance or intervening structures would hide most of the construction equipment or activities from those views.

Alternative A would result in minor adverse impacts on Views #4, 7, 10, 11, 12, 14, 15, 21, and 24. Construction equipment and activities would be distinctly visible from those views for at least part of the construction period. Impacts would be minor for the following reasons. The function of the Project Area as a rail terminal already gives it a semi-industrial appearance. Visually, construction would accentuate this aspect of the Project Area rather than represent a major change in visual quality. Also, although construction would take place over more than a decade, the focus of activities, and the corresponding impacts, would change over time. This would make the impacts of constructing Alternative A on any single view similar to those of most large-scale construction projects in the District despite the long overall duration of the construction activities. In general, impacts would be greater during Phases 1 and 4, when the focus would be on the eastern and western edges of the terminal, respectively, than during Phases 2 and 3, when activities would be in the middle of the terminal and less visible from outside. Impacts would be least during the 12-month Intermediate Phase, when only column removal work in the First Street Tunnel would take place.

Construction would have a moderate impact on one view from the H Street Bridge (#28). This is due to the proximity of the construction relative to the bridge and passersby.

11.5.2.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A would result in adverse direct and indirect operational visual impacts on 20 views and a beneficial impact on one view, as shown in **Table 11-5**. In general, impacts relative to existing conditions would be greater than relative to the No-Action Alternative because the changes caused by Alternative A would be more noticeable without the private air-rights development.

Table 11-5. Summary of Direct and Indirect Impacts Relative to Existing Conditions, Alternative A

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	2	Delaware Avenue NE (#2), H Street Bridge (#28)
Moderate Adverse	6	First Street NE (#1), Louisiana Avenue NE (#3), First Street NE (#10), New York Avenue Bridge (#11), E Street NE (#4), view from U.S. Capitol Dome (#24)
Minor Adverse	5	G Street NW (#7), K Street NW (#9), K Street NE (#13), H Street NE (#15), view from Columbus Plaza (#19),
Negligible Adverse	7	F Street NW (#5), H Street NW (#8), Second Street NE (#12), G Street NE (#16), Massachusetts Avenue NE (#18), view from Columbus Circle Drive east side (#20), view from Washington Monument (#22)
Beneficial	1	View from Columbus Circle Drive, west side (#21)

1. # refers to the number assigned to the view in **Table 11-8**.

11.5.3 Alternative B

11.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative B would result in adverse direct operational visual impacts on one view and a beneficial direct operational impact on one view, as shown in Table 11-6.

Table 11-6. Summary of Direct Operational Impacts, Alternative B

Impact	Number of Views Affected	Views Affected[1]
Negligible Adverse	1	H Street NE (#15)
Beneficial	1	View from Columbus Circle Drive, west side (#21)

1. # refers to the number assigned to the view in **Table 11-8**.

In Alternative B, all parking would be below ground. Therefore, there would be no parking above the bus facility, resulting in a structure that would be less tall than in the No-Action Alternative. Only the view from H Street NE looking west (#15) would experience an adverse impact, and this impact would be negligible due to low building elevation. There would be a beneficial impacts on the view from the west side of Columbus Circle Drive (#21) as in Alternative A (**Section 11.5.2.1**, *Direct Operational Impacts*).

11.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would result in adverse indirect operational visual impacts on nine views, as shown in Table 11-7.

Table 11-7. Summary of Indirect Operational Impacts, Alternative B

Impact	Number of Views Affected	Views Affected[1]
Moderate Adverse	3	Delaware Avenue NE (#2), Louisiana Avenue NE (#3), E Street NE (#4)
Minor Adverse	3	First Street NE (#1), G Street NW (#7), View from Columbus Plaza (#19)
Negligible Adverse	3	F Street NW (#5), First Street NE (#10), Massachusetts Avenue NE (#18)

1. # refers to the number assigned to the view in **Table 11-8**.

The indirect operational impacts of Alternative B would be similar to those of Alternative A because the total massing of the combined bus facility and potential Federal air-rights development would be the same in both alternatives and affect the same views in a similar fashion. However, because the area available for the potential Federal air-rights development would be larger, there would additionally be a moderate indirect operational impact to Delaware Avenue NE (#2) and a negligible indirect operational impact to First Street NE (#10).

11.5.3.3 Construction Impacts

Construction of Alternative B would result in negligible adverse impacts on eight views and minor adverse impacts on 11 views. One view would have a moderate construction-related visual impact.

The impacts of constructing Alternative B would be the same as those of constructing Alternative A (see **Section 11.5.2.3**, *Construction Impacts*) with two exceptions.[8] Because it would involve construction in the K Street NE underpass, Alternative B would involve heavier construction activity along K Street, affecting Views 9 and 13 in addition to the views that would be affected in Alternative A. Impacts on these views would be minor for the same reasons as explained for Alternative A. Similar to Alternative A, construction would have a moderate impact on one view from the H Street Bridge. This is due to the proximity of the construction relative to the bridge and passersby.

11.5.3.4 Comparison to Existing Conditions

Impacts of Alternative B would be the same as those of Alternative A (see **Section 11.5.2.4**, *Comparison to Existing Conditions*). Relative to existing conditions, Alternative B would result

[8] Alternative B would take longer to complete than Alternative A (approximately 14 years and 4 months). However, the longer duration would largely be due to the deeper excavation needed to accommodate two levels of below-ground parking. Most of this work would take place below grade and, as such, would not cause additional visual disruptions.

in adverse direct operational impacts on 20 views and a beneficial impact on one view, as shown in **Table 11-5,** above.

Table 11-8. Visual Impacts of the No-Action Alternative, Alternative A and Alternative B

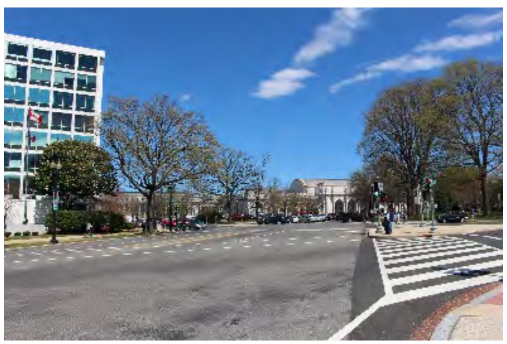
(beginning on the following page)

Table Legend:

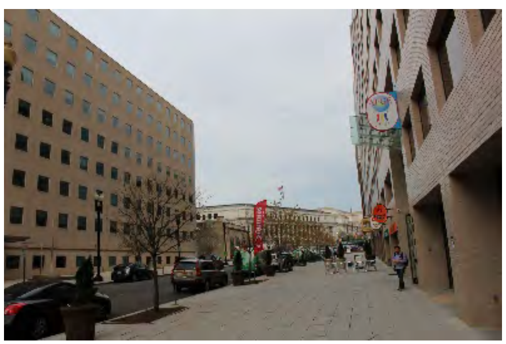
Private Air Rights (maximum buildable volume including penthouse)		Project	
Potential Federal Air Rights (maximum buildable volume including penthouse)		Outline of Existing Parking Garage	

View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
1. First Street NE, view looking north:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and sensitivity) No Construction Impacts	 Alt B & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and sensitivity) No Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and low sensitivity)	 Alt B & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and low sensitivity)

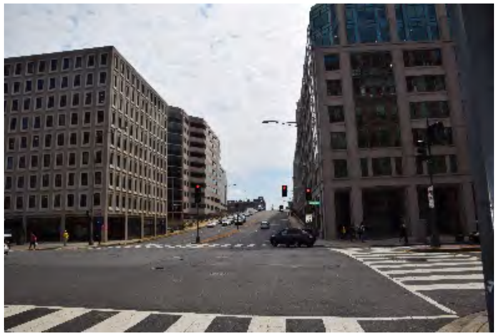
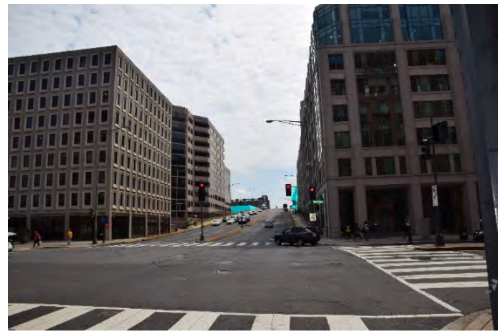
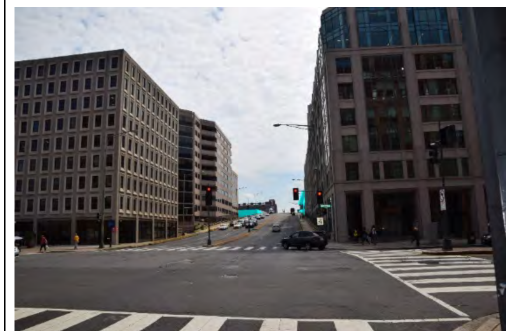
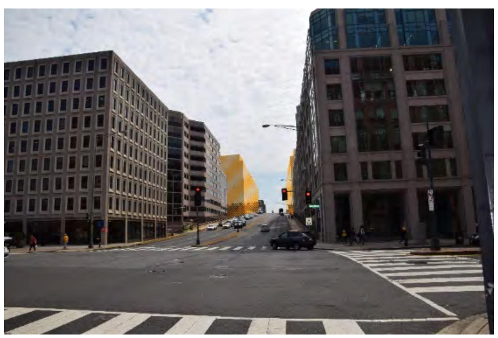
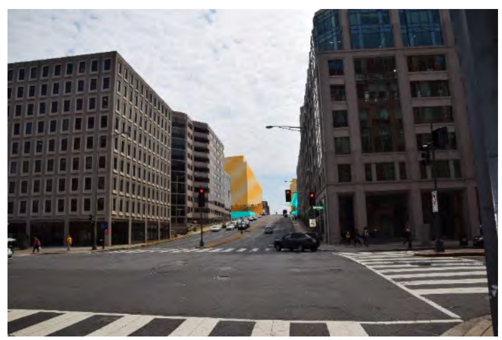
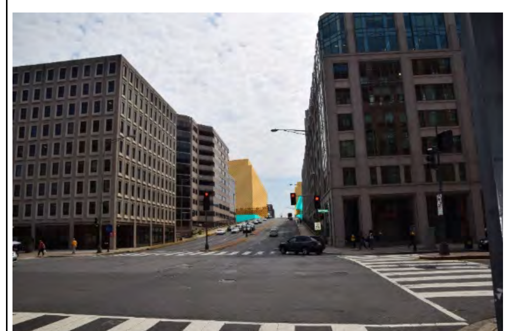
View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
2. Delaware Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (high visibility and high sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights rights (high visibility and high sensitivity) Negligible Construction Impacts

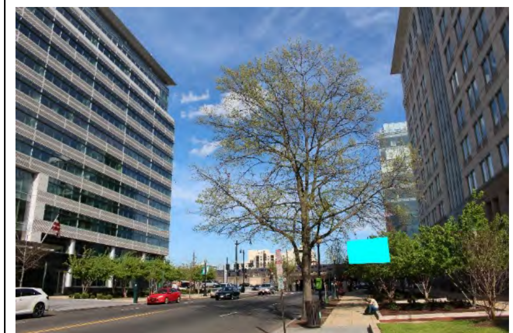
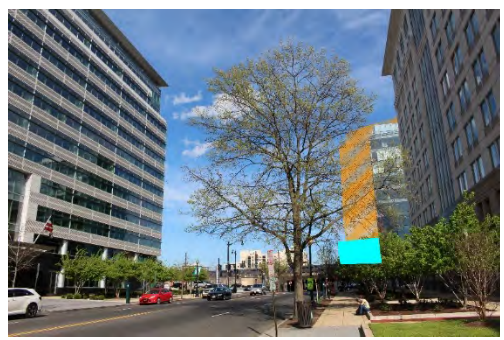
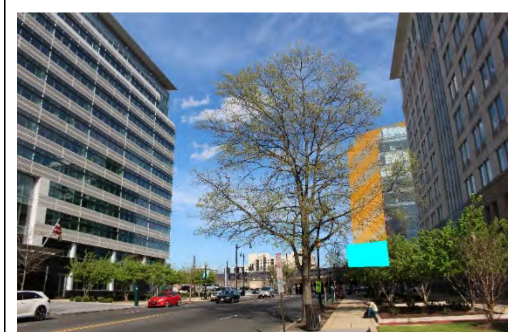
View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (high visibility and moderate sensitivity)	 Alt B & No-Action: **Moderate Adverse Impact** due to indirect impacts of the potential Federal air rights (high visibility and moderate sensitivity)
3. Louisiana Avenue NE, view looking northeast:	 Existing Condition	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and moderate sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and moderate sensitivity) Negligible construction Impacts

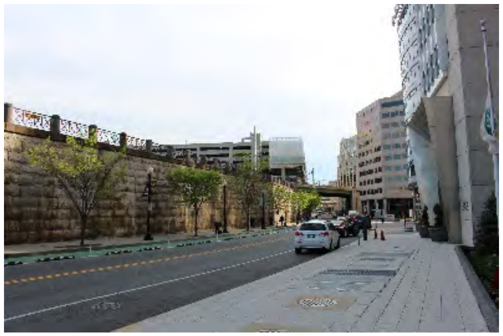
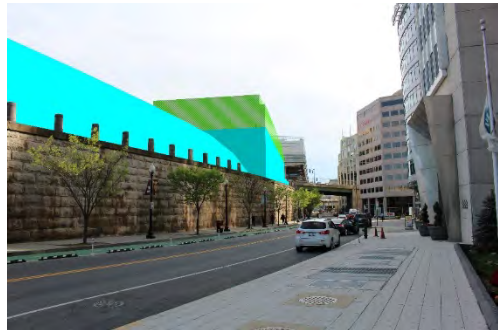
View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and moderate sensitivity)	 Alt B & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and moderate sensitivity)
4. E Street NE, looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt B & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and moderate sensitivity) Minor Construction Impacts

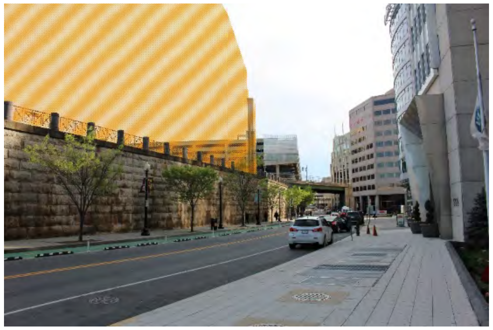
View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, moderate sensitivity)	 Alt B & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, moderate sensitivity)
5. F Street NW, view looking east:	 Existing Conditions & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to indirect impact of the potential Federal air rights (low visibility, low sensitivity) No Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** due to indirect impact of the potential Federal air rights low visibility, low sensitivity) No Construction Impacts

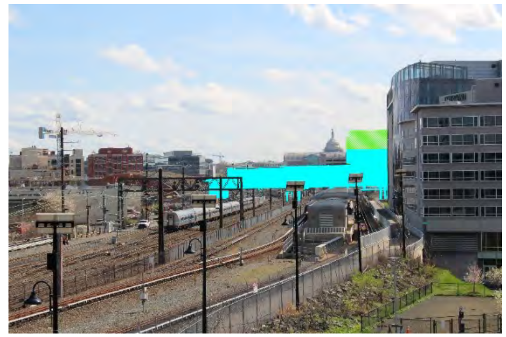
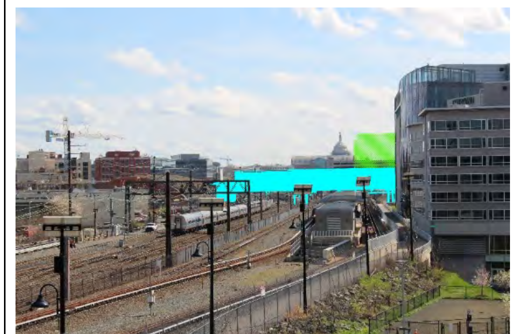
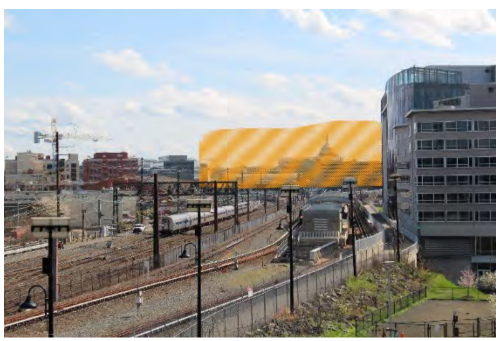
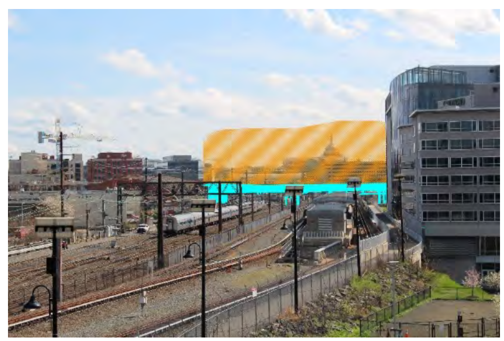
View	Existing Conditions/No-Action Alternative		Alternative A	Alternative B
6. Massachusetts Avenue NW, view looking east:	 Existing Condition & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt B & No-Action: **No Impact** (no visible change) No Construction Impacts
7. G Street NW, view looking east:	 Existing Conditions & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A & Existing Conditions; Alt A & No-Action: **Minor Adverse Impact** due to indirect impacts of the potential Federal air rights (high visibility, low sensitivity) Minor Construction Impacts	 Alt B & Existing Conditions; Alt B & No-Action: **Minor Adverse Impact** due to indirect impacts of the potential Federal air rights (high visibility, low sensitivity) Minor Construction Impacts

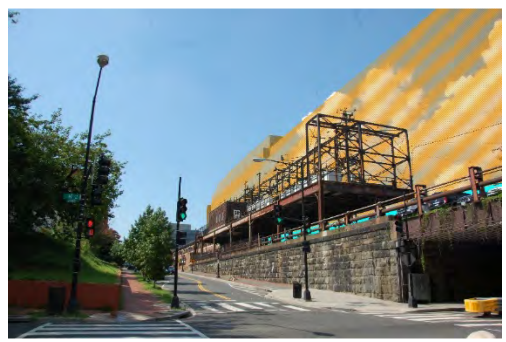
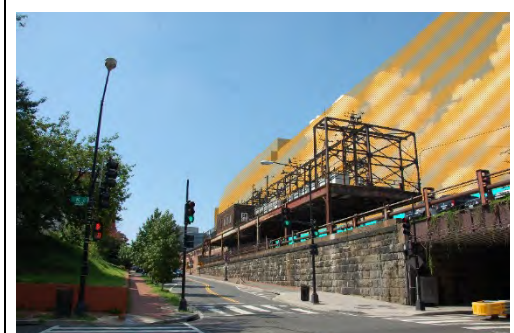
View	Existing Conditions/No-Action		Alternative A	Alternative B
8. H Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative A	Alternative B
9. K Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) No Construction Impacts	 Alt B & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative A	Alternative B
10. First Street NE, view looking south:	 Existing Conditions	Compared to Existing Conditions	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt B & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts

View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)	 Alt B & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)

View	Existing Conditions/No-Action		Alternative A	Alternative B
11. New York Avenue Bridge NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt B & Existing Condition: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative A	Alternative B
12. Second Street NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Minor Construction Impacts	 Alt B & Existing Condition: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative A	Alternative B
13. K Street NE, view looking west:	 Existing Condition	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) No Construction Impacts	 Alt B & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact**, (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

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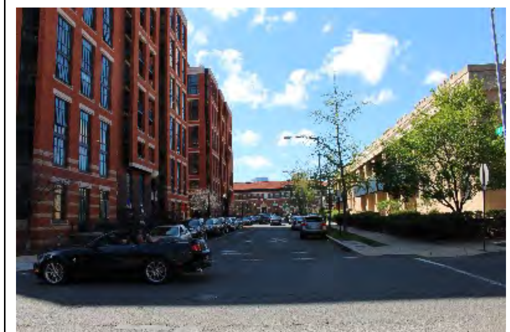
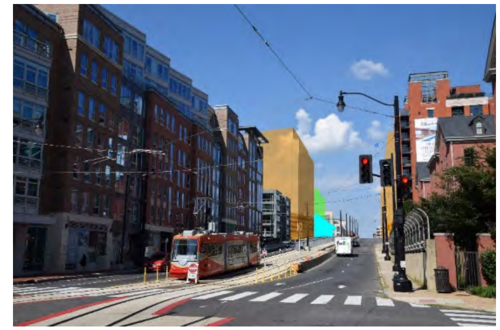
View	Existing Conditions/No-Action		Alternative A	Alternative B
14. I (Eye) Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **No Impact** (no visible change) Minor Construction Impacts	 Alt B & Existing Conditions: **No Impact (**no visible change) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visible change)	 Alt B & No-Action: **No Impact** (no visible change)

View	Existing Conditions/No-Action		Alternative A	Alternative B
15. H Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, low sensitivity) Minor Construction Impacts	 Alt B & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, low sensitivity) Minor Construction Impacts

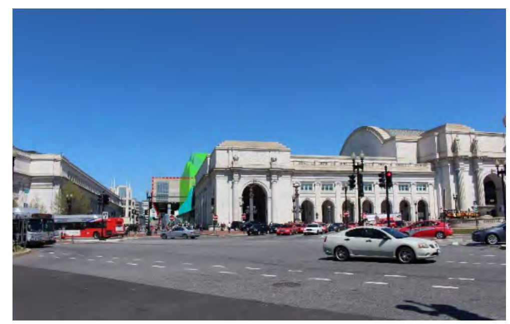
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)	 Alt B & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)
16. G Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts

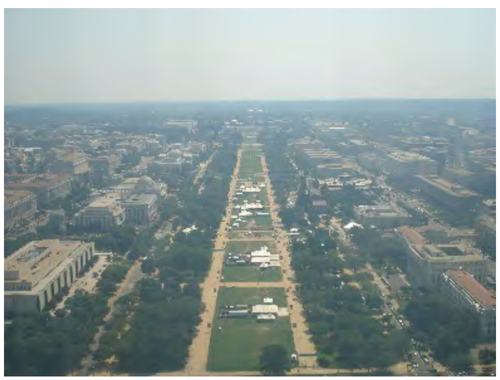
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visible change)	 Alt B & No-Action: **No Impact** (no visible change)
17. F Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **No Impact** (no visible change) No Construction Impacts	 Alt B & Existing Conditions: **No Impact** (no visible change) No Construction Impacts

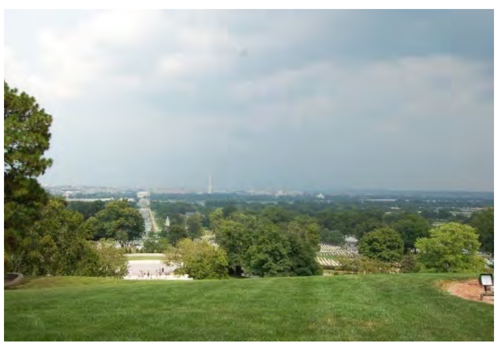
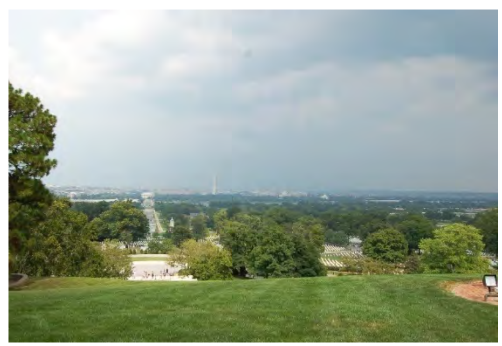
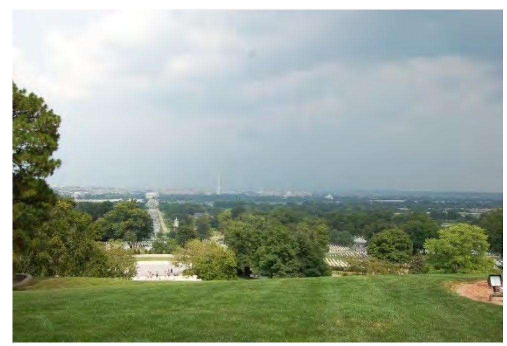
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) No Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visible change)	 Alt B & No-Action: **No Impact** (no visible change)
18. Massachusetts Avenue NE, view looking northwest:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts

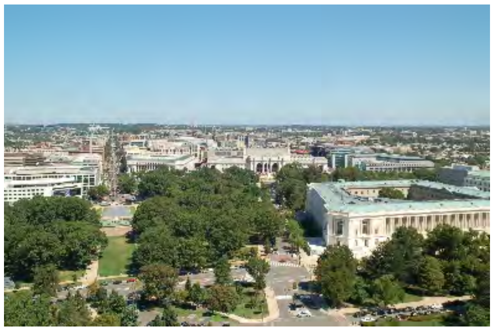
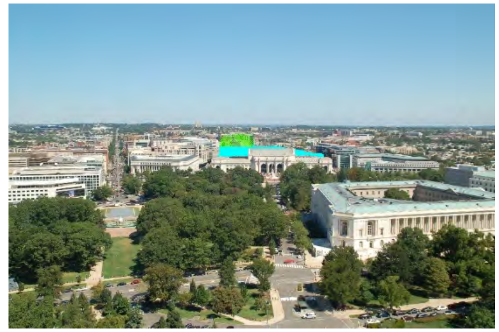
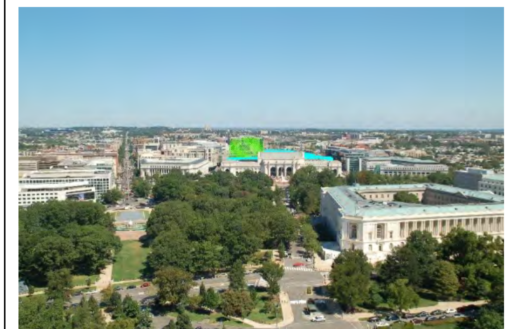
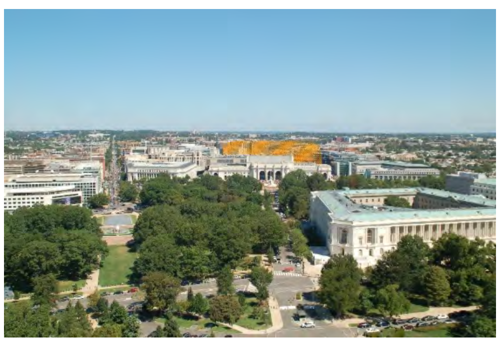
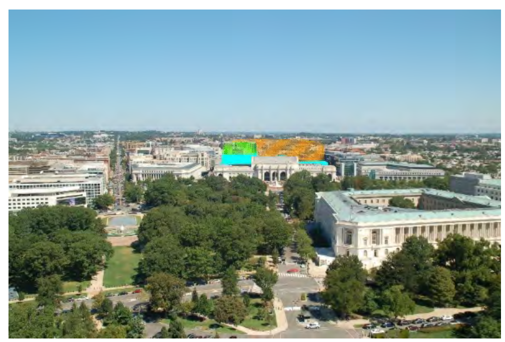
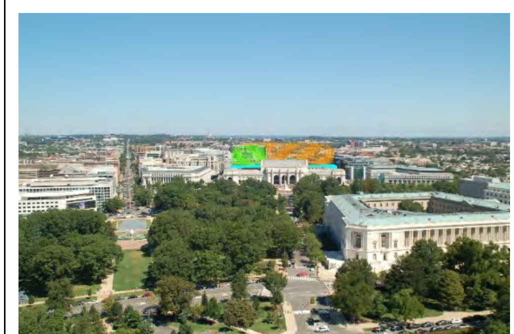
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity)	 Alt B & No-Action: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity)
19. View from Columbus Plaza:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity) Negligible Construction Impacts

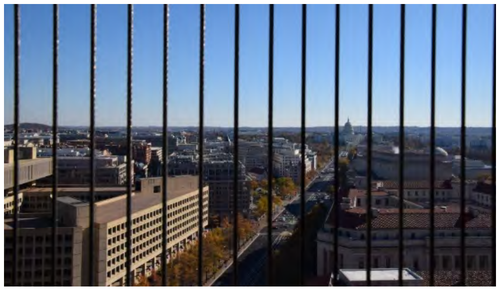
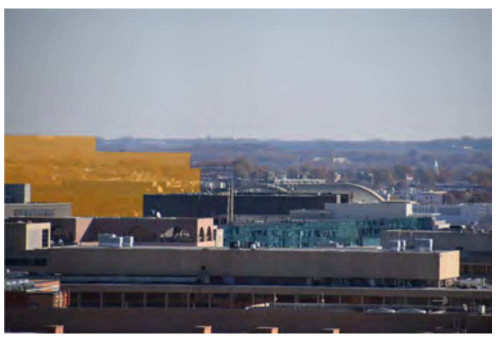
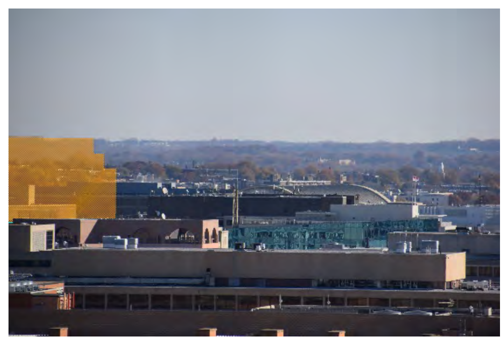
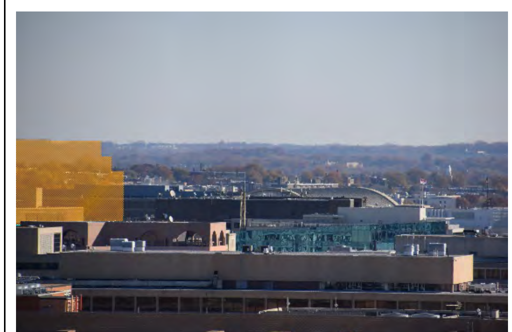
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Minor Adverse Impact** (low visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity)	 Alt B & No-Action: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity)
20. View from Columbus Circle Drive – East Side:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts

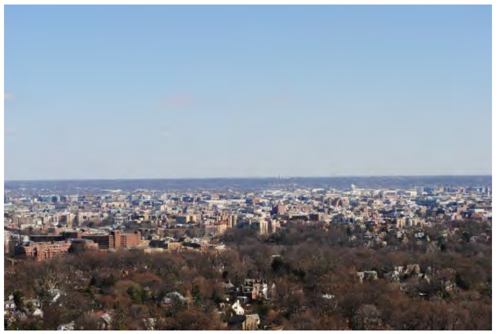
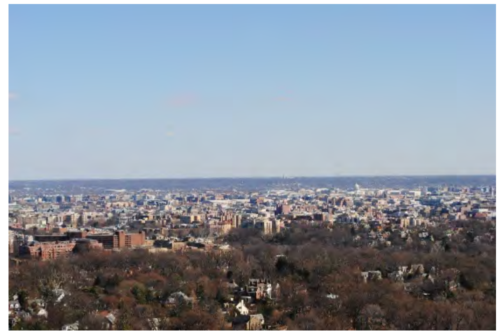
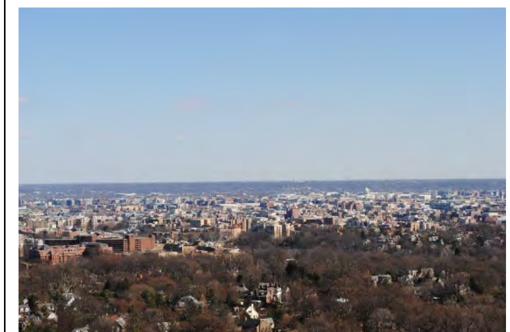
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Moderate Adverse Impact**, (moderate visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
21. View from Columbus Circle Drive – West Side:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Beneficial Impact** (alternative will reinstate the L'Enfant Plan street view down First Street NE by removing the overhanging parking garage) Minor Construction Impacts	 Alt B & Existing Conditions: **Beneficial Impact** (alternative will reinstate the L'Enfant Plan street view down First Street NE by removing the overhanging parking garage) Minor Construction Impacts

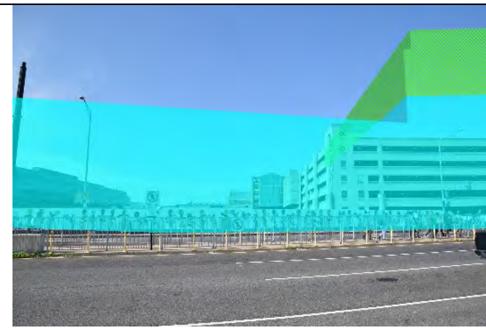
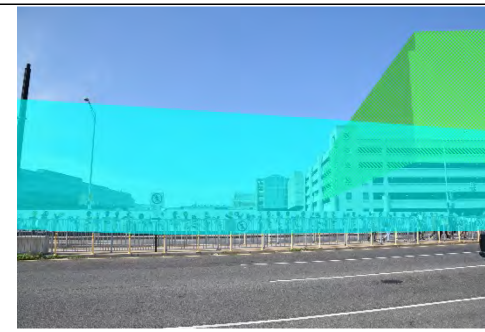
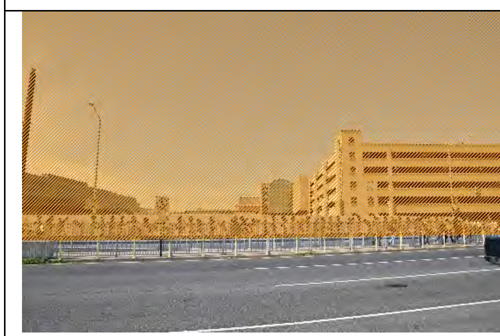
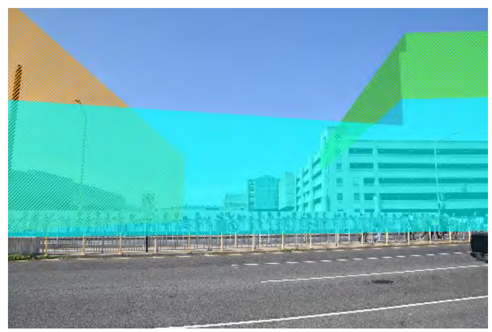
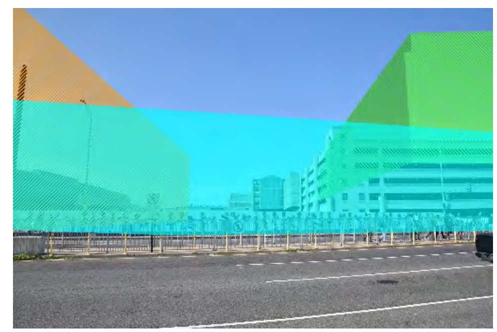
View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **Beneficial Impact (**as above)	 Alt B & Existing Condition: **Beneficial Impact** (as above)
22. View from Washing-ton Monument:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts	 Alt B & Existing Conditions: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts

View	Existing Conditions/No-Action		Alternative A	Alternative B
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
23. View from Arlington House at Arlington National Cemetery:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	Compared to Existing Conditions	 Alt A & Existing Conditions; Alt A & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt B & Existing Conditions; Alt A & No-Action: **No Impact** (no visible change) No Construction Impacts

View	Existing Conditions/No-Action		Alternative A	Alternative B
24. View from U.S. Capitol Dome:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts	 Alt B & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt B & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative A	Alternative B
25.View from the Old Post Office Building:	 Existing Conditions	Compared to Existing Conditions	 Alt A & Existing Conditions: **No Impact** (no visible change) No Construction Impacts	 Alt B & Existing Conditions: **No Impact** (no visible change) No Construction Impacts
	 No-Action: **Negligible Adverse Impact** (low visibility and no sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A & No-Action: **No Impact** (no visible chang	 Alt B & No-Action: **No Impact** (no visible change)

View	Existing Conditions/No-Action		Alternative A	Alternative B
26. View from Washing-ton National Cathedral:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditions**	 Alt A & Existing Conditions; Alt A & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt B & Existing Conditions; Alt B & No-Action: **No Impact** (no visible change) No Construction Impacts
27. View from St. Elizabeths West Campus:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditions**	 Alt A & Existing Conditions; Alt A & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt B & Existing Conditions; Alt B & No-Action: **No Impact** (no visible change) No Construction Impacts

View	Existing Conditions/No-Action		Alternative A	Alternative B
28. View from H Street Bridge Looking south	 Existing Conditions	**Compared to Existing Conditions**	 **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Moderate Construction Impacts	 **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Moderate Construction Impacts
	 Existing Conditions No-Action: **Major Adverse Impact** due to direct impacts of the private air rights (high visibility, high sensitivity) Moderate Construction Impacts	**Compared to the No-Action**	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)

11.5.4 Alternative C

11.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would result in no adverse direct operational impacts and a beneficial direct operational impact on two views, as shown in Table 11-9.

Table 11-9. Summary of Direct Operational Impacts, Alternative C

Impact	Number of Views Affected	Views Affected[1, 2]
Beneficial	2	G Street NW (#7), View from Columbus Circle Drive, west side (#21)

1. Includes both east and west parking options
2. # refers to the number assigned to the view in **Table 11-13**

Alternative C features an east-west train hall that would span the width of the rail terminal. A new bus facility would be provided north of H Street NE, on the east or west side of the Project Area. There would also be a bus pick-up and drop-off area integrated with the train hall. Parking would be located above the bus facility and in one below-ground level.

There would be changes in views from the west side of Columbus Circle Drive, where the projecting portion of the existing garage and service roadway would be removed, resulting in the reestablishment of the view along First Street NE and a beneficial impact, the view from the west side of Columbus Circle Drive (#21). There would also be a beneficial impact on View #7, the view from G Street looking east, because of the reduction in building massing and the opening of the view after the removal of the existing parking garage.

While the Project elements of Alternative C would be visible from several other locations around WUS, they would not be visually distinct from the taller and more visible private air rights development. Therefore, there would be no impact.

11.5.4.2 Indirect Impacts

Relative to the No-Action Alternative, Alternative C (either option) would result in adverse indirect operational visual impacts on five views, as shown in Table 11-10.

Table 11-10. Summary of Indirect Operational Impacts, Alternative C

Impact	Number of Views Affected	Views Affected[1, 2]
Moderate Adverse	2	Delaware Avenue NE (#2), E Street NE (#4)
Minor Adverse	2	First Street NE (#1), Louisiana Avenue NE (#3)
Negligible Adverse	1	First Street NE (#10)

1. Refers to either option
2. # refers to the number assigned to the view in **Table 11-13**

Indirect visual impacts would be caused by the mass and height of the potential Federal air-rights development within the approximate footprint of the existing garage and up to the maximum height allowed under the USN zoning applying to the area. The maximum buildable volume for the potential Federal air-rights development was used for the visual assessment images in **Table 11-13**.

The potential Federal air-rights development would be most noticeable from Views #2 and 4, as it would rise above the roofline of the west pavilion and would not be obscured by the private air-rights development, resulting in moderate adverse impacts. There would be minor adverse impacts on the views from First Street NE (#1) and Louisiana Avenue NE (#3), and negligible adverse impacts on the view from First Street NE (#10). While visible from there, the Federal air-rights would largely blend in with the private air-rights development.

11.5.4.3 Construction Impacts

Construction of Alternative C (either option) would result in negligible adverse impacts on six views and minor adverse impacts on 12 views. One view would have a moderate construction-related visual impact.

Like that of the other Action Alternatives, construction of Alternative C would change the appearance of the rail terminal and its immediate surroundings for the duration of the construction period, approximately 12 years and 3 months.

Based on distance, perspective, and the anticipated location and height of heavy construction equipment and activities, construction of Alternative C (either option) would result in negligible adverse impacts on the following: Views #2, 3, 16, 19, 20, and 22. Distance or intervening structures would hide most of the construction equipment or activities from those views.

Alternative C (either option) would result in minor adverse impacts on Views #4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 21, and 24. Construction equipment and activities would be more visible from those views for at least part of the construction period. Impacts would be minor for the same reasons as explained in **Section 11.5.2.3**, *Construction Impacts* for Alternative A. Also as in Alternative A, construction would have a moderate impact on one view from the H Street Bridge (#28). This would be due to the proximity of the construction relative to the bridge and passersby.

11.5.4.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative C would result in adverse direct and indirect operational impacts on 17 (East Option) or 16 (West Option) views and a beneficial impact on two views, as shown in **Table 11-11 and Table 11-12**. As with the other Action Alternatives, the impacts of Alternative C relative to existing conditions would be greater than relative to the No-Action Alternative because the changes caused by Alternative C would be more noticeable against a baseline that does not include the private air-rights development.

Table 11-11. Summary of Direct and Indirect Impacts Relative to Existing Conditions, Alternative C, East Option

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	3	First Street NE (#1), Delaware Avenue NE (#2), New York Avenue Bridge (#11)
Moderate Adverse	6	Louisiana Avenue NE (#3), E Street NE (#4), First Street NE (#10), I Street NE (#14), view from U.S. Capitol Dome (#24), view from H Street Bridge (#28)
Minor Adverse	4	H Street NW (#8), K Street NW (#9), K Street NE (#13), H Street NE (#15)
Negligible Adverse	4	Second Street NE (#12), G Street NE (#16), view from Columbus Circle Drive east side (#20), view from Washington Monument (#22)
Beneficial	2	G Street NW (#7), View from Columbus Circle Drive west side (#21)

1. # refers to the number assigned to the view in **Table 11-13**

Table 11-12. Summary of Direct and Indirect Impacts Relative to Existing Conditions, Alternative C, West Option

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	3	First Street NE (#1), Delaware Avenue NE (#2), New York Avenue Bridge (#11)
Moderate Adverse	5	Louisiana Avenue NE (#3), E Street NE (#4), First Street NE (#10), view from U.S. Capitol Dome (#24), view from H Street Bridge (#28)
Minor Adverse	4	H Street NW (#8), K Street NW (#9), K Street NE (#13), H Street NE (#15)
Negligible Adverse	4	Second Street NE (#12), G Street NE (#16), view from Columbus Circle Drive east side (#20), view from Washington Monument (#22)
Beneficial	2	G Street NW (#7), View from Columbus Circle Drive west side (#21)

1. # refers to the number assigned to the view in **Table 11-13**

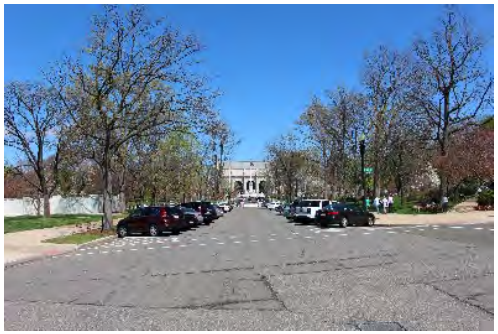
Table 11-13. Visual Impacts of Alternative C

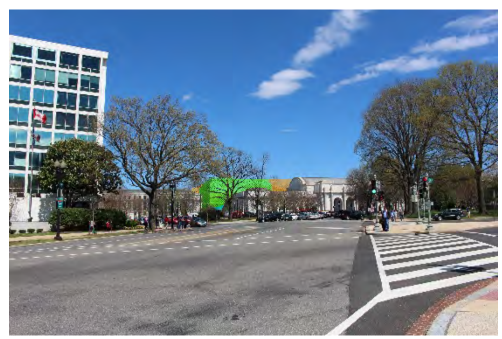
(beginning on the following page)

Table Legend:

Private Air Rights (maximum buildable volume including penthouse)		Project	
Potential Federal Air Rights (maximum buildable volume including penthouse)		Outline of Existing Parking Garage	

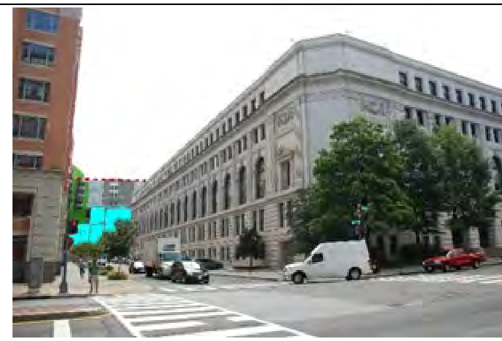
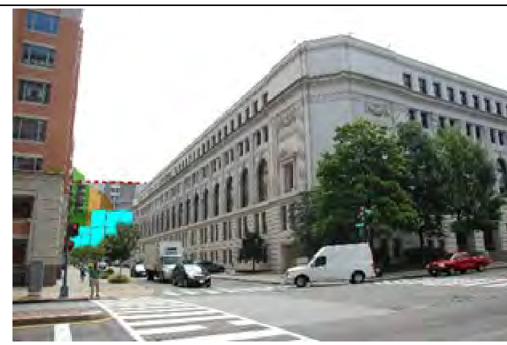
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
1. First Street NE, view looking north:	 Existing Conditions	Compared to Existing Conditions	 Alt C East & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, high sensitivity) No Construction Impacts	Same as East Option: **Major Adverse Impact** due to indirect impact of the potential Federal air-rights
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, low sensitivity)	Same as East Option: **Minor Adverse Impact**

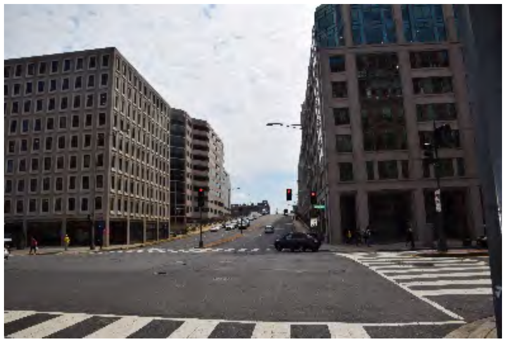
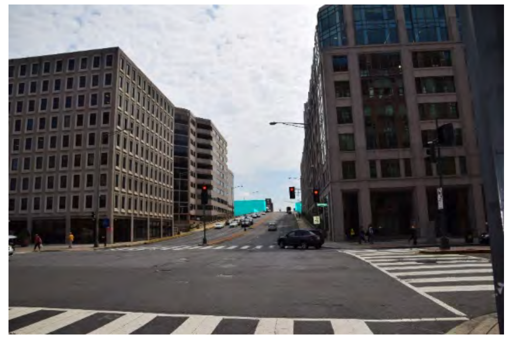
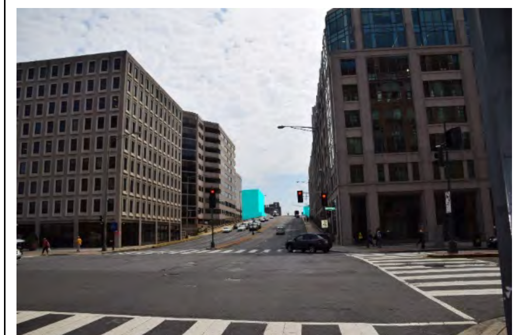
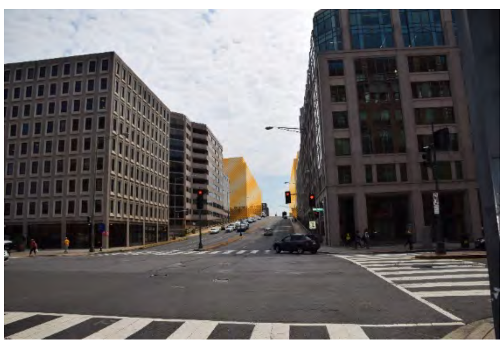
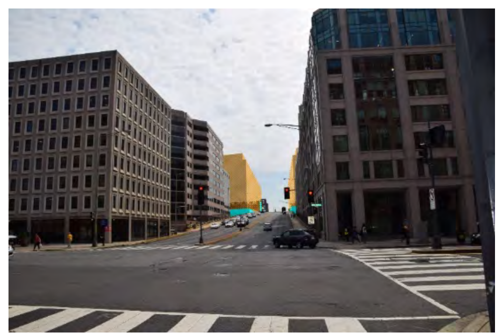
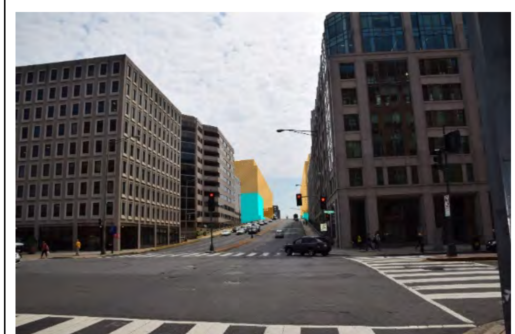
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
2. Delaware Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, high sensitivity) Negligible Construction Impacts	Same as East Option: **Major Adverse Impact**, due to indirect impact of the potential Federal air rights
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity)	Same as East Option: **Moderate Adverse Impact**

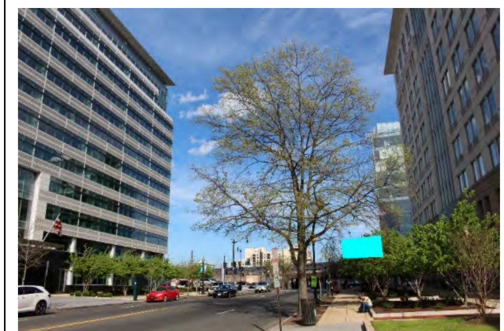
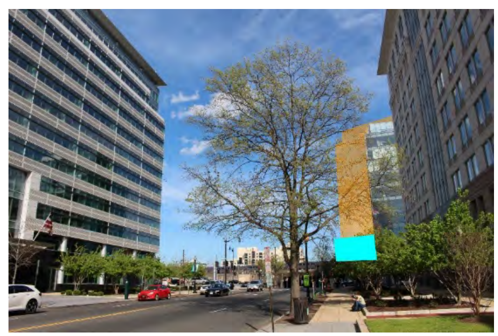
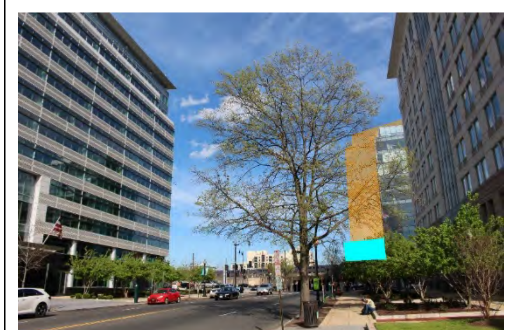
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
3. Louisiana Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity) Negligible Construction Impacts	Same as East Option: **Moderate Adverse Impact**, due to indirect impact of the potential Federal air rights
	 No-Action: **Major Adverse Impact**, due to the direct impact of the private air-rights development Negligible Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, low sensitivity)	Same as East Option: **Minor Adverse Impact**

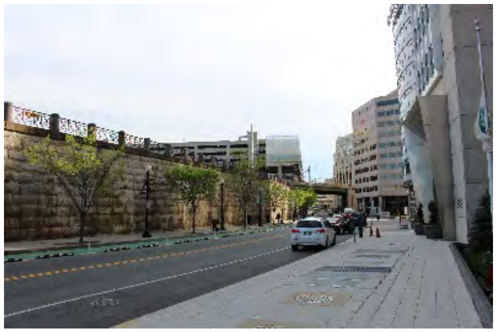
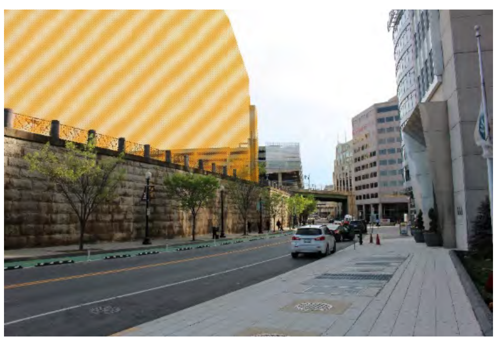
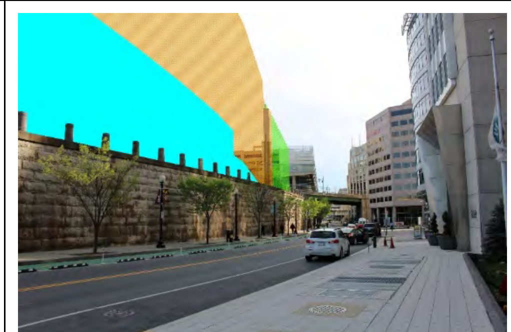
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
4. E Street NE, looking northeast:	 Existing Conditions	Compared to Existing Conditions	 Alt C East & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts	Same as East Option: **Moderate Adverse Impact**, due to indirect impact of the potential Federal air rights
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity)	Same as East Option: **Moderate Adverse Impact**

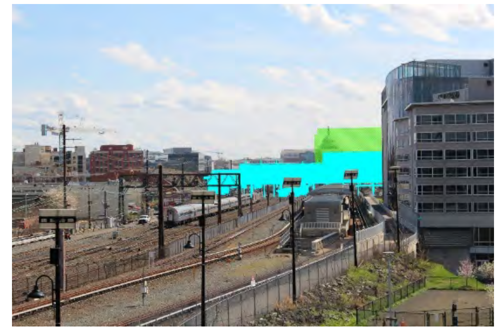
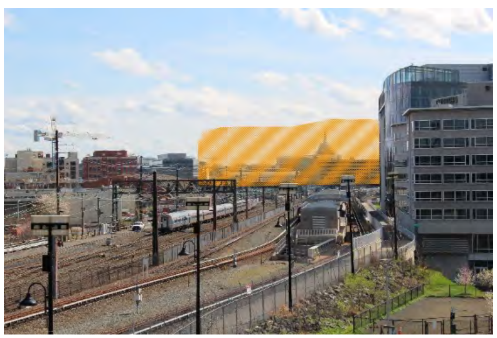
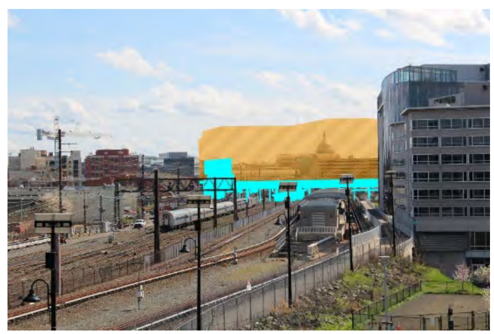
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
5. F Street NW, view looking east:	 Existing Conditions and No-Action: **No Impact** (no visible change**)**	**Compared to Existing Conditons and No-Action**	 Alt C East & Existing Conditions; Alt C East & No-Action: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**
6. Massachusetts Avenue NW, view looking east:	 Existing Conditions and No-Action: **No Impact** (no visible change**)** No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt C East & Existing Conditions; Alt C East & No-Action: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**

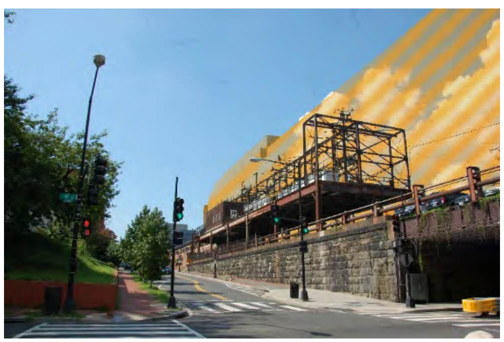
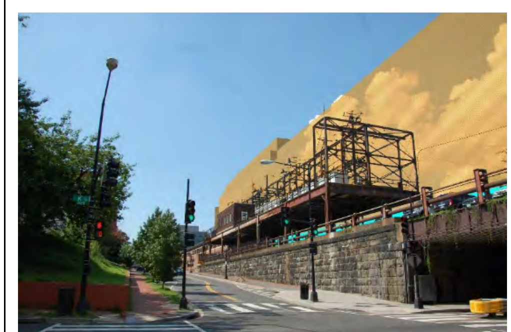
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
7. G Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Beneficial Impact** due to Project mass being lower than existing garage Minor Construction Impacts	Same as East Option: **Beneficial Impact**
	 No-Action: No Impact (no visible change) No Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **Beneficial Impact** due to Project mass being lower than existing garage	Same as East Option: **Beneficial Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
8. H Street NW, view looking east:	 Existing Conditions	Compared to Existing Conditions	 Alt C East & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

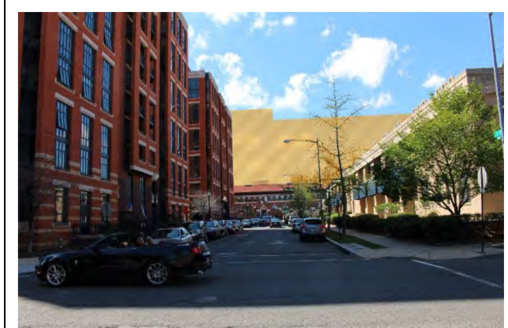
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
9. K Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

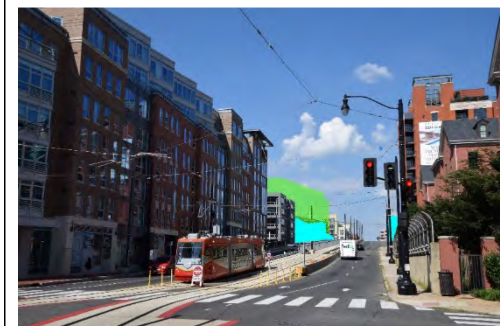
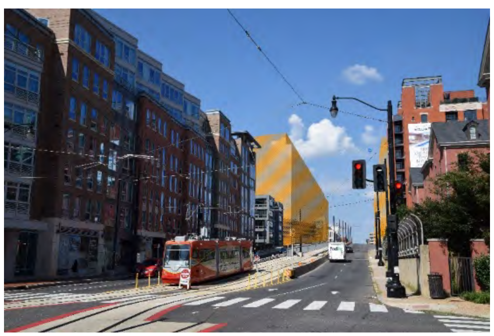
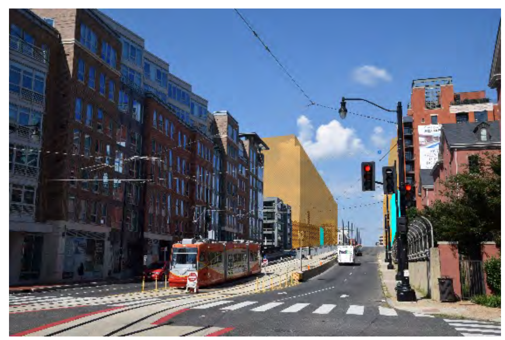
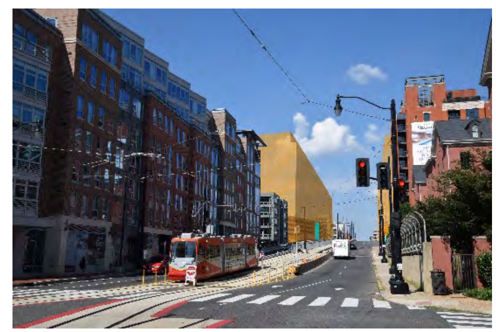
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
10. First Street NE, view looking south:	 Existing Conditions	Compared to Existing Conditions	 Alt C East & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)	 Alt C West & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
11. New York Avenue Bridge NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
12. Second Street NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project rights (low visibility, low sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project rights (low visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
13. K Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
14. I Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Moderate Adverse Impact** due to direct impact of the Project (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **No Impact** (no visible change) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visible change)

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
15. H Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt C East & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility and low sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility and low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt C West & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

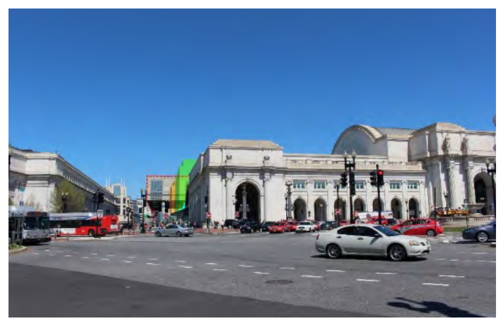
<table>
<tr><th>View</th><th>Existing Conditions/No-Action</th><th></th><th>Alternative C (East Option)</th><th>Alternative C (West Option)</th></tr>
<tr><td rowspan="2">16. G Street NE, view looking west:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt C East & Existing Conditions:
Negligible Adverse Impact due to indirect impact of the potential Federal air rights (low visibility, low sensitivity)
Negligible Construction Impacts</td><td>Same as East Option:
Negligible Adverse Impact</td></tr>
<tr><td>
No-Action:
Minor Adverse Impact (moderate visibility, low sensitivity)
Negligible Construction Impacts</td><td>Compared to the No-Action</td><td>
Alt C East & No-Action: No Impact (potential Federal air rights are not visible)</td><td>Same as East Option:
No Impact</td></tr>
</table>

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
17. F Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) No Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visible change)	Same as East Option: **No Impact**

<table>
<tr><th>View</th><th>Existing Conditions/No-Action</th><th></th><th>Alternative C (East Option)</th><th>Alternative C (West Option)</th></tr>
<tr><td rowspan="2">18. Massachusetts Avenue NE, view looking northwest:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt C East & Existing Conditions: No Impact (no visible change)
No Construction Impacts</td><td>Same as East Option:
No Impact</td></tr>
<tr><td>
No-Action:
Negligible Adverse Impact (low visibility, low sensitivity)
Negligible Construction Impacts</td><td>Compared to the No-Action</td><td>
Alt C East & No-Action: No Impact (no visible change)</td><td>Same as East Option:
No Impact</td></tr>
</table>

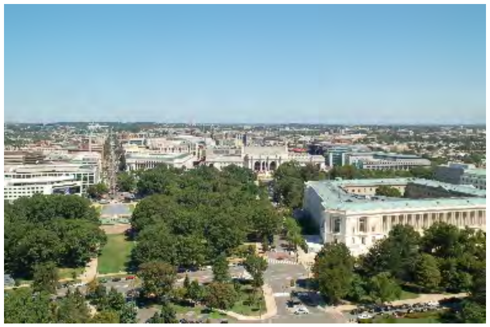
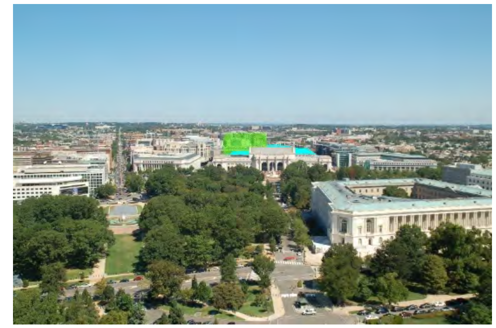
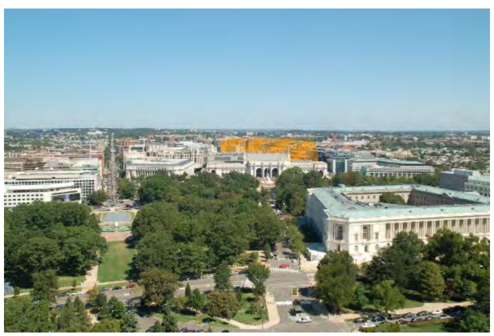
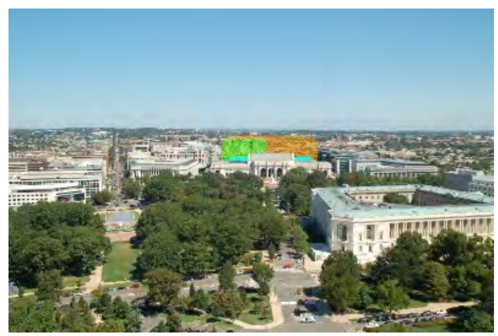
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
19. View from Columbus Plaza:	 Existing Conditions	Compared to Existing Conditions	 Alt C-East & Existing Conditions: **No Impact** (no visible change) Negligible Construction Impacts	Same as East Option: **No Impact**
	 No-Action: **Minor Adverse Impact** (low visibility, moderate sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt C East & No-Action: **No Impact** (no visible change)	Same as East Option: **No Impact**

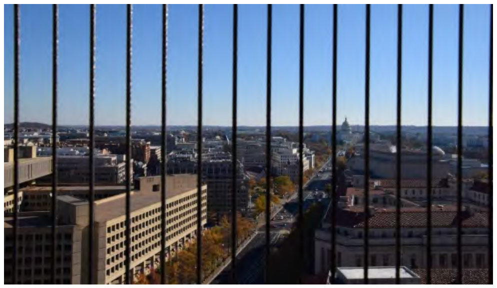
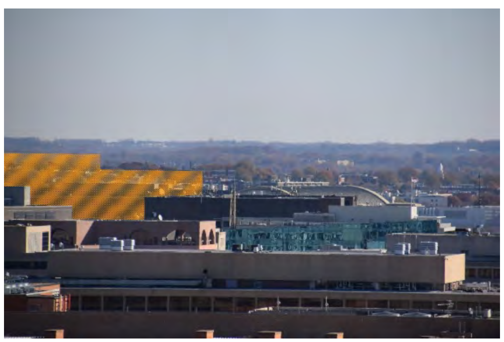
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
20. View from Columbus Circle Drive – east side:	 Existing Conditions	**Compared to the Existing Conditions**	 Alt C East & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts	Same as East Option: **Negligible Adverse Impact**
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	Same as East Option: **No Impact**

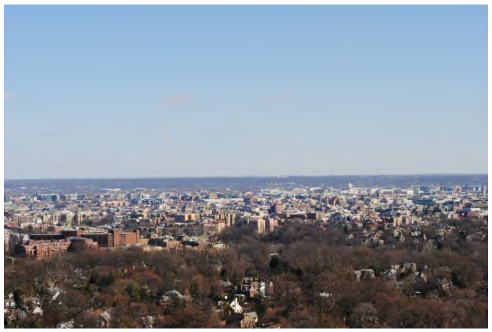
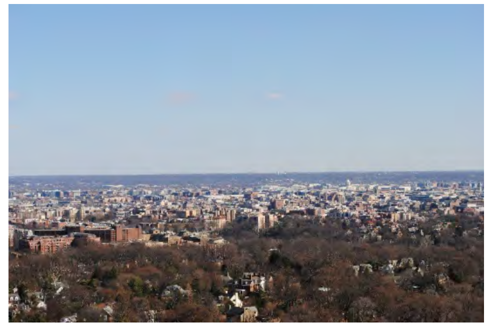
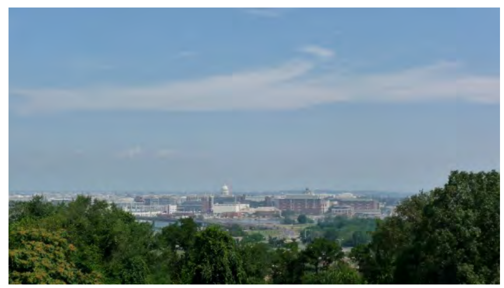
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
21. View from Columbus Circle Drive – West Side:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Beneficial Impact** (view along First Street NE will be reestablished) Minor Construction Impacts	Same as East Option: **Beneficial Impact**
	 No-Action: **No Impact** (no visible change**)** No Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **Beneficial Impact** (view along First Street NE will be reestablished)	Same as East Option: **Beneficial Impact**

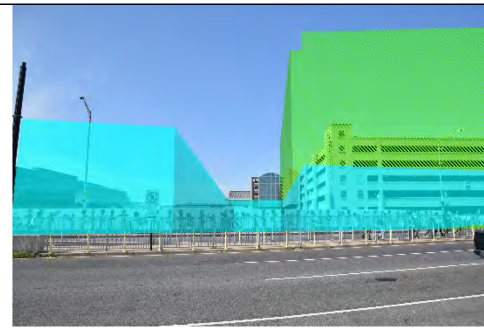
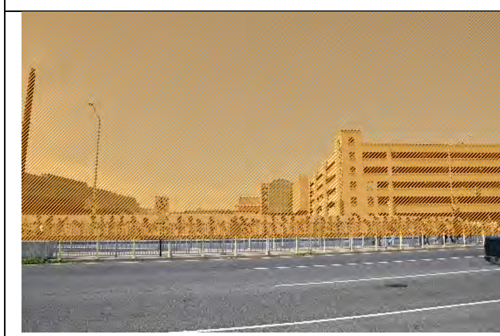
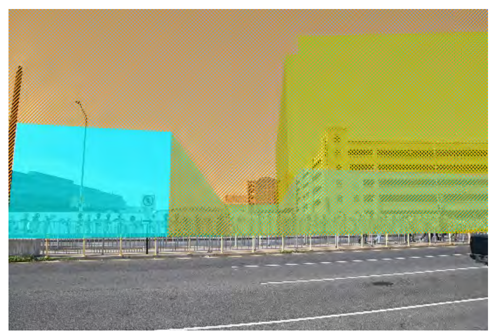
View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
22. View from Washington Monument:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts	Same as East Option: **Negligible Adverse Impact**
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity)	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	Same as East Option: **No Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
	Negligible Construction Impacts			
23. View from Arlington House at Arlington National Cemetery:	 Existing Conditions and No-Action: **No Impact** (no visible change**)** Negligible Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt C East & Existing Conditions; Alt C East & No-Action: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
24. View from U.S. Capitol Dome:	 Existing Conditions	**Compared to Existing Conditions**	 Alt C East & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt C West & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	Same as East Option: **No Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
25. View from the Old Post Office Building:	 Existing Conditions	**Compared to Existing Conditons**	 Alt C East & Existing Conditions: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**
	 No-Action: **No Impact** (very low visibility, no sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt C East & No-Action: **No Impact** (no visible change)	Same as East Option: **No Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
26. View from Washington National Cathedral:	 Existing Conditions and No-Action: **No Impact** (no visible change**)** No Construction Impacts	Compared to Existing Conditons and No-Action	 Alt C East & Existing Conditions; Alt C East & No-Action: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**
27. View from St. Elizabeths West Campus:	 Existing Conditions and No-Action: **No Impact** (no visible change) No Construction Impacts	Compared to Existing Conditons and No-Action	 Alt C East & Existing Conditions; Alt C East & No-Action: **No Impact** (no visible change) No Construction Impacts	Same as East Option: **No Impact**

View	Existing Conditions/No-Action		Alternative C (East Option)	Alternative C (West Option)
28. View from H Street Bridge Looking south	 Existing Conditions	**Compared to Existing Conditions**	 **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Moderate Construction Impacts	Same as East Option: **Moderate Adverse Impact**
	 Existing Conditions No-Action: **Major Adverse Impact** due to direct impacts of the private air rights (high visibility, high sensitivity) Moderate Construction Impacts	**Compared to the No-Action**	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)	Same as East Option: **No Impact**

11.5.5 Alternative D

11.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative D would result in no adverse direct operational visual impacts and a beneficial direct operational impact on two views.

The beneficial impacts of Alternative D would be the same as those of Alternative C (see **Section 11.5.4.1**, *Direct Operational Impacts*). As in Alternative C, in Alternative D the Project elements would not visually stand out against the background of the private air-rights development and have no adverse impacts on any views.

11.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would result in adverse indirect operational visual impacts on five views.

The indirect operational visual impacts of Alternative D would be the same as those of Alternative C (see **Section 11.5.4.2**, *Indirect Operational Impacts*). The Federal air-rights development would occupy a similar volume, with similar visual effects.

11.5.5.3 Construction Impacts

Construction of Alternative D would result in negligible adverse visual impacts on eight views and minor adverse impacts on 11 views. One view would have a moderate construction-related visual impact.

Like that of the other Action Alternatives, construction of Alternative D would change the appearance of the rail terminal and its immediate surroundings for the duration of the construction period, approximately 12 years and 3 months.

Based on distance, perspective, and the anticipated location and height of heavy construction equipment and activities, construction of Alternative D would result in negligible adverse impacts on the following: Views #2, 3, 8, 16, 18, 19, 20, and 22. Distance or intervening structures would hide most of the construction equipment or activities from those views.

Alternative D would result in minor adverse impacts on Views #4, 7, 9, 10, 11, 12, 13, 14, 15, 21, and 24. Construction equipment and activities would be more visible from those views for at least part of the construction period. Impacts would be minor for the same reasons as explained in **Section 11.5.2.3**, *Construction Impacts*. Construction would have a moderate impact on one view from the H Street Bridge (#28). This is due to the proximity of the construction relative to the bridge and passersby.

11.5.5.4 Comparison to Existing Conditions

Alternative D would result in adverse direct and indirect operational visual impacts on 16 views and a beneficial impact on two views, as shown in **Table 11-14**. As with the other Action Alternatives, the impacts of Alternative D relative to existing conditions would be greater than relative to the No-Action Alternative because the changes caused by Alternative D would be more noticeable without the private air-rights development.

Table 11-14. Summary of Direct and Indirect Impacts Relative to Existing Conditions, Alternative D

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	3	First Street NE (#1), Delaware Avenue NE (#2), New York Avenue Bridge (#11)
Moderate Adverse	7	Louisiana Avenue NE (#3), E Street NE (#4), First Street NE (#10), 2nd Street NE (#12), K Street NE (#13), view from U.S. Capitol Dome (#24), view from H Street Bridge (#28)
Minor Adverse	3	K Street NW (#9), H Street NE (#15), view from Columbus Circle Drive, east side (#20)
Negligible Adverse	3	H Street NW (#8), G Street NE (#16), view from Washington Monument (#22)
Beneficial	2	G Street NW (#7), View from Columbus Circle Drive, west side (#21)

1. # refers to the number assigned to the view in **Table 11-16**

11.5.6 Alternative E

11.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative E would result in no adverse direct operational visual impacts and a beneficial direct operational impact on two views.

The beneficial impacts of Alternative E would be the same as those of Alternative C (see **Section 11.5.4.1**, *Direct Operational Impacts*). As in Alternative C, in Alternative E the Project elements would not visually stand out against the background of the private air-rights development and have no adverse impacts on any views.

11.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would result in adverse indirect operational visual impacts on five views.

The indirect operational visual impacts of Alternative E would be the same as those of Alternative C (**Section 11.5.4.2**, *Indirect Operational Impacts*). The Federal air-rights development would occupy a similar volume, with similar visual impacts.

11.5.6.3 Construction Impacts

Construction of Alternative E would result in negligible adverse visual impacts on eight views and minor adverse impacts on 11 views. One view would have a moderate construction-related visual impact.

Like that of the other Action Alternatives, construction of Alternative E would change the appearance of the rail terminal and its immediate surroundings for the duration of the construction period, approximately 14 years and 4 months.

Based on distance, perspective, and the anticipated location and height of heavy construction equipment and activities, construction of Alternative E would result in negligible adverse impacts on the following: Views #2, 3, 8, 16, 18, 19, 20, and 22. Distance or intervening structures would hide most of the construction equipment or activities from those views.

Alternative E would result in minor adverse impacts on Views #4, 7, 9, 10, 11, 12, 13, 14, 15, 21, and 24. Construction equipment and activities would be more visible from those views for at least part of the construction period. Impacts would be minor for the same reasons as explained in **Section 11.5.2.3**, *Direct Operational Impacts*, for Alternative A. Construction would have a moderate impact on one view from the H Street Bridge (#28). This would be due to the proximity of the construction relative to the bridge and passersby.

11.5.6.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative E would result in adverse direct and indirect operational impacts on 16 views and a beneficial impact on two views, as shown in **Table 11-15**. As with the other Action Alternatives, the impacts of Alternative E relative to existing conditions would be greater than relative to the No-Action Alternative because the changes caused by Alternative E would be more noticeable without the private air-rights development.

Table 11-15. Summary of Direct and Indirect Impacts Relative to Existing Conditions, Alternative E

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	3	First Street NE (#1), Delaware Avenue NE (#2), New York Avenue Bridge (#11)
Moderate Adverse	5	Louisiana Avenue NE (#3), E Street NE (#4), First Street NE (#10), view from U.S. Capitol Dome (#24), view from H Street Bridge (#28)
Minor Adverse	4	K Street NW (#9), K Street NE (#13), H Street NE (#15), view from Columbus Circle Drive, east side (#20)
Negligible Adverse	4	H Street NW (#8), 2nd Street NE (#12), G Street NE (#16), view from Washington Monument (#22)
Beneficial	2	G Street NW (#7), View from Columbus Circle Drive, west side (#21)

1. # refers to the number assigned to the view in **Table 11-16**

Table 11-16. Visual Impacts of Alternative D and Alternative E

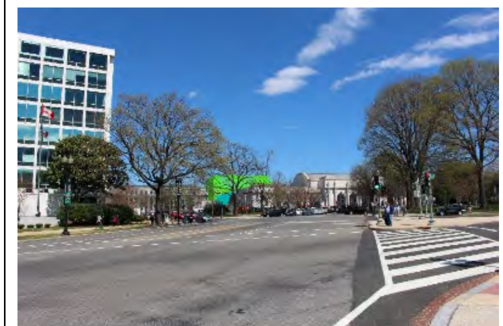
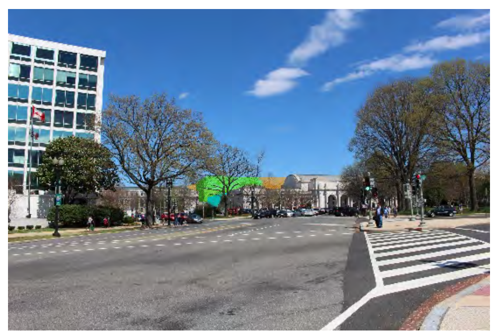
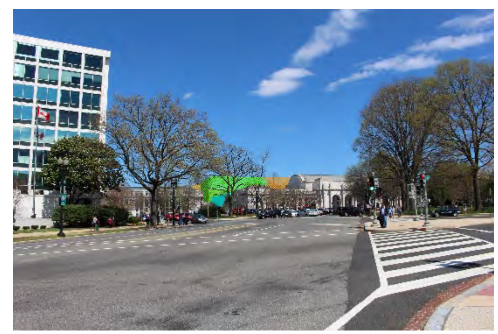
(beginning on the following page)

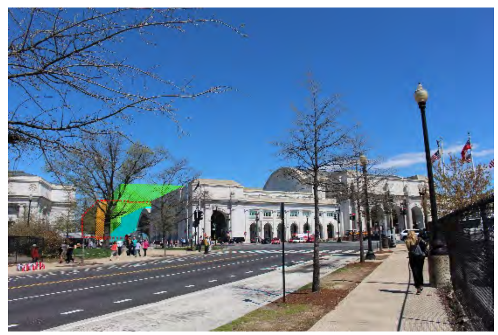
Table Legend:

Private Air Rights (maximum buildable volume including penthouse)		Project	
Potential Federal Air Rights (maximum buildable volume including penthouse)		Outline of Existing Parking Garage	

View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
1. First Street NE, view looking north:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, high sensitivity) No Construction Impacts	 Alt E & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility, high sensitivity) No Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action Alternative**	 Alt D & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, low sensitivity)	 Alt E & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, low sensitivity)

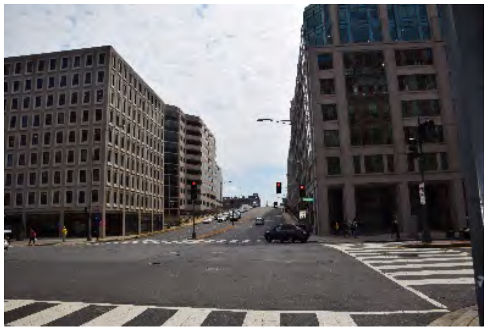
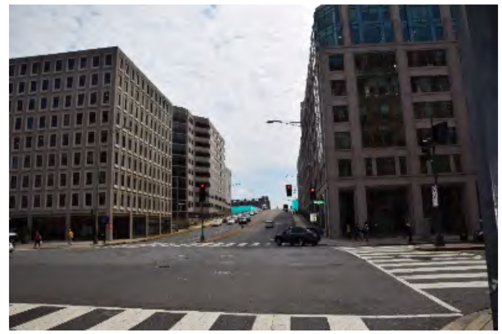
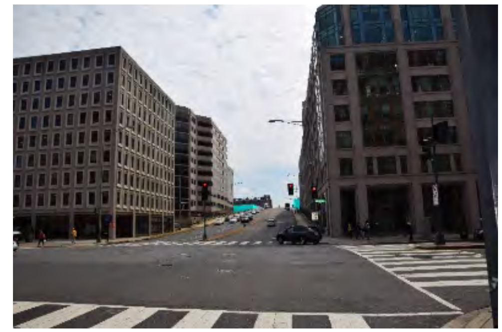
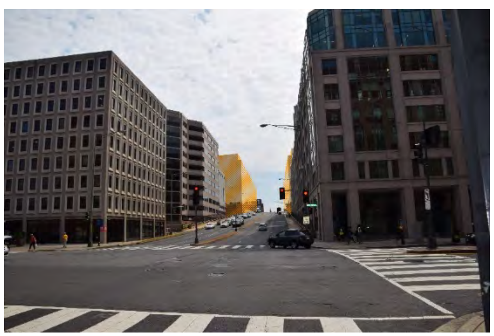
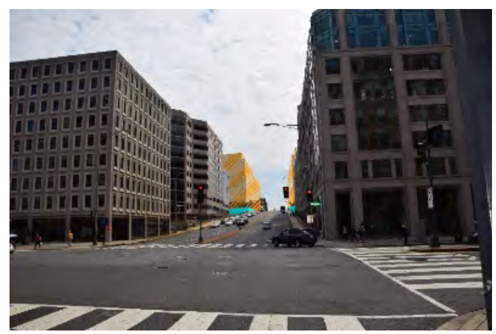
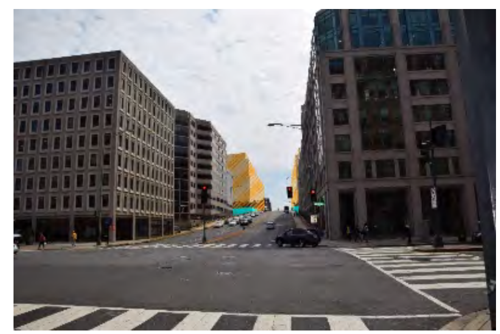
View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
2. Delaware Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Major Adverse Impact** due to indirect impact of potential Federal air rights (high visibility, high sensitivity) Negligible Construction Impacts	 Alt E & Existing Conditions: **Major Adverse Impact** due to indirect impact of potential Federal air rights (high visibility, high sensitivity) Negligible Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (high visibility, moderate sensitivity)	 Alt E & No-Action: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (high visibility, moderate sensitivity)

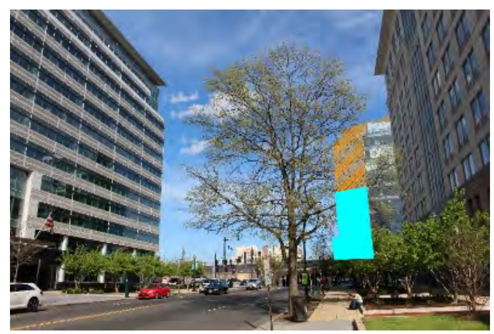
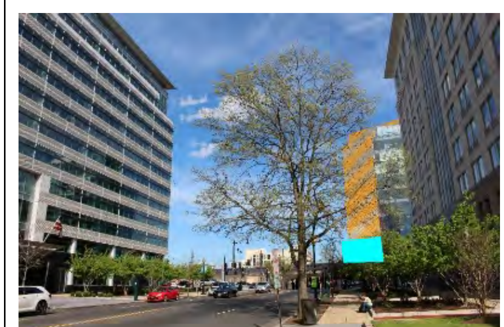
View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
3. Louisiana Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity) Negligible Construction Impacts	 Alt E & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity) Negligible Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Minor Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, low sensitivity)	 Alt E & No-Action: **Minor Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, low sensitivity)

View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
4. E Street NE, looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity)	 Alt E & No-Action: **Moderate Adverse Impact** due to indirect impact of potential Federal air rights (moderate visibility, moderate sensitivity)

View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
5. F Street NW, view looking east:	 Existing Condition and No-Action: **No Impact** (no visible change**)**	**Compared to Existing Conditons and No-Action**	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change**)** No Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) No Construction Impacts
6. Massachusetts Avenue NW, view looking east:	 Existing Conditions and No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) No Construction Impacts

View	Existing Conditions/No-Action Alternative		Alternative D	Alternative E
7. G Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Beneficial Impact** due to the Project mass being lower than existing garage Minor Construction Impacts	 Alt E & Existing Conditions: **Beneficial Impact,** due to Project mass being lower than existing garage Minor Construction Impacts
	 No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Beneficial Impact** due to the Project mass being lower than existing garage	 Alt E & No-Action: **Beneficial Impact** due to the Project mass being lower than existing garage

View	Existing Conditions/No-Action		Alternative D	Alternative E
8. H Street NW, view looking east:	 Existing Conditions	Compared to Existing Conditions	 Alt D & Existing Conditions**:** **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts	 Alt E & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative D	Alternative E
9. K Street NW, view looking east:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility,low sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility,low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

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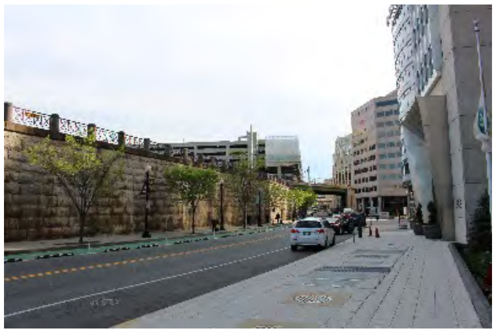
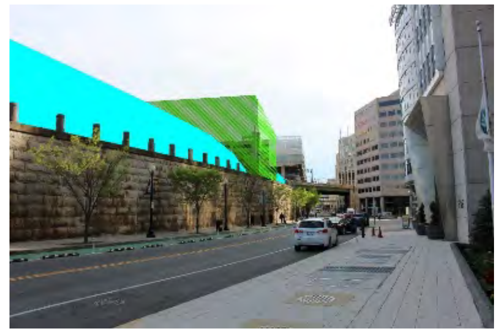
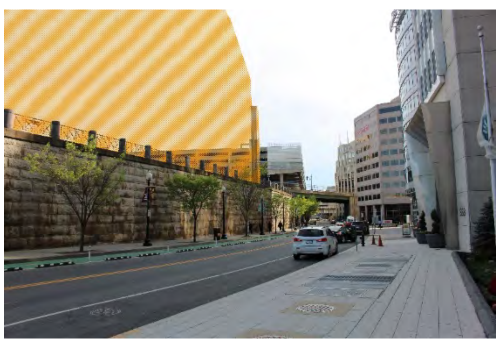
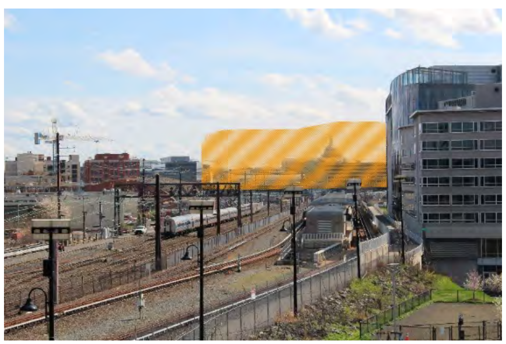
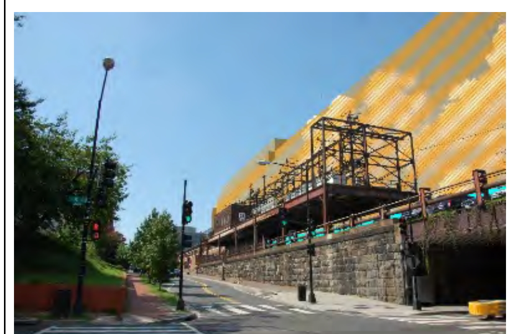
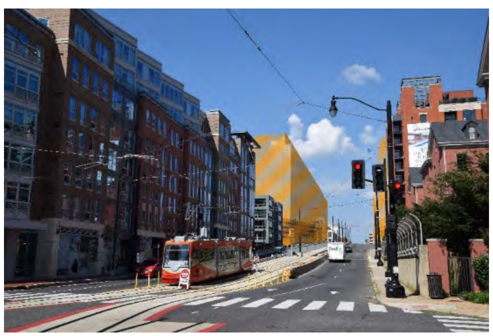
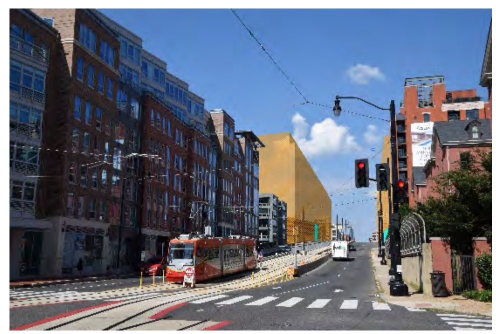
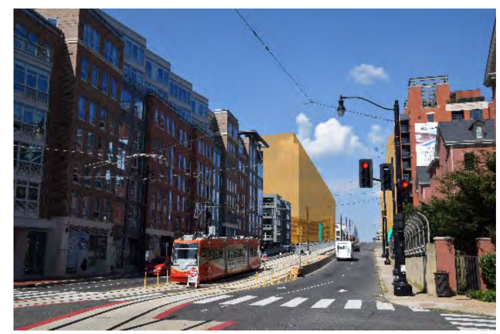
View	Existing Conditions/No-Action		Alternative D	Alternative E
10. First Street NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**:** **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights high visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)	 Alt E & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)

View	Existing Conditions/No-Action		Alternative D	Alternative E
11. New York Avenue Bridge NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**:** **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative D	Alternative E
12. Second Street NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**:** **Moderate Adverse Impact** due to direct impact of the Project (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative D	Alternative E
13. K Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt D & Existing Conditions**:** **Moderate Adverse Impact** due to direct impact of the Project (high visibility, moderate sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative D	Alternative E
14. I Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**: No Impact** (no visible change) Minor Construction Impacts	 Alt E & Existing Conditions: **No Impact** (no visible change) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visible change)	 Alt E & No-Action: **No Impact** (no visible change)

View	Existing Conditions/No-Action		Alternative D	Alternative E
15. H Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, low sensitivity) Minor Construction Impacts	 Alt E & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

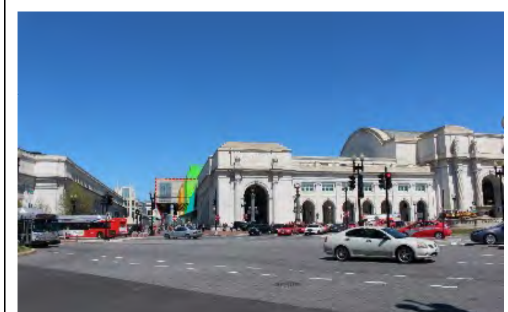
<table>
<tr><th>View</th><th>Existing Conditions/No-Action</th><th></th><th>Alternative D</th><th>Alternative E</th></tr>
<tr><td rowspan="2">16. G Street NE, view looking west:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt D & Existing Conditions: Negligible Adverse Impact (low visibility, low sensitivity)
Negligible Construction Impacts</td><td>
Alt E & Existing Conditions: Negligible Adverse Impact (low visibility, low sensitivity)
Negligible Construction Impacts</td></tr>
<tr><td>
No-Action:
Minor Adverse Impact (moderate visibility, low sensitivity)
Negligible Construction Impacts</td><td>Compared to the No-Action</td><td>
Alt D & No-Action: No Impact (no visible change)</td><td>
Alt E & No-Action: No Impact (no visible change)</td></tr>
</table>

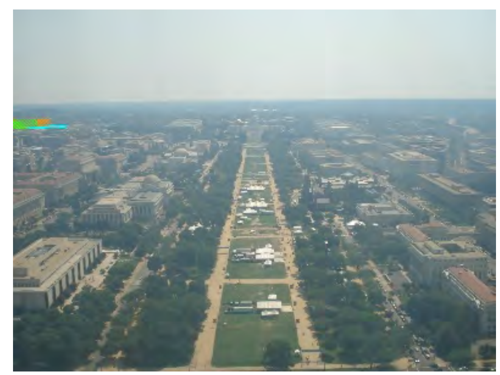
View	Existing Conditions/No-Action		Alternative D	Alternative E
17. F Street NE, view looking west:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**: No Impact** (no visible change) No Construction Impacts	 Alt E & Existing Conditions: **No Impact** (no visible change) No Construction Impacts
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) No Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visible change)	 Alt E & No-Action: **No Impact** (no visible change)

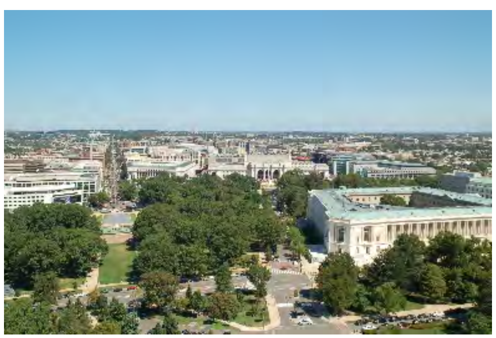
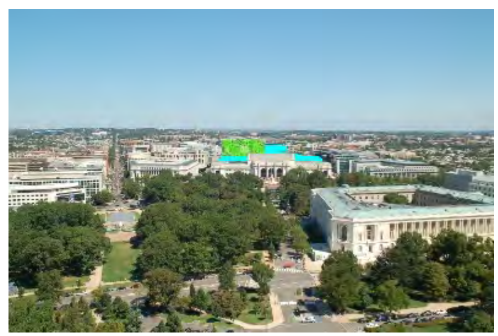
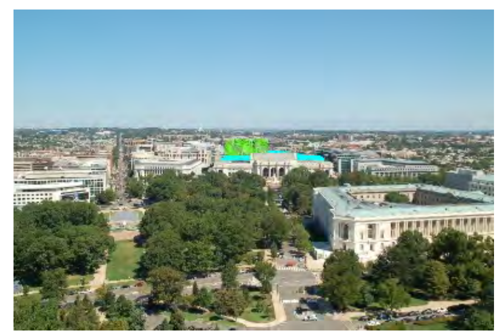
View	Existing Conditions/No-Action		Alternative D	Alternative E
18. Massachusetts Avenue NE, view looking northwest:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**: No Impact** (no visible change) Negligible Construction Impacts	 Alt E & Existing Conditions: **No Impact** (no visible change) Negligible Construction Impacts
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visible change)	 Alt E & No-Action: **No Impact** (no visible change)

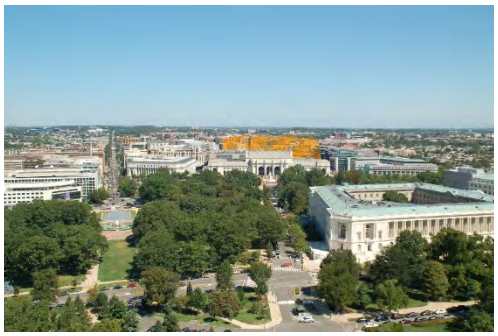
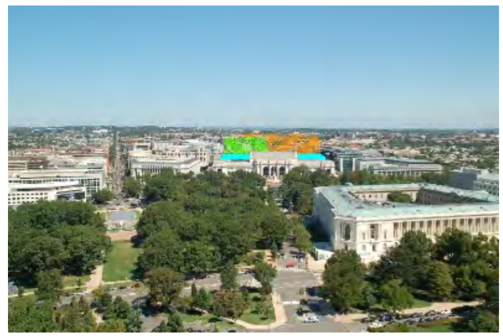
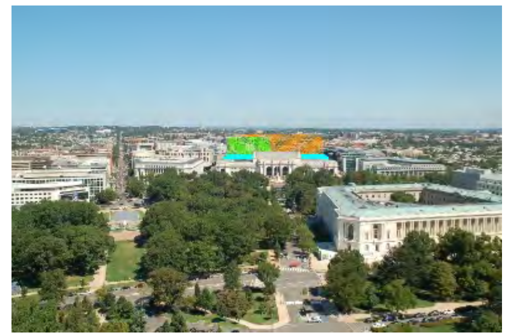
View	Existing Conditions/No-Action		Alternative D	Alternative E
19. View from Columbus Plaza:	 Existing Conditions	Compared to Existing Conditons	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change) Negligible Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (low visibility, moderate sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt D & No-Action: **No Impact** (no visible change)	 Alt E & No-Action: **No Impact** (no visible change)

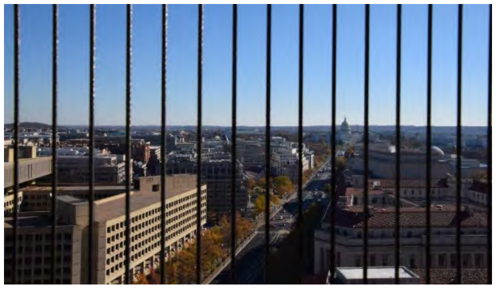
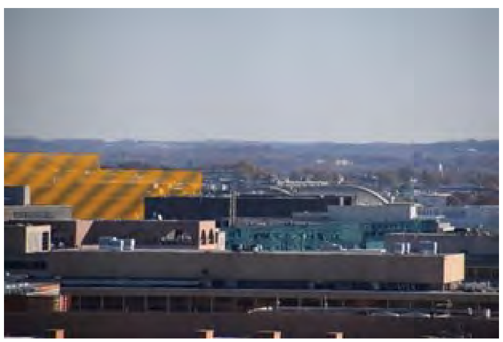
View	Existing Conditions/No-Action		Alternative D	Alternative E
20. View from Columbus Circle Drive – East Side:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**:** **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) Negligible Construction Impacts	 Alt E & No-Action: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity Negligible Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

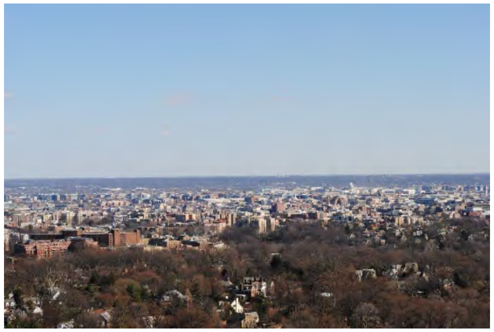
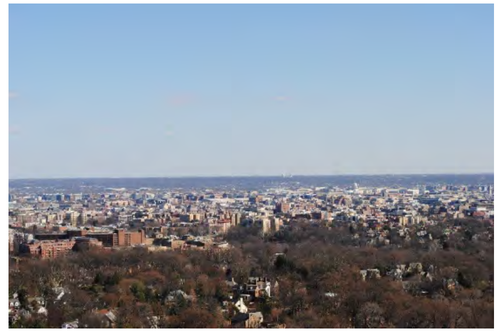
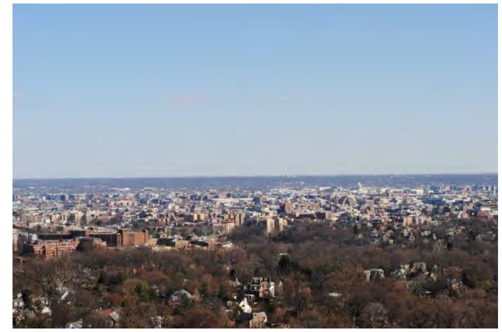
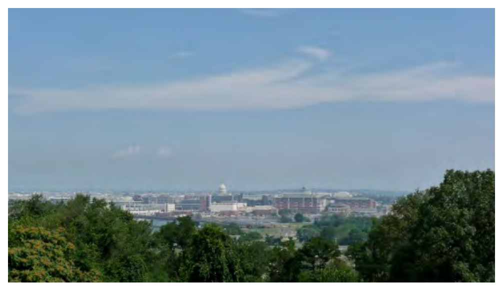
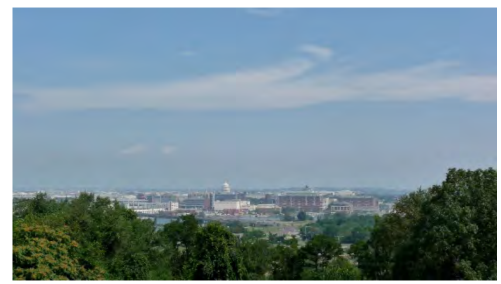
View	Existing Conditions/No-Action		Alternative D	Alternative E
21. View from Columbus Circle Drive – West Side:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Beneficial Impact** (removal of existing garage reestablishes the original view down First Street NE) Minor Construction Impacts	 Alt E & Existing Conditions: **Beneficial Impact** (removal of existing garage reestablishes the original view down First Street NE) Minor Construction Impacts
	 No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **Beneficial Impact** (removal of existing garage reestablishes the original view down First Street NE)	 Alt E & No-Action: **Beneficial Impact** (removal of existing garage reestablishes the original view down First Street NE)

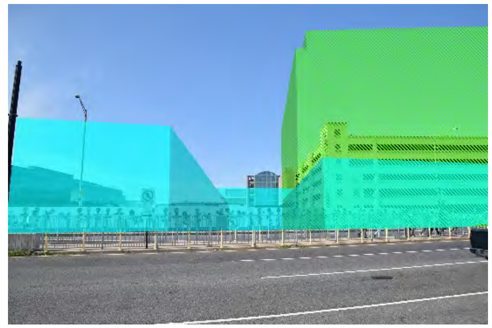
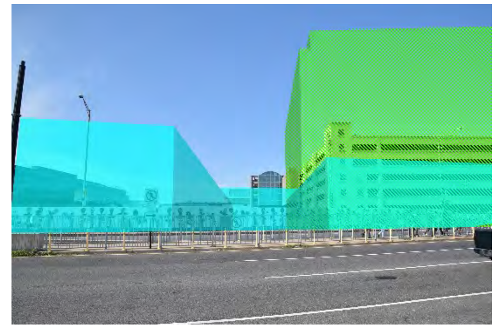
View	Existing Conditions/No-Action		Alternative D	Alternative E
22. View from Washington Monument:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions**:** **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts	 Alt E & Existing Conditions: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts
	 No-Action:	**Compared to the No-Action**	 Alt D & No-Action:	 Alt E & No-Action:

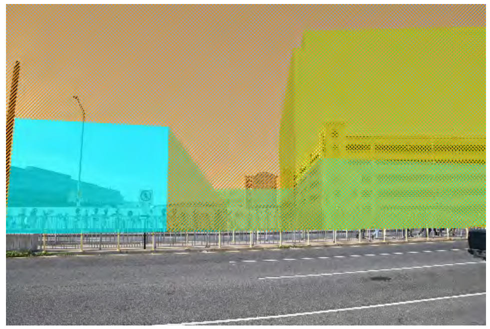
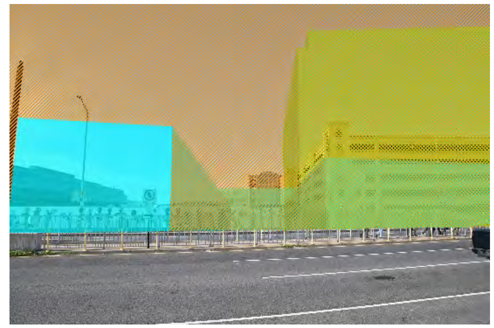
View	Existing Conditions/No-Action		Alternative D	Alternative E
	Negligible Adverse Impact (low visibility, low sensitivity) Negligible Construction Impacts		**No Impact** (no visual distinction between private air rights and the Project)	**No Impact** (no visual distinction between private air rights and the Project)
23. View from Arlington House at Arlington National Cemetery:	 Existing Conditions and No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) No Construction Impacts
24. View from U.S. Capitol Dome:	 Existing Conditions	**Compared to Existing Conditions**	 Alt D & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the	 Alt E & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the

View	Existing Conditions/No-Action		Alternative D	Alternative E
			potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts	potential Federal air rights (high visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt D & No-Action: **No Impact** (no visual distinction between private air rights and the Project)	 Alt E & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

View	Existing Conditions/No-Action		Alternative D	Alternative E
25. View from the Old Post Office Building:	 Existing Conditions	**Compared to Existing Conditons**	 Alt D & Existing Conditions (zoomed image as compared to Existing Conditions): **No Impact** (very low visibility and no sensitivity) No Construction Impacts	 Alt E & Existing Conditions (zoomed image as compared to Existing Conditions): **No Impact** (very low visibility and no sensitivity) No Construction Impacts
	 **Negligible Adverse Impact** (low visibility and no sensitivity) Negligible Construction Impacts	**Compared to No-Action**	 Alt D & No-Action: **No Impact** (very low visibility and no sensitivity) No Construction Impacts	 Alt E & No-Action: **No Impact** (very low visibility and no sensitivity) No Construction Impacts

View	Existing Conditions/No-Action		Alternative D	Alternative E
26. View from Washington National Cathedral:	 Existing Conditions and No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) No Construction Impacts
27. View from St. Elizabeths West Campus:	 Existing Conditions and No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt D & Existing Conditions; Alt D & No-Action: **No Impact** (no visible change) No Construction Impacts	 Alt E & Existing Conditions; Alt E & No-Action: **No Impact** (no visible change) No Construction Impacts

View	Existing Conditions/No-Action		Alternative D	Alternative E
28. View from H Street Bridge Looking south	 Existing Conditions	**Compared to Existing Conditions**	 **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Moderate Construction Impacts	 **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Moderate Construction Impacts

View	Existing Conditions/No-Action		Alternative D	Alternative E
	 Existing Conditions No-Action: **Major Adverse Impact** due to direct impacts of the private air rights (high visibility, high sensitivity) Moderate Construction Impacts	**Compared to the No-Action**	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)

11.5.7 Alternative A-C (Preferred Alternative)

11.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would result in adverse direct operational impacts on three views and a beneficial direct operational visual impact on one view, as shown in Table 11-17.

Table 11-17. Summary of Direct Operational Impacts, Alternative A-C

Impact	Number of Views Affected	Views Affected[1]
Moderate Adverse	1	Delaware Avenue NE (#2)
Minor Adverse	1	Louisiana Avenue NE (#3)
Negligible Adverse	1	First Street NE (#10)
Beneficial	1	View from Columbus Circle Drive, west side (#21)

1 # refers to the number assigned to the view in **Table 11-20**.

Louisiana Avenue, Delaware Avenue, and First Street NE are the radial streets providing direct views to WUS, visually connecting it with the U.S. Capitol and Capitol Grounds. This relationship played an important role in determining the site and design of WUS. The existing view is dominated by the uninterrupted silhouette of the barrel-vault roof and wide tree-lined streets currently used for U.S. government parking. The views are characterized by the prominence of the historic station building and Columbus Plaza, designed by D.H. Burnham and Company and completed in 1908 and 1912, respectively. Alternative A-C would have a moderate adverse impact on the view from Delaware Avenue NE (#2) because the parking facility would be distinctly visible above the station's west pavilion adjacent to the barrel vault roof of the central pavilion. It would be less visible from Louisiana Avenue NE and First Street NE, resulting in minor and negligible impacts, respectively.

The proposed parking facility and bus facility in Alternative A-C would occupy a similar footprint to the existing parking garage, but the portion projecting over the service roadway on the west side would be eliminated, re-establishing views along First Street NE. This would amount to a beneficial impact on the view from the west side of Columbus Circle Drive (View #21).

11.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would result in adverse indirect operational visual impacts on seven views, as shown in Table 11-18.

Table 11-18. Summary of Indirect Operational Impacts, Alternative A-C

Impact	Number of Views Affected	Views Affected[1]
Moderate Adverse	1	E Street NE (#4)
Minor Adverse	4	First Street NE (#1), G Street NW (#7), View from Columbus Plaza (#19), view from Columbus Circle Drive east side (#20)
Negligible Adverse	2	F Street NW (#5), Massachusetts Avenue NE (#18)

1 # refers to the number assigned to the view in **Table 11-20**.

Indirect impacts would be caused by the mass and height of the potential Federal air-rights development. Until the design of this potential development is more defined, its compatibility and degree of impact can only be assessed based on the maximum allowed buildable volume consistent with the USN zoning that would apply to the area. The maximum buildable volume for the potential Federal air-rights development is shown in the visual assessment images of **Table 11-20**.

The potential Federal air-rights development would be most noticeable from View #4, as it would rise above the roofline of the west pavilion, resulting in a moderate adverse impact. Views #1, #7, #19, and #20 would experience minor adverse impacts, and views #5 and #18 negligible adverse impacts because the development would be less visible and sensitive against the background of the existing station and the private air-rights development.

11.5.7.3 Construction Impacts

Construction of Alternative A-C would result in negligible adverse impacts on eight views and minor adverse impacts on nine views. One view would have a moderate construction-related visual impact.

Like that of the other Action Alternatives, construction of Alternative A-C would change the appearance of the rail terminal and its immediate surroundings for the duration of the construction period, approximately 12 years and 3 months.

Based on distance, perspective, and the anticipated location and height of heavy construction equipment and activities, construction of Alternative A-C would result in negligible adverse impacts on the following views: Views #2, 3, 8, 16, 18, 19, 20, and 22. Distance or intervening structures would hide most of the construction equipment or activities from those views.

Alternative A-C would result in minor adverse impacts on Views #4, 7, 10, 11, 12, 14, 15, 21, and 24. Construction equipment and activities would be more visible from those views for at least part of the construction period. Impacts would be minor for the same reasons as explained in **Section 11.5.2.3**, *Construction Impacts* for Alternative A. Construction would have a moderate impact on one view from the H Street Bridge (#28). This is due to the proximity of the construction relative to the bridge and passersby.

11.5.7.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would result in adverse direct and indirect operational impacts on 20 views and a beneficial impact on one view, as shown in **Table 11-19**. As with the other Action Alternatives, the impacts of Alternative A-C relative to existing conditions would be greater than relative to the No-Action Alternative because the changes caused by Alternative A-C would be more noticeable without the private air-rights development.

Table 11-19. Summary of Indirect Operational Impacts, Alternative A-C

Impact	Number of Views Affected	Views Affected[1]
Major Adverse	3	First Street NE (#1), Delaware Avenue NE (#2), New York Avenue Bridge (#11)
Moderate Adverse	5	Louisiana Avenue NE (#3), E Street NE (#4), First Street NE (#10), view from U.S. Capitol Dome (#24), view from H Street Bridge (#28)
Minor Adverse	6	G Street NW (#7), K Street NW (#9), K Street NE (#13), H Street NE (#15), view from Columbus Plaza (#19), view from Columbus Circle Drive east side (#20)
Negligible Adverse	6	F Street NW (#5), H Street NW (#8), Second Street NE (#12), G Street NE (#16), Massachusetts Avenue NE (#18), view from Washington Monument (#22)
Beneficial	1	View from Columbus Circle Drive west side (#21)

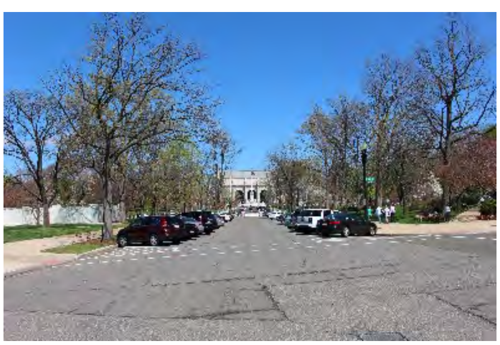
1 # refers to the number assigned to the view in **Table 11-20**.

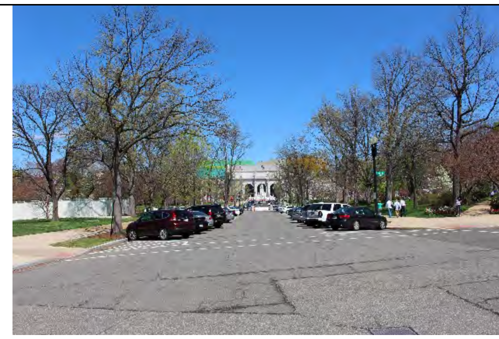
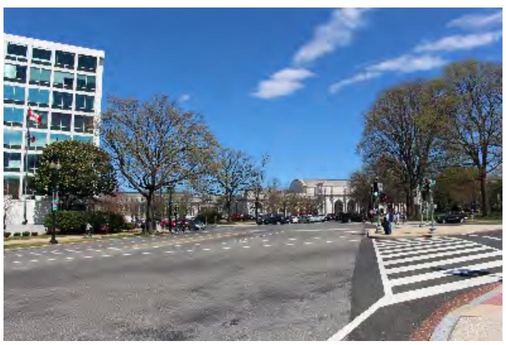
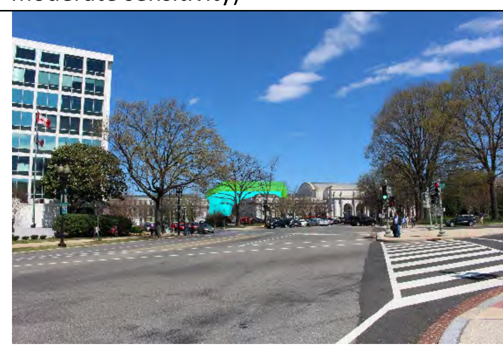
Table 11-20. Visual Impacts of Alternative A-C

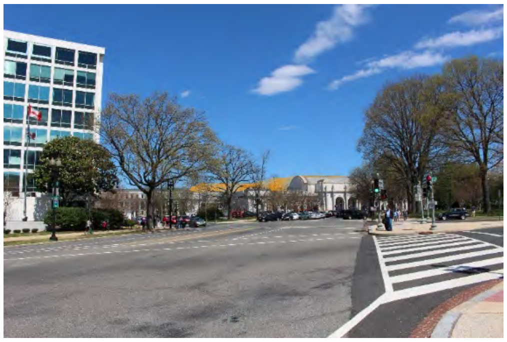
(beginning on the following page)

Table Legend:

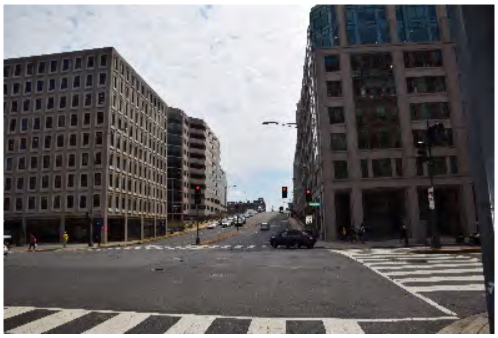
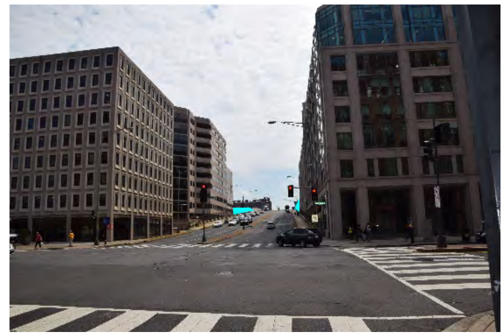
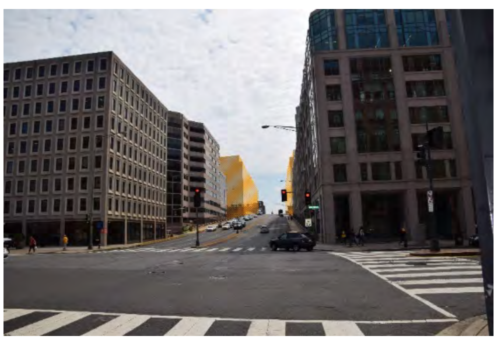
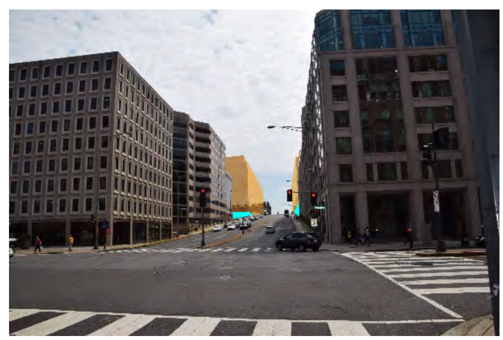
Private Air Rights (maximum buildable volume including penthouse)		Project	
Potential Federal Air Rights (maximum buildable volume including penthouse)		Outline of Existing Parking Garage	

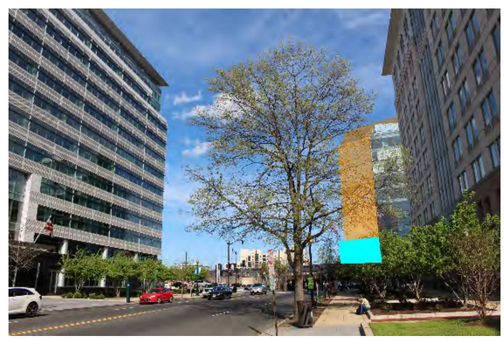
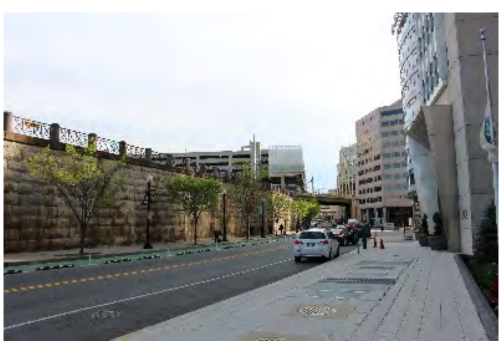
View	Existing Conditions/No-Action Alternative		Alternative A-C
1. First Street NE, view looking north:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions: **Major Adverse Impact** due to indirect impact of the potential Federal air rights (high visibility and high sensitivity) No Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A-C & No-Action: **Minor Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility and low sensitivity)
2. Delaware Avenue NE, view looking northeast:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (high visibility and high sensitivity). Negligible Construction Impacts

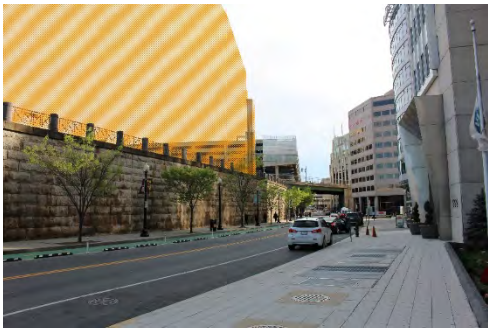
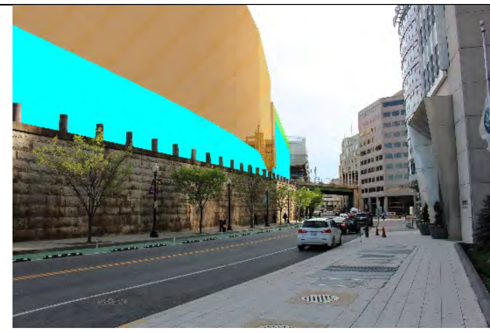
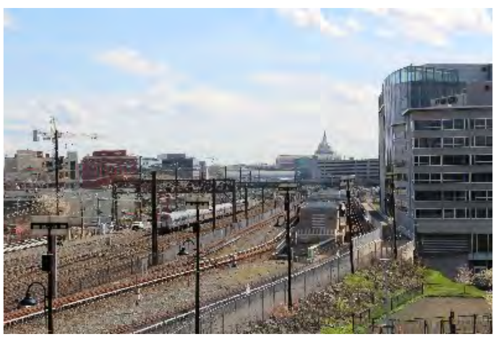
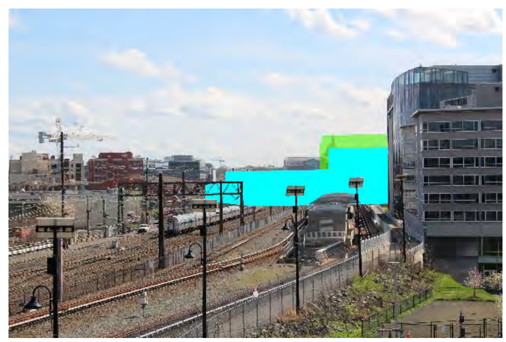
View	Existing Conditions/No-Action Alternative		Alternative A-C
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A-C & No-Action: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (moderate visibility and moderate sensitivity)
3. Louisiana Avenue NE, view looking northeast:	 Existing Condition	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impact of the Project and potential Federal air rights (moderate visibility and moderate sensitivity) Negligible Construction Impacts

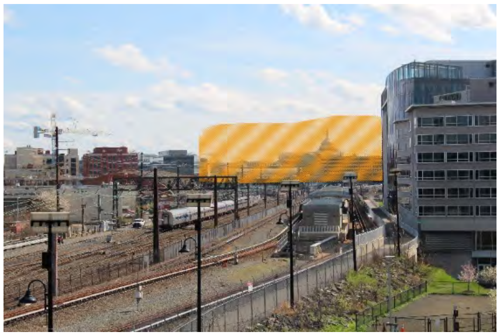
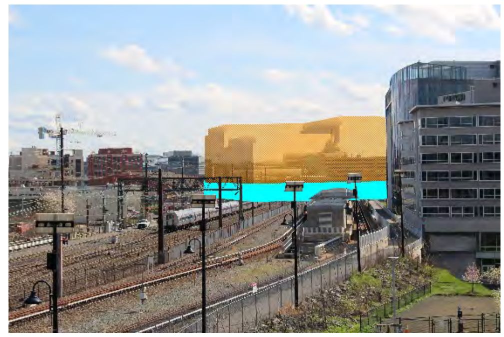
View	Existing Conditions/No-Action Alternative		Alternative A-C
	 No-Action: **Major Adverse Impact** (high visibility and high sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **Minor Adverse Impact** due to direct and indirect impact of the Project and potential Federal air rights (moderate visibility and low sensitivity)
4. E Street NE, looking northeast:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **Moderate Adverse Impact** due to indirect impact of the potential Federal air rights (moderate visibility, moderate sensitivity)

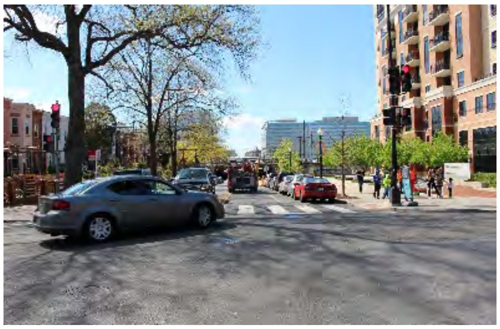
View	Existing Conditions/No-Action Alternative		Alternative A-C
5. F Street NW, view looking east:	 Existing Conditions & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to indirect impact of the potential Federal air rights (low visibility, low sensitivity) No Construction Impacts
6. Massachusetts Avenue NW, view looking east:	 Existing Condition & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A-C & No-Action: **No Impact** (no visible change) No Construction Impacts
7. G Street NW, view looking east:	 Existing Conditions & No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditons and No-Action**	 Alt A-C & Existing Conditions; Alt A-C & No-Action: **Minor Adverse Impact** due to direct and indirect impact of the Project and potential Federal air rights (moderate visibility and low sensitivity). Minor Construction Impacts

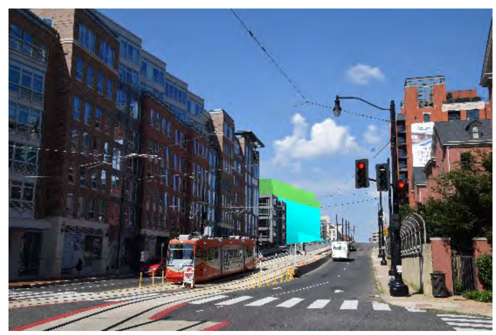
View	Existing Conditions/No-Action Alternative		Alternative A-C
8. H Street NW, view looking east:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to direct impact of the Project (low visibility, low sensitivity) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

<table>
<tr><th>View</th><th>Existing Conditions/No-Action</th><th></th><th>Alternative A-C</th></tr>
<tr><td rowspan="2">9. K Street NW, view looking east:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt A-C & Existing Conditions:
Minor Adverse Impact due to direct impact of the Project (moderate visibility, low sensitivity)
No Construction Impacts</td></tr>
<tr><td>
No-Action:
Minor Adverse Impact (moderate visibility, low sensitivity)
Minor Construction Impacts</td><td>Compared to the No-Action</td><td>
Alt A-C & No-Action:
No Impact (no visual distinction between private air rights and the Project)</td></tr>
<tr><td>10. First Street NE, view looking south:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt A-C & Existing Conditions:
Moderate Adverse Impact due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity)
Minor Construction Impacts</td></tr>
</table>

View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	**Compared to the No-Action**	 Alt A-C & No-Action: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (low visibility, low sensitivity)
11. New York Avenue Bridge NE, view looking south:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions: **Major Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, high sensitivity) Minor Construction Impacts

View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
12. Second Street NE, view looking south:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to the indirect impact of the potential Federal air rights (low visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Major Adverse Impact** (high visibility, high sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visible change)

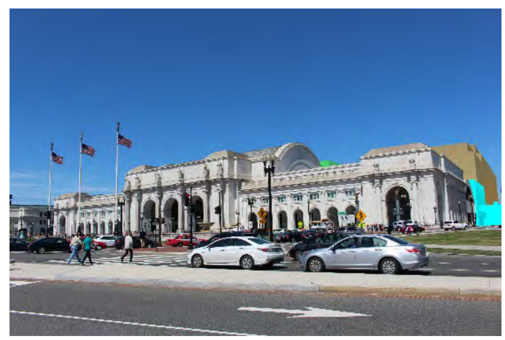
View	Existing Conditions/No-Action		Alternative A-C
13. K Street NE, view looking west:	 Existing Condition	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Minor Adverse Impact** due to direct impact of the Project (moderate visibility, low sensitivity) No Construction Impacts
	 No-Action: **Moderate Adverse Impact**, (high visibility, moderate sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
14. I (Eye) Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **No Impact** (no visible change) Minor Construction Impacts

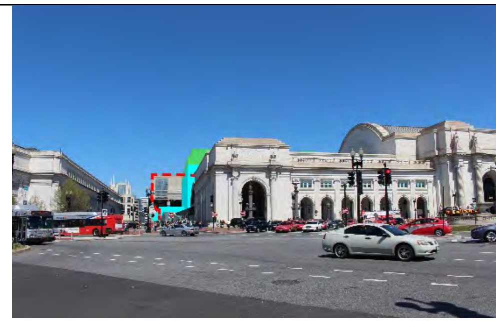
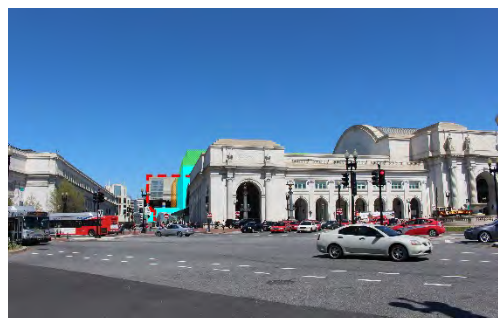
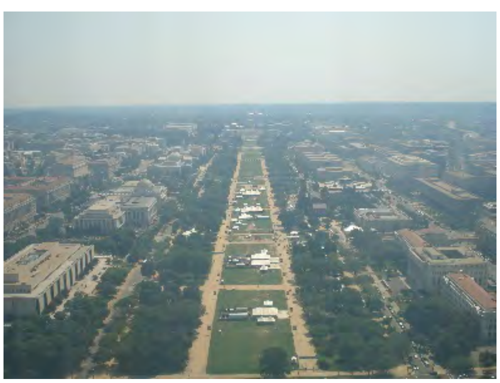
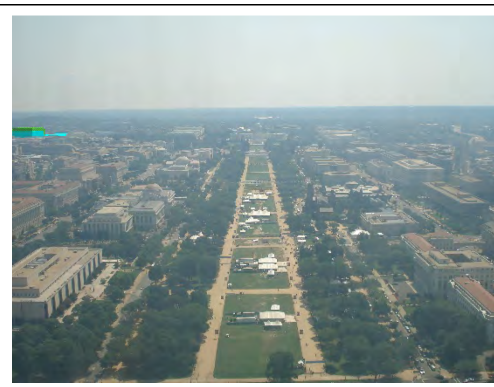
View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Moderate Adverse Impact** (high visibility, moderate sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visible change)
15. H Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Minor Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, low sensitivity) Minor Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)

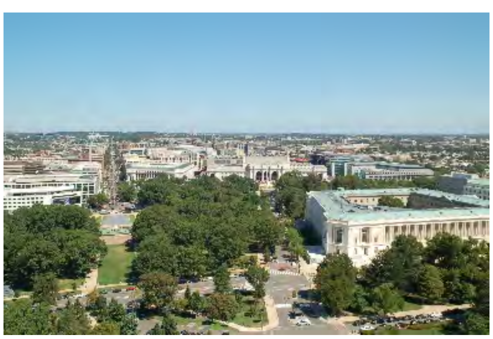
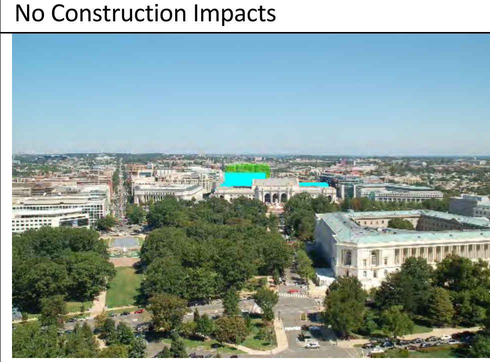
View	Existing Conditions/No-Action		Alternative A-C
16. G Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to the indirect impact of the potential Federal air rights (low visibility and low sensitivity) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (moderate visibility, low sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visible change)
17. F Street NE, view looking west:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **No Impact** (no visible change) No Construction Impacts

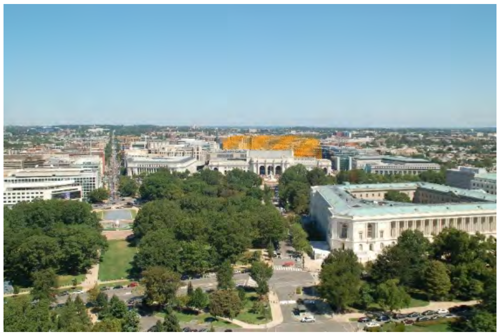
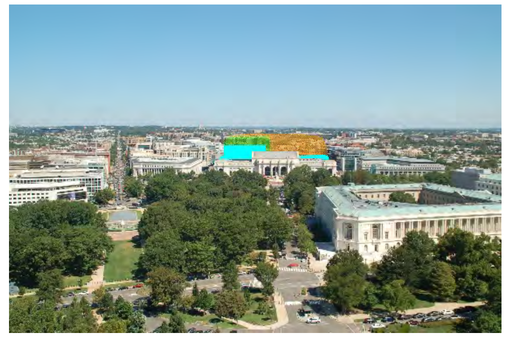
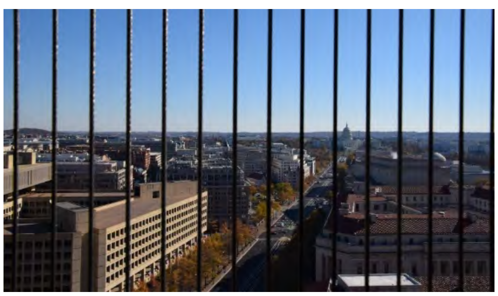
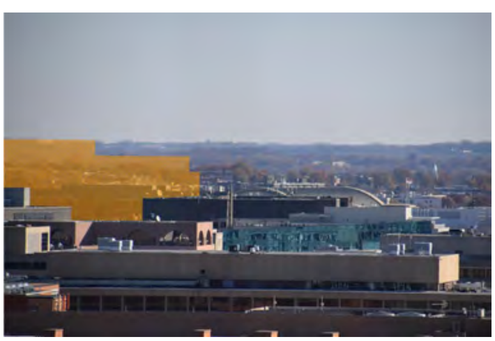
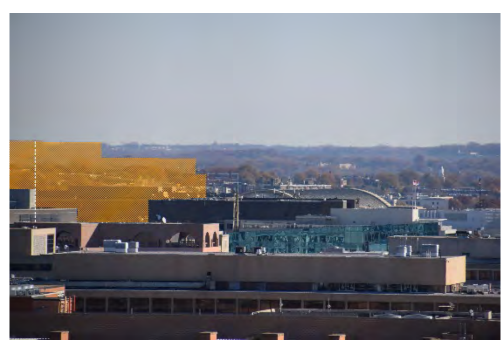
View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) No Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visible change)
18. Massachusetts Avenue NE, view looking northwest:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **Negligible Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, low sensitivity)

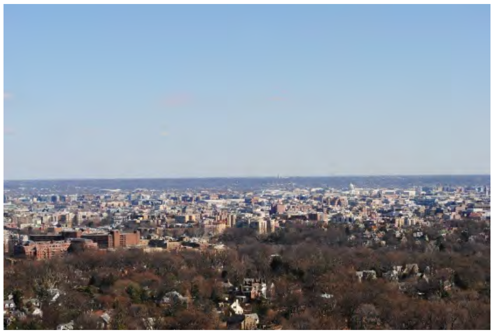
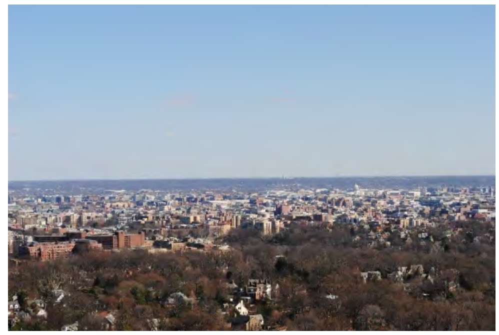
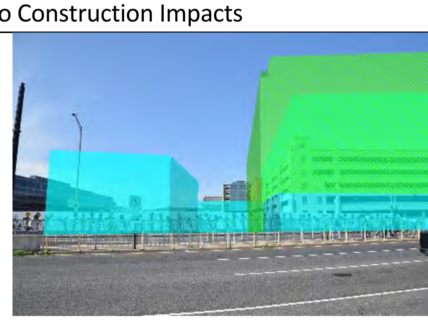
View	Existing Conditions/No-Action		Alternative A-C
19. View from Columbus Plaza:	 Existing Conditions	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity) Negligible Construction Impacts
	 No-Action: **Minor Adverse Impact** (low visibility, moderate sensitivity) Negligible Construction Impacts	**Compared to the No-Action**	 Alt A-C & No-Action: **Minor Adverse Impact** due to the indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity)

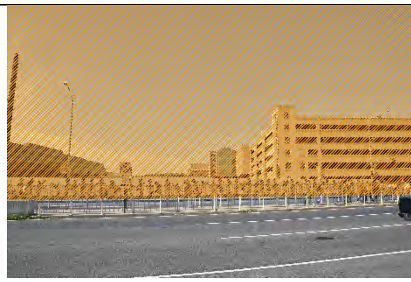
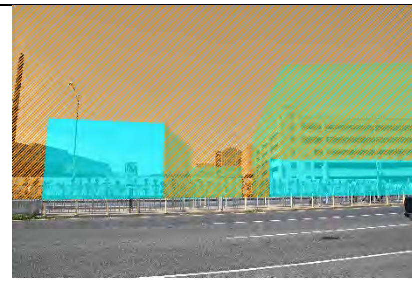
<table>
<tr><th>View</th><th>Existing Conditions/No-Action</th><th></th><th>Alternative A-C</th></tr>
<tr><td rowspan="2">20. View from Columbus Circle Drive – East Side:</td><td>
Existing Conditions</td><td>Compared to Existing Conditions</td><td>
Alt A-C & Existing Conditions:
Minor Adverse Impact due to direct and indirect impacts of the Project and potential Federal air rights (low visibility, moderate sensitivity)
Negligible Construction Impacts</td></tr>
<tr><td>
No-Action:
Moderate Adverse Impact, (moderate visibility, moderate sensitivity)
Negligible Construction Impacts</td><td>Compared to the No-Action</td><td>
Alt A-C & No-Action:
Minor Adverse Impact due to indirect impacts of the potential Federal air rights (low visibility, moderate sensitivity)</td></tr>
</table>

View	Existing Conditions/No-Action		Alternative A-C
21. View from Columbus Circle Drive – West Side:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Beneficial Impact** (alternative will reinstate the L'Enfant Plan street view down First Street NE by removing the overhanging parking garage) Minor Construction Impacts
	 No-Action: **No Impact** (no visible change) No Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **Beneficial Impact (**as above)
22. View from Washing-ton Monument:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Negligible Adverse Impact** due to direct and indirect impacts of the Project and potential Federal air rights (low visibility, low sensitivity) Negligible Construction Impacts

View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Negligible Adverse Impact** (low visibility, low sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
23. View from Arlington House at Arlington National Cemetery:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	Compared to Existing Conditions	 Alt A-C & Existing Conditions; Alt A-C & No-Action: **No Impact** (no visible change) No Construction Impacts
24. View from U.S. Capitol Dome:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (moderate visibility, moderate sensitivity) Minor Construction Impacts

View	Existing Conditions/No-Action		Alternative A-C
	 No-Action: **Moderate Adverse Impact** (moderate visibility, moderate sensitivity) Minor Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visual distinction between private air rights and the Project)
25.View from the Old Post Office Building:	 Existing Conditions	Compared to Existing Conditions	 Alt A-C & Existing Conditions: **No Impact** (no visible change) No Construction Impacts
	 No-Action: **Negligible Adverse Impact** (low visibility and no sensitivity) Negligible Construction Impacts	Compared to the No-Action	 Alt A-C & No-Action: **No Impact** (no visible change)

View	Existing Conditions/No-Action		Alternative A-C
26. View from Washing-ton National Cathedral:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions; Alt A-C & No-Action: **No Impact** (no visible change) No Construction Impacts
27. View from St. Elizabeths West Campus:	 Existing Conditions No-Action: **No Impact** (no visible change) No Construction Impacts	**Compared to Existing Conditions**	 Alt A-C & Existing Conditions; Alt A-C & No-Action: **No Impact** (no visible change) No Construction Impacts
28. View from H Street Bridge Looking south	 Existing Conditions	**Compared to Existing Conditions**	 **Moderate Adverse Impact** due to direct and indirect impacts of the Project and the potential Federal air rights (high visibility, moderate sensitivity) Moderate Construction Impacts

View	Existing Conditions/No-Action		Alternative A-C
	 Existing Conditions No-Action: **Major Adverse Impact** due to direct impacts of the private air rights (high visibility, high sensitivity) Moderate Construction Impacts	Compared to the No-Action	 **No Impact** due to direct and indirect impacts of the Project and Federal air rights (no visual distinction between the private air rights and the Project and potential Federal air rights)

11.6 Comparison of Alternatives

A summary of the impacts of the Action Alternatives relative to the No-Action Alternative is provided in **Table 11-21**.

Among all alternatives, the No-Action Alternative would have the greatest visual impacts because of the size and height of the private air-rights development. Only the No-Action Alternative would result in major adverse impacts on six views. The Project and the potential Federal air-rights development would be visually compatible, obscured, encompassed, or balanced by the massing of the private air-rights development. Therefore, the visual impacts of the Action Alternatives would be smaller than those of the No-Action Alternative, both in terms of the number of affected views and in intensity.

Alternatives C (both options), D, and E would adversely affect the fewest views (5 out of 28) while Alternatives A, B, and A-C would affect the most (10 out of 28). None of the Action Alternatives would result in major adverse impacts. With regard to other impacts, the Action Alternatives fall into two groups: Alternatives A, B, and A-C on the one hand, and Alternatives C through E on the other. Overall, Alternatives A, B, and A-C would have greater visual impacts than Alternatives C through E.

While all Action Alternatives would have a moderate adverse impact on views from E Street NE looking northeast (#2) and from Delaware Avenue NE looking northeast (#4), only Alternatives A and B would have a moderate adverse impact to the view from Louisiana Avenue (#3). This is because the potential Federal air-rights development would have high visibility and moderate sensitivity regardless of the presence of the private air-rights development. Alternatives A, B, and A-C would be the only Action Alternatives with minor impacts on the view from Columbus Plaza (#19). All other Action Alternatives would have no impact because the Project and potential Federal air-rights development would not be visible from the plaza. Alternative A-C is the only alternative with a minor impact to the view from the east side of Columbus Circle Drive (#20), as a portion of the Federal air rights would be visible extending from the barrel vault roof of the station. Finally, Alternatives A, B, and A-C would have a beneficial impact on only one view, instead of two for the other Action Alternatives.

All Action Alternatives would result in a beneficial impact to the view from the west side of Columbus Circle Drive due to the removal of the existing, visually incompatible parking garage. This would reestablish the open view down First Street NE originally created by the L'Enfant Plan. Only Alternatives C through E would also have a beneficial impact on the view from G Street NW to the east, because of the reduction in building massing and opening of the view resulting from the removal of the existing parking garage and the construction of the east-west train hall.

Table 11-21. Summary of Impacts by Alternative Relative to the No-Action Alternative

	Alternative and Impact[1]							
View	**No-Action**	**A**	**B**	**C-East**	**C-West**	**D**	**E**	**A-C**
1. First Street NE, view looking north	Major Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
2. Delaware Avenue NE, view looking northeast	Major Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
3. Louisiana Avenue NE, view looking northeast	Major Adverse	Moderate Adverse	Moderate Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
4. E Street NE, looking northeast	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
5. F Street NW, view looking east		Negligible Adverse	Negligible Adverse					Negligible Adverse
6. Massachusetts Avenue NW, view looking east								
7. G Street NW, view looking east		Minor Adverse	Minor Adverse	Beneficial	Beneficial	Beneficial	Beneficial	Minor Adverse
8. H Street NW, view looking east	Minor Adverse							
9. K Street NW, view looking east	Minor Adverse							
10. First Street NE, view looking south	Moderate Adverse	Negligible Adverse	Negligible Adverse	Negligible Adverse	Negligible Adverse	Negligible Adverse	Negligible Adverse	Negligible Adverse
11. New York Avenue Bridge NE, view looking south	Major Adverse							

	Alternative and Impact[1]							
View	**No-Action**	**A**	**B**	**C-East**	**C-West**	**D**	**E**	**A-C**
12. 2nd Street NE, view looking south	Major Adverse							
13. K Street NE, view looking west	Moderate Adverse							
14. I Street NE, view looking west	Moderate Adverse							
15. H Street NE, view looking west	Minor Adverse	Negligible Adverse	Negligible Adverse					
16. G Street NE, view looking west	Minor Adverse Impact							
17. F Street NE, view looking west	Negligible Adverse							
18. Massachusetts Avenue NE, view looking northwest	Negligible Adverse	Negligible Adverse	Negligible Adverse					Negligible Adverse
19. View from Columbus Plaza	Minor Adverse	Minor Adverse	Minor Adverse					Minor Adverse
20. View from Columbus Circle Drive – East Side	Moderate Adverse							Minor Adverse
21. View from Columbus Circle Drive – West Side		Beneficial	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
22. View from Washington Monument	Negligible Adverse							
23. View from Arlington House at								

	Alternative and Impact[1]							
View	**No-Action**	**A**	**B**	**C-East**	**C-West**	**D**	**E**	**A-C**
Arlington National Cemetery								
24. View from U.S. Capitol Dome	Moderate Adverse							
25.View from the Old Post Office Building	Negligible Adverse							
26. View from Washington National Cathedral								
27. View from St. Elizabeths West Campus								
28. View from H Street Bridge	Major Adverse							
Summary[2]								
Total Views with No Impact	7	17	17	21	21	21	21	17
Total Views with Negligible Adverse Impact	4 (2)(0)	4 (2)(2)	4 (1)(3)	1 (0)(1)	1 (0)(1)	1 (0)(1)	1 (0)(1)	3 (1)(2)
Total Views with Minor Adverse Impact	5 (5)(0)	3 (0)(3)	3 (0)(3)	2 (0)(2)	2 (0)(2)	2 (0)(2)	2 (0)(2)	5 (1)(4)
Total Views with Moderate Adverse Impact	6 (6)(0)	3 (1)(2)	3 (0)(3)	2 (0)(2)	2 (0)(2)	2 (0)(2)	2 (0)(2)	2 (1)(1)
Total Views with Major Adverse Impact	6 (6)(0)	0	0	0	0	0	0	0

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	Alternative and Impact[1]							
View	**No-Action**	**A**	**B**	**C-East**	**C-West**	**D**	**E**	**A-C**
Total Views with Beneficial Impacts	0	1 (1)(0)	1 (1)(0)	2 (2)(0)	2 (2)(0)	2 (2)(0)	2 (2)(0)	1 (1)(0)

Notes: 1. Blank cells indicate no impact; grayed-out cells indicate indirect impact; other cells indicate direct impact.
2. Total (direct impact) (indirect impact)

11.7 Avoidance, Minimization and Mitigation Evaluation

In this section, visual impacts were assessed by reviewing the compatibility and sensitivity of the visual changes. Due to the still undefined exact massing, form, and materials in the No-Action Alternative and Action Alternatives' design, findings of adverse impacts are conservative. They do not take into account that actual design, particularly as it relates to massing, form, and materials, may affect compatibility and sensitivity and avoid or mitigate the impact. To avoid, minimize, or mitigate adverse impacts, FRA is proposing that, as much as possible, the Project Proponents design the Project with context-compatible architecture and materials, and in a manner that is sensitive to surrounding structures.

Adverse impacts to certain views would also be avoided, minimized, or mitigated if the private air-rights development and the potential Federal air-rights development are designed and constructed to be lower than their maximum buildable volume. This is especially true for the views from Delaware Avenue NE, First Street NE, Louisiana Avenue NE, and E Street NE, where the maximum buildable volume would result in structures rising above the barrel vault and side pavilions of the historic station building. Impacts to views from the south of WUS could be minimized if the private air-rights and potential Federal air-rights developments are constructed to be the same height and of similar form and materials, creating a symmetrical pattern. The overall color of the buildings should also be a consideration, as this would also affect visual compatibility. However, decisions regarding the design of the future private air-rights development would be made by the property owner.

11.8 Permits and Regulatory Compliance

The Project would be reviewed by NCPC and CFA for final approval. Typically, NCPC reviews at pre-design/programming, during schematic design (preliminary review), and at design development (final review). CFA reviews at the concept design phase and the final design phase.

In addition, any reviews stipulated as part of a Programmatic Agreement resulting from the Section 106 process or as part of the Record of Decision would have to be met. The approval of the design is critical because design would contribute greatly to the compatibility and sensitivity of the aesthetic and visual quality of the Project. For all views where the Action Alternatives were found to cause an adverse impact, the Project design may contribute to avoiding this impact.

The various components of the No-Action Alternative would also be reviewed and would need final approval from NCPC, CFA, and the District's Historic Preservation Review Board. All three bodies would have to approve the final design and site plan information. Approval of each project's design is critical because design would contribute greatly to the compatibility and sensitivity of the aesthetic and visual quality of the Project. For all views where the No-Action Alternative was found to cause an adverse impact, the design may contribute to a reduction in the intensity of the impact or in no impact.

All further regulatory compliance would follow Federal and District regulations and guidelines concerning aesthetics or changes to the visual resource including:

- *Urban Design Element: The Comprehensive Plan for the National Capital* (from NCPC)
- Executive Order 1259 – CFA Review of Public Buildings in the District of Columbia Proposed by the Federal or DC governments;
- Shipstead-Luce Act of 1930 (Public Law 71-231, Public Law 76-248);
- Executive Order 1862 – CFA Review of New Structures and Matters of Art Proposed by the Federal Government in DC;
- Executive Order 11593 – Protection and Enhancement of the Cultural Environment;
- The Historic Landmark and Historic District Protection Act of 1978 (D. Law 2-144, as amended through October 1, 2016); and
- The Height of Buildings Act of 1910.

12 Cultural Resources

12.1 Overview

This section describes the impacts of the No-Action Alternative and the Action Alternatives on cultural resources. "Cultural resources" for the purposes of this section include the historic properties evaluated as part of the Section 106 of the National Historic Preservation Act of 1966 (Section 106) process for the Washington Union Station (WUS) Expansion Project (Project). They include districts, buildings, sites, structures, and objects included in or eligible for inclusion in the National Register of Historic Places (NRHP) and the District of Columbia Inventory of Historic Sites (DC Inventory); properties that fall within the purview of the Architect of the Capitol (AOC) and are listed as AOC Heritage Assets; and properties that are under the jurisdiction of the National Park Service's National Mall and Memorial Parks.

In March 2019, FRA completed a Draft Assessment of Effects (AOE) in compliance with Section 106 to evaluate how the Project would affect historic properties and provided it for review and comment to the District State Historic Preservation Officer (DC SHPO) and the Section 106 Consulting Parties. On April 30, 2019, FRA hosted a Consulting Parties Meeting to present the Draft AOE and receive comments. [1]

The March 2019 AOE did not address Alternative A-C, which FRA and the Project Proponents developed and identified as the Preferred Alternative in summer and fall 2019. FRA presented the Preferred Alternative to the Consulting Parties at a meeting on November 19, 2019. Following this meeting, FRA prepared a revised Draft AOE incorporating Alternative A-C and addressing the comments received on the March 2019 Draft AOE. The revised Draft AOE has been submitted for review to the DC SHPO and Consulting Parties at the same time as the Draft Environmental Impact Statement (DEIS). It is included in the DEIS as **Appendix D1**.

The cultural resource impact assessment presented in this section builds on the findings of the revised Draft AOE. It also incorporates information from the September 2017 *Identification of Historic Properties for the Washington Union Station Expansion Project Report*, which can be found in DEIS **Appendix D1a**. As explained below (**Section 12.4**, *Methodology*), an adverse impact under NEPA does not necessarily mean that there would be an adverse effect under Section 106.

[1] See **Section 8.4**, *National Historic Preservation Act Section 106 Consultation*, of the DEIS for a summary of the Section 106 consultation process to this date. Consulting Parties are certain individuals and organizations with a demonstrated interest in the undertaking, who may participate in the Section 106 process due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effect on historic properties.

As applicable, this section recommends measures to avoid, minimize, or mitigate adverse impacts and it describes permitting and regulatory compliance requirements.

12.2 Regulatory Context

Federal policies, regulations, and guidance that are relevant to this section include:

- Section 106 (16 United States Code [USC] 470);
- *Protection of Historic Properties* (36 Code of Federal Regulations [CFR] 800);
- The Secretary of the Interior's *Standards for the Treatment of Historic Properties* (SOI Standards) (36 CFR 68);
- *Assumption of Responsibility for Preservation of Historic Property*, (54 USC 306101);
- NRHP (36 CFR 60); and
- AOC Heritage Assets.[2]

District of Columbia (District) policies, regulations, and guidance relevant to this section include:

- The Historic Landmark and Historic District Protection Act of 1978 (DC Law 2-144, as amended);
- DC Municipal Regulations (DCMR), *Preservation Regulations*, Title 10-C; and
- DC Inventory.[3]

12.3 Study Area

The Local Study Area consists of the APE, defined in consultation with the DC SHPO and Section 106 Consulting Parties as part of the Section 106 review process (**Figure 12-1**). The APE is the geographic area in which an undertaking may directly or indirectly affect historic properties.[4] A description of the process for developing the APE is available in DEIS **Appendix D1a**, *WUS Expansion Project, Area of Potential Effects Report*.[5] The inventory of historic properties in the APE is documented in **Appendix D1**, *WUS Expansion Project, Draft Assessment of Effects Report*.

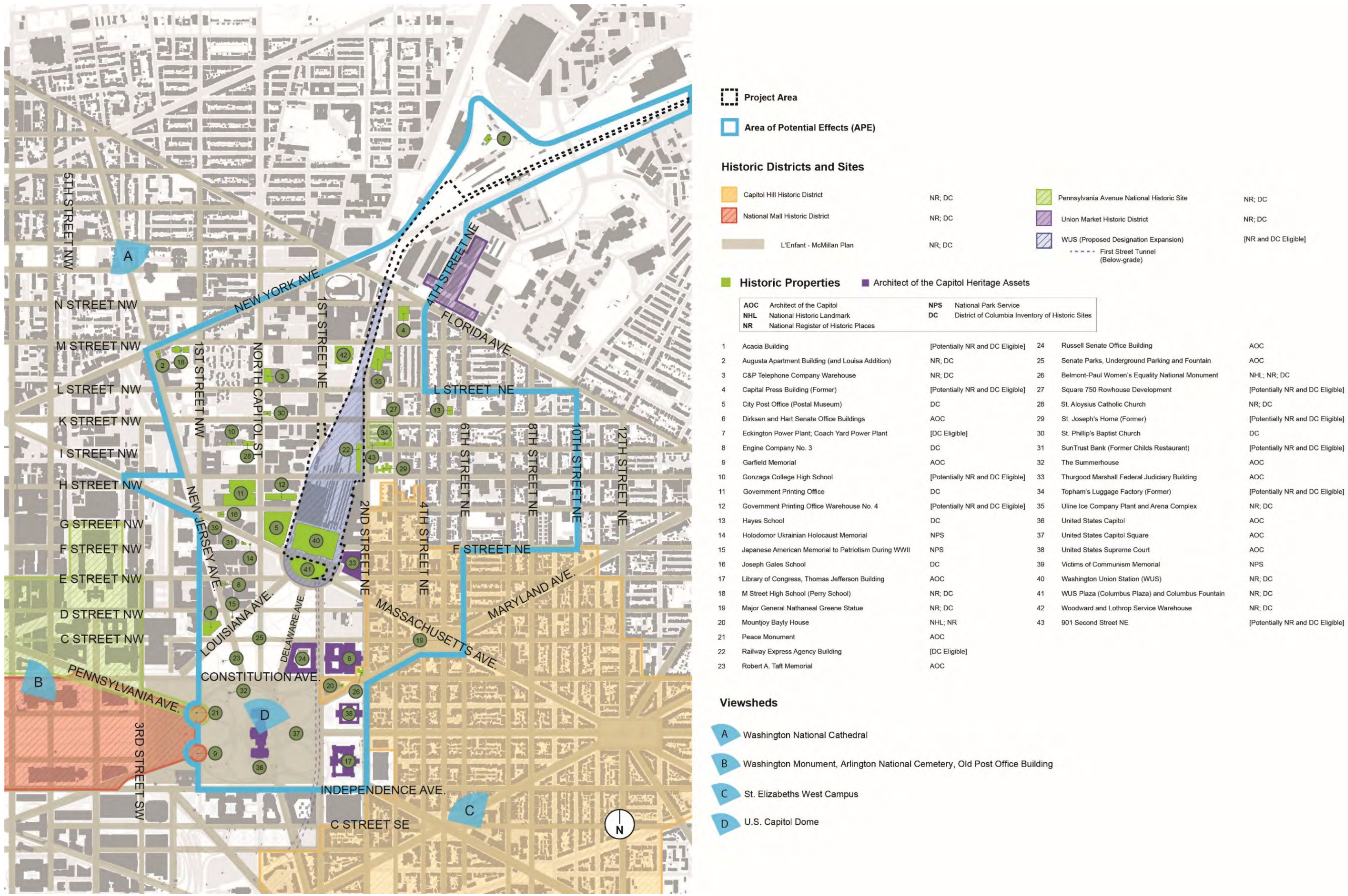
2 AOC, Order 37-1, *Preservation Policy and Standards*, February 6, 2012.

3 DC Inventory of Historic Sites. Accessed from https://planning.dc.gov/node/924472. Accessed on December 3, 2018.

4 36 CFR 800.16. *Protection of Historic Properties*. 2004. Accessed from https://www.achp.gov/sites/default/files/regulations/2017-02/regs-rev04.pdf. Accessed on April 27, 2018.

5 The DC SHPO concurred with the APE by letter dated September 29, 2017.

Figure 12-1. Local Study Area (APE) and Cultural Resources



The Local Study Area contains 55 cultural resources, including six culturally significant viewsheds (Washington National Cathedral, Washington National Monument, Old Post Office Building, Arlington National Cemetery, U.S. Capitol Dome, and St. Elizabeths West Campus). The viewsheds represent topographic high points or are referenced in the *Federal Urban Design Element of the Comprehensive Plan for the District of Columbia*.[6]

There is no Regional Study Area because neither the No-Action Alternative nor the Action Alternatives have the potential to affect cultural resources beyond the Local Study Area.

12.4 Methodology

Section 12 of **Appendix C1**, *WUS Expansion Project Methodology Report* describes the general approach used to assess the impacts of the No-Action and Action Alternatives on cultural resources. A more detailed description is below.

The cultural resource impact assessment is based on the Section 106 assessment of effects conducted in accordance with 36 CFR 800.5.[7] A major adverse impact on a cultural resource would occur if the Project would cause an adverse effect to the resource under Section 106. An adverse effect is an effect that would alter, directly or indirectly, the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association in a manner that would result in a finding of adverse effect under Section 106.[8] Examples of adverse effects/major adverse impacts include:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the *Secretary's Standards for the Treatment of Historic Properties* and applicable guidelines;
- Removal of the property from its historic location;
- Change of character of the property's use or of physical features within the property's setting that contributes to its historic significance;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;

6 National Capital Planning Commission. 2016. *The Comprehensive Plan for the National Capital: Federal Elements*. Accessed from https://www.ncpc.gov/plans/compplan/. Accessed on July 12, 2018.

7 See Appendix D1. In the No-Action Alternative, the Project would not occur and, therefore, there would be no Federal undertaking for the purposes of Section 106. For the purpose of the NEPA assessment, the impacts of the No-Action Alternative were assessed based on available data and, when possible, using a similar approach to the approach used for the Action Alternatives, but there are no corresponding Section 106 findings for this alternative.

8 36 CFR 800.5.

- Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

If the Project would change or alter a resource's location, design, setting, materials, workmanship, feeling, or association but not sufficiently to result in an adverse effect under Section 106, a negligible, minor, or moderate adverse impact may occur under NEPA. It is important to note that a negligible, minor, or adverse impact under NEPA does not mean that there would be an adverse effect under Section 106. When adverse impacts may occur but insufficient data are available to determine whether they would in fact occur and what their intensity would be, they are identified only as "potential adverse impacts."

12.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. To assess such impacts, the alternatives were reviewed to determine whether physical, visual, and traffic, noise, and vibration effects on a resource would diminish its integrity and alter the characteristics that qualify it for inclusion in the National Register.

Physical impacts were assessed based on whether the alternative would cause the destruction, alteration, or removal of part or whole of a resource and the potential of the impacts to diminish the resource's integrity.

Visual impacts may affect a resource's integrity of setting, feeling and association by changing the way it relates to its environment and the experience of users, visitors, or passers-by. Visual impacts include the direct impacts of the Project as well as the indirect impacts of the potential Federal air-rights development within the footprint of the existing parking garage.

Visual simulations prepared as part of the Section 106 assessment are the basis for assessing visual impacts on cultural resources.[9] These simulations supported the identification of changes in views from or to cultural resources. The assessment of visual impacts on cultural resources was based on the visibility of these changes and the sensitivity of the affected view to such changes. Visibility and sensitivity informed the impact finding as shown in **Table 12-1**. Visibility was rated low, moderate, or high based on the visualizations. Sensitivity was rated low, moderate, or high depending on the compatibility of the visual change with the existing

[9] The simulations can be found in **Appendix D1**.

surrounding environment and the likelihood it would diminish the resource's integrity of setting, feeling, and association.

Table 12-1. Intensity of Visual Impacts[10]

Visibility	Sensitivity	Intensity of Impact
None	None	None
Low	Low	Negligible
Low	High	Minor
Low	Moderate	Minor
High	Low	Minor
Moderate	Low	Minor
High	Moderate	Moderate
Moderate	Moderate	Moderate
Moderate	High	Moderate
High	High	Major

Impacts from noise and vibration were assessed based on the analyses presented in **Section 10**, *Noise and Vibration* of this report. Impacts from noise and vibration on a cultural resource's integrity of setting, feeling, and association were assessed using the following scale combined with the sensitivity of the resource to the anticipated changes:

- No Impact: No measurable change in noise or vibration levels.
- Negligible Impact: Change in noise level of less than 3 decibels (dBA)[11] and resulting in no impact per Federal Transit Administration (FTA) criteria; vibration levels below FTA criteria.[12]
- Minor Impact: Change in noise level less than 3 dBA and resulting in a moderate impact per FTA criteria; vibration levels below FTA criteria.
- Moderate Impacts: Change in noise levels less than 3 dBA resulting in a severe impact per FTA criteria; vibration levels below FTA criteria.
- Major Impacts: Change in noise levels more than 3 dBA resulting in a severe impact per FTA criteria or vibration levels above FTA criteria.

Vehicular traffic would be the main source of noise impacts in all alternatives. Other impacts from traffic were assessed based on the findings of the traffic impact analysis presented in

10 For the Action Alternatives*, No Impact* corresponds to *No Effect* under Section 106; *Negligible*, *Minor*, and *Moderate Impact* correspond to *No Adverse Effect*; *Major Impacts* corresponds to *Adverse Effect*.

11 A change of less than 3 dBA is generally considered barely perceptible (Federal Highway Administration, *Traffic Noise: Analysis and Abatement Guidance* [June 2010] in District Department of Transportation, *Noise Policy* [January 10, 2011], p. 9, Table 4).

12 See Section 10.4.1, *Noise and Vibration, Methodology, Operational Impacts*, for a definition of the FTA criteria.

Section 5, *Transportation*, of this report and a qualitative estimate of the potential for changes in traffic volumes to diminish a resource's integrity of setting, feeling, or association.

12.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts may result from multiple activities associated with the construction of the Project, including storage and staging of construction equipment; excavation work; and movement of trucks transporting spoils and materials to and from the Project Area. Steps to evaluate construction impacts included:

- Understanding constructability phases and processes and identifying what physical construction effects may occur;
- Assessing visual impacts related to construction activity and how changes in visual character or quality could affect cultural resources; and
- Reviewing construction noise and vibration analyses to evaluate the potential for impacts on cultural resources of mobile and stationary construction activities.

The approach used to assess construction impacts was similar to that used for operational impacts. Assessment of noise and vibration impacts used the FTA thresholds applicable to construction noise and vibration.

12.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on cultural resources. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational, and construction impacts are considered. To remain consistent with the effect analysis conducted in compliance with Section 106, operational impacts are assessed relative to existing conditions. For the Action Alternatives, each section also provides an assessment relative to the No-Action Alternative.

Effect analysis indicated that of the cultural resources included in the Study Area, 26 (including the Arlington National Cemetery, St. Elizabeths West Campus, and Washington National Cathedral viewsheds) would experience no noticeable changes in any of the alternatives. This is because these resources are too far from the Project Area to be physically affected; experience changes in noise or vibration levels; or afford distinct views of the Project. Therefore, there would be no impacts on those resources in any alternatives. The unaffected resources are identified in **Section 12.6**, *Comparison of Alternatives*, **Table 12-3** below (grayed out rows). This section does not address them further. Additionally, two viewsheds (from the Old Post Office Building and the Washington Monument) would experience negligible visual impacts. Such impacts would not affect the character of the views and are not addressed further in this section.

12.5.1 No-Action Alternative

12.5.1.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, in the No-Action Alternative, projects that would be completed in the Project Area would potentially result in adverse direct operational physical impacts on WUS and the WUS Historic Site.[13]

Several station improvement projects included in the No-Action Alternative could result in direct adverse operational impacts on WUS and the WUS Historic Site if not completed in accordance with the SOI Standards. These projects include, but are not limited to:

- Sub-basement track-bed replacement;
- Reconfiguration of the Retail Concourse's mezzanine; and
- Reconfiguration of the Presidential Reception Room.

The relocation of Substation 25A would alter the physical and historic integrity of the WUS Historic Site, to which it is a contributing element. The private air-rights development would cover the currently open rail terminal between the historic station building and K Street with a structural deck supported by deep-foundation columns. This would involve modifications to the physical layout of the rail terminal that may affect the physical and historic integrity of the WUS Historic Site.

These potential direct adverse impacts would be avoided, minimized, or mitigated through compliance with Section 106, which require all projects funded, permitted, or authorized by the Federal government to undergo review in consultation with the DC SHPO and other parties, as appropriate. While Section 106 does not generally apply to private developers, in the case of the private air-rights development, historic preservation covenants attached to the property require review and approval by the DC SHPO and the Commission of Fine Arts (CFA).

Additionally, it can be anticipated that WUS projects would be designed and implemented in accordance with the 2015 *Washington Union Station Historic Preservation Plan*, to which the Union Station Redevelopment Corporation, Amtrak, and the private air-rights developer, are parties.[14] The plan provides design considerations and guidelines consistent with the SOI Standards.

[13] The WUS Historic Site, as defined in the *Determination of Eligibility Amendment* to WUS that FRA prepared in 2017, includes the rail terminal in addition to the historic station building, Columbus Plaza, and the First Street Tunnel.

[14] Union Station Redevelopment Corporation. 2015. *Washington Union Station Historic Preservation Plan.* Accessed from https://www.usrcdc.com/projects/historic-preservation-plan/. Accessed on March 28, 2019.

Visual Impacts

In the No-Action Alternative, relative to existing conditions, visual changes would result in major adverse direct operational impacts on three cultural resources: WUS, the WUS Historic Site, and the Railway Express Agency (REA) Building. They would result in moderate adverse direct operational impacts on seven cultural resources; minor adverse direct operational impacts on five resources; and negligible adverse direct operational impacts on three resources.

The development of the private air rights above the rail terminal southeast and north of H Street NE and the construction of several building blocks on a deck within this area would noticeably change the visual surroundings of WUS, the WUS Historic Site, and REA Building. The new visual elements would diminish the integrity of setting, feeling, and association of these resources and cause them to experience a major adverse impact as the changes would be highly visible and the resources are highly sensitive to them:

- **WUS:** The development of the private air rights to the north of the historic station building would change the character of the views towards the building and diminish its integrity of setting, feeling, and association. The top of the new buildings would be visible above the roof of the historic station building on the east side. No change would occur on the west side because the existing parking garage is not visible above the station's roofline. This would disrupt the visual symmetry of the station's monumental Beaux Arts design. Such an effect would be especially noticeable from Delaware Avenue NE; First Street and C Street NE; and the east side of Columbus Circle Drive. The introduction of new buildings and resulting loss of symmetry would also disrupt the open character of the cultural landscape north of the historic station building and sever the visual connection between the rail terminal and the historic station building.
- **WUS Historic Site:** The private air-rights development would replace the existing, open rail terminal south of K Street NE with buildings constructed on a deck above the tracks. The change would be especially noticeable from the north (New York Avenue Bridge). Seen from there, the private air-rights development would fully hide the rail terminal and back of the historic station building. This would break the visual connection between the rail terminal and the historic station building, a connection that is essential to the resource's integrity of setting, feeling, and association.
- **REA Building:** The private air-rights development would also change the visual environment of the REA building. It would compromise the building's integrity of setting, feeling, and association, which are tied to its connection to the rest of the rail terminal. The eastern edge of the private air-rights deck and development would rise just behind the building, visually cutting it off from the rest of the rail terminal.

As explained below, 15 other cultural resources, including one cultural viewshed, would be affected visually but not in a manner that would alter any of their respective character-defining features and diminish their integrity of setting, feeling, and association.

The private air-rights development would also be highly visible from several parts of the Square 750 Rowhouse Development, especially from Parker Street NE when looking west, and from 901 Second Street NE. However, the integrity of setting, feeling and association of Square 750 and 901 Second Street has already been affected by prior alterations and adjacent developments, which have altered the character of the neighborhood. The private air-rights development would be visually consistent with the current condition of the area. Therefore, while its visibility would be high, the sensitivity of Square 750 and 901 Second Street to this visual change is moderate, resulting in a moderate adverse impact on these two resources.

Similarly, visual changes would result in moderate adverse operational impacts on the following three resources: Thurgood Marshall Federal Judiciary Building; Topham's Luggage Factory (Former); and Woodward and Lothrop Service Warehouse. The private air-rights development would be moderately to highly visible from these resources. However, their sensitivity to this change is moderate, as it would be in keeping with other large-scale multi-story developments in the surrounding area and the resources' integrity of setting, feeling, or association does not depend on the affected visual relationships.

Though the private air-rights development would affect vistas along several street corridors that are part of the L'Enfant-McMillan Plan, the visibility of the development would vary according to the street and distance. Of the views assessed in **Section 5.11***, Aesthetic and Visual Quality,* 19 contribute to the L'Enfant-McMillan Plan. Of these 19 contributing views, the No-Action Alternative would cause major adverse visual impacts to four; moderate impacts to five; minor impacts to five; and negligible impacts to two. The views that would see major visual impacts are located to the south of the station, along the radial streets of Louisiana Avenue, Delaware Avenue, and First Street NE. However, the majority of views would experience negligible to moderate impacts. Together, visual impacts would not affect the integrity of the L'Enfant-McMillan Plan's setting, feeling, or association. The private air-rights development would not block or interrupt any views and views of Columbus Plaza and the south elevation of Washington Union Station would remain intact. Therefore, visual changes would result in only a moderate adverse impact on the L'Enfant-McMillan Plan.

Finally, the private air-rights development would cause a moderate adverse impact on the U.S. Capitol Dome Viewshed. The development would be highly visible from the dome but sensitivity would moderate as it would not interrupt the horizon or any views along North Capitol Street or Delaware Avenue toward Columbus Plaza and the historic station building.

The following five resources would experience minor adverse operational impacts from visual changes: Senate Parks, Underground Garage, and Fountains; St. Joseph's Home (Former); Uline Ice Company Plant and Arena Complex; Columbus Plaza; and the Capitol Hill Historic District. The private air-rights development would be moderately visible from those resources. But all five resources have low sensitivity to this visual change because their integrity of setting, feeling, or association does not depend on the affected visual relationships.

Potential adverse operational impacts from visual changes on the following three resources would be negligible: Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; and the Russell Senate Office Building. The private air-rights development would be just barely visible from these resources because of distance and intervening structures or vegetation. The integrity of setting, feeling, or association of the five affected resources does not depend on those slightly changed views.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, in the No-Action Alternative, there would be negligible adverse direct operational impacts from increases in noise and vibration on 18 cultural resources. Increased traffic volumes have the potential to result in adverse direct operational impacts on the Capitol Hill Historic District due to visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The primary cause of noise and vibration impacts would be greater vehicular traffic on streets around WUS; near the rail terminal, rail operations would also contribute to the impacts. Based on the noise and vibration analysis conducted for the No-Action Alternative (**Section 10.5.1.1**, *Direct Operational Impacts*), increases in ambient noise would occur at or near 18 cultural resources: WUS, the C&P Telephone Company Warehouse; the Capitol Press Building (Former); the City Post Office /Postal Museum; GPO Warehouse No.4; Holodomor Ukrainian Holocaust Memorial; Square 750 Rowhouse Development; St. Aloysius Catholic Church; St. Joseph's Home (Former); St. Phillip's Baptist Church; Thurgood Marshall Federal Judiciary Building; Topham's Luggage Factory (Former); Uline Ice Company Plant and Arena Complex; Columbus Plaza; Woodward and Lothrop Service Warehouse; 901 Second Street NE; the Union Market Historic District; and the Capitol Hill Historic District (along 2nd Street NE).

Adverse impacts from traffic-related noise on these 18 cultural resources would be negligible because the change in noise levels would not exceed 3 dBA and it would not cause noise anywhere to exceed FTA criteria. A change of less than 3 dBA would be an imperceptible. [15] Additionally, the operational vibration analysis showed that changes in vibration levels throughout the Local Study Area would be negligible as well.

While noise and vibration are the main source of potential traffic-related impacts on cultural resources, increases in traffic volumes along nearby streets has the potential to cause visual

[15] A change of less than 3 dBA is generally considered barely perceptible: Federal Highway Administration, *Traffic Noise: Analysis and Abatement Guidance* [June 2010] in District Department of Transportation, *Noise Policy* [January 10, 2011], p. 9, Table 4.

impacts, conflicts with pedestrians and bicyclists, and other disturbances affecting access to homes and businesses. Anticipated traffic impacts in the No-Action Alternative are addressed in **Section 5.5.1.1**, *Direct Operational Impacts, Vehicular Traffic*, of this report. The No-Action Alternative is anticipated to be accompanied by an increase in traffic volumes in the vicinity of WUS caused by general background economic and demographic growth, the development of the private air rights above the rail terminal, and greater station activity. Traffic impact modeling indicates that adverse impacts would be concentrated along a few major thoroughfares, including North Capitol Street, and H Street as well as, to a lesser extent, K Street and Massachusetts Avenue.

The 18 cultural resources within the APE that are located along or close to those thoroughfares would experience negligible noise and vibration impacts as described above. Additional impacts directly linked to traffic volumes are not anticipated. North Capitol Street, H Street, K Street, and Massachusetts Avenue are principal or minor arterials and, as such, already carry and are intended to carry significant amounts of traffic (see **Appendix C2**, *Washington Union Station Expansion, Affected Environment Technical Report*, **Section 5.5.13**, *Vehicular Traffic*).[16] No-Action Alternative volumes would represent an incremental change that would not substantively alter the busy, traffic-heavy urban environment of the 18 resources. Traffic would not cause additional adverse impacts to these resources, with one potential exception.

The potential exception is the Capitol Hill Historic District. The historic district is largely residential, with areas of commercial and light industrial activity. East of WUS within the Study Area, Massachusetts Avenue runs through the historic district while H Street runs close to its northern boundary (see **Figure 12-1** above). As explained above, increased traffic along these two thoroughfares would not by itself have an adverse impact on cultural resources. However, it is possible that increased congestion and delays at intersections on those main roadways may prompt drivers to seek alternative routes that would take them through the residential streets of the historic district, such as 3rd Street, 5th Street, or G Street. It is not known whether this would happen and, if it did, by how much traffic volumes along those residential streets would increase because the modeling conducted for this DEIS, in coordination with the District Department of Transportation (DDOT), does not account for this type of reactive and discretionary behavior by drivers. However, even relatively small

[16] Urban principal arterials serve major activity centers, highest traffic volume corridors, and longest trip demand. They carry a high proportion of total urban travel and accommodate trips entering and leaving the urban area as well as movements through the urban area. They also serve demand for intra-area travel between the central business district and outlying residential areas. Urban minor arterials Interconnect and augment the higher-level arterials; serve trips of moderate length; distribute traffic to smaller geographic areas than those served by higher-level arterials; and provide more land access than principal arterials without penetrating identifiable neighborhoods (Federal Highway Administration [FHWA], *Highway Functional Classification Concepts, Criteria and Procedures, 2013 Edition*. Accessed from: https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/. Accessed on January 2, 2020.

changes may be noticeable given the predominantly residential character of the potentially affected streets.

Additional traffic would travel along the streets of the historic district in the No-Action Alternative due to general growth in the area, including the private air-rights development at WUS. For instance, during peak hours, the traffic impact analysis shows that traffic on 2nd Street NE between Massachusetts Avenue and H Street would increase by approximately 12 percent (from approximately 1,400 trips to approximately 1,560 trips). Along F Street NE east of 2nd Street, the number of peak hour trips would increase by approximately 13 percent (from around 550 trips to around 620 trips). Diverted traffic may add to these volumes.

Visual impacts from increased traffic, along disturbance, and conflicts with pedestrians and bicyclists may detract from the enjoyment residents and visitors derive from the neighborhood and from the peaceful setting some residents consider to be a defining character of their historic neighborhood.

12.5.1.2 Indirect Operational Impacts

There would be no indirect impacts in the No-Action Alternative. In the No-Action Alternative, the Federally owned air-rights would not be developed and there would be no impacts on cultural resources.

12.5.1.3 Construction Impacts

In the No-Action Alternative, the construction of projects in the Project Area could cause a range of potential construction-related adverse impacts, including potential adverse impacts on undiscovered archaeological resources within the WUS rail terminal.

Construction of the private air-rights development has potential to cause an adverse physical impact on archaeological resources. This project would require establishing foundations within the rail terminal for the columns supporting the air-rights decks. Much of the rail terminal has moderate to high archaeological potential. Although there are no known archaeological resources in the rail terminal, it is possible that excavation of the foundations and other ground-disturbing activities may inadvertently damage or destroy unknown archaeological deposits.

It is likely that the same resources that would experience adverse operational visual impacts also would potentially experience construction-related adverse visual impacts although information to determine the intensity of these impacts is not available. Construction of the private air-rights development as well as that of other projects in the rail terminal – such as the replacement of the H Street Bridge – would involve the storing, staging, and use of construction equipment and materials within or next to the Project Area, most likely in fenced areas around the periphery of the terminal. This would adversely affect views from nearby cultural resources. The location and schedule of construction activities, not known at this time, would determine which resources are affected and to what degree.

In general, while construction equipment and activities may detract from the visual setting of a cultural resource, they are a common sight in an urban environment. Additionally, although they may continue for several years, their presence would not be a permanent condition. The significance and historic integrity of the potentially affected resources do not depend on keeping views or vistas permanently free of any encumbrances.

Construction activities would also generate noise and vibration from the operation of construction equipment and trucks that would travel on nearby streets to reach the site, including First Street NE, 2nd Street NE, and H Street NE. It is not possible to assess the intensity of these potential impacts, as they would depend on construction methods and schedules that would vary among the projects and are not known at this time. Quantitative estimates were not developed for potential No-Action Alternative construction-related noise and vibration impacts. Impacts would vary with the method and duration of construction for each project included in the No-Action Alternative, which is unavailable information. The project with the greatest potential to cause noise and vibration-related impacts is the private air-rights development. It is likely that construction of this project would affect the same resources as construction of the Action Alternatives (see **Section 12.5.2.3**, *Construction Impacts*).

12.5.2 Alternative A

12.5.2.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative A would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

WUS

Alternative A would result in a major physical adverse direct operational impact on WUS. Alternative A would involve the demolition of the Claytor Concourse and construction of a new passenger concourse (Concourse A) and train hall just north of the historic station building. This would affect the north façade of the Retail and Ticketing Concourse, which was previously altered by the construction of the Claytor Concourse in 1988. The Retail and Ticketing Concourse originally featured an immense opening leading to the tracks and platforms. It was punctuated by a colonnade of nine steel-plated Doric columns with cast-iron capitals spaced evenly along its length. Currently, a section of the entablature, supported by the Doric columns, is the only original fabric that remains visible from within the Claytor Concourse but it is possible that the Doric columns are still in place, encapsulated by the Claytor Concourse.

Alternative A also includes work to remove columns in the portion of the First Street Tunnel below the Retail and Ticketing Concourse. This would involve accessing the tunnel from above and demolishing portion of the floor (approximately 15,000 square feet). The floor is constructed of steelwork consisting of girders and I-beams spaced at intervals of 4 to 5 feet on center. The current marble finish was installed in the 1980s and is not part of the historic fabric of the building. The spaces between these beams are filled with terra cotta-tile arches that are part of the original fabric, however. Their demolition and replacement, along with the removal of the columns, would affect the historic integrity of the building, although in a manner that would not be readily noticeable by the general public.

WUS Historic Site

Alternative A would result in a major adverse direct operational physical impact to the WUS Historic Site. Alternative A would involve extensive modifications to the railroad terminal, including the reconstruction of all tracks, platforms, and associated infrastructure. Reconstruction of the rail terminal, construction of the new concourses and of the structural deck needed to support the new bus and parking facility and associated roadways would require the removal of numerous structures throughout the historic site. These would include the K Tower, all existing platforms, umbrella sheds, catenary poles, catenary with cross beam, signal bridges, and pneumatic switch valves. Ventilation intake may require the insertion of vents in the southwest portion of the historic retaining walls (Burnham Wall). Such changes in the defining features of the WUS Historic Site would be detrimental to its integrity of design, setting, materials, workmanship, feeling, and association.

REA Building

As defined in the NRHP Nomination Form, the REA Building occupies Lot 812 of Square 717 in the District. The historic property boundary, which is the same as the parcel boundary, is approximately 63,000 square feet in size. It is located between 2nd Street NE and the eastern edge of the WUS rail terminal. To the south, the parcel partially overlaps with the old H Street alignment (H Street Tunnel). There is direct access from the tunnel into the basement of the REA Building.

In Alternative A and all Action Alternatives, construction of the new H Street Concourse along the alignment of the H Street Tunnel would require using the part of the historic property parcel that overlaps with the alignment (approximately 9,800 square feet). Construction of the H Street concourse would also require modifying or eliminating the connection between the tunnel and the building. At this early stage of design, how this would affect the REA Building is undetermined. However, there is potential for an adverse impact on the REA Building.

Visual Impacts

Relative to existing conditions, in Alternative A, visual changes would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and REA Building; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct

operational impacts on two other cultural resources. They would also result in a beneficial direct operational impact on one cultural resource.

Alternative A would result in direct changes to the visual environment of eight cultural resources. Among these, these changes would have a major adverse impact on the WUS Historic Site. With the reconstruction of the rail terminal and the erection of the north-south train hall, bus and parking facility, and supporting deck, Alternative A would change the appearance of the historic site and alter existing visual connections between its components. The change would be especially noticeable from the north. Seen from there, the train hall and new bus and parking facility would partially hide the rail terminal and the back of the historic station building. The new structures, while highly visible, would be functionally compatible with the character of the site as a historic train station and rail terminal. However, the sensitivity of the WUS Historic Site to these highly visible changes is high and they would likely compromise its character-defining features and integrity of setting, feeling, and association.

Visual changes would also result in a major adverse impact on WUS. The top of the new bus and parking facility would be just visible above the historic station building's roofline from Delaware Avenue at D and C Streets NE. From that perspective, this change would introduce a noticeable asymmetry in the view of the station. The new bus and parking facility would be visible from the west side of Columbus Circle Drive but its massing would be similar to that of the existing garage. Overall, visual changes would be highly noticeable and the sensitivity of WUS to them is high, largely due to the loss of symmetry in the views from the south. Therefore, adverse impacts would be major.

Finally, visual changes in Alternative A would also have a major adverse impact on the REA Building. The building stands to the north of H Street NE along the eastern edge of the Project Area. The most visible elements of Alternative A (train hall, new bus facility, and parking facility) would be south of H Street NE, in the center and western part of the Project Area. Therefore, views toward the REA Building from the east would not change. However, on the rail terminal side, while the building would maintain a visual connection with the tracks, the reconstruction of the rail terminal would change the character of this connection. The new train hall and parking facility to the southwest would also be visible, although the H Street Bridge and the existing parking garage would partly obstruct views in that direction. The changes in the visual environment would be highly noticeable and the resource's sensitivity to these changes is high, resulting in major adverse impacts.

Visual changes in Alternative A would cause minor adverse impacts to the Thurgood Marshall Federal Judiciary Building and the Woodward Lothrop Building. While the bus facility, parking facility, and train hall would have moderate to high visibility from those resources, their sensitivity to the changes in view is low, as they do not derive their significance from their visual connection to WUS.

There would further be negligible direct impacts on Square 750 Rowhouse Development and St. Joseph's Home (Former). The bus facility, parking facility, and train hall would be just noticeable from these resources and these slight changes in views would not affect the resources' integrity.

Alternative A would finally have a beneficial impact on the GPO Warehouse No. 4. This is because the height of the Alternative A elements would be less visible than the existing parking garage, reducing an existing visual obstruction.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative A would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 other cultural resources. Increased traffic volumes in Alternative A have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

Noise from traffic in Alternative A would result in minor adverse operational impacts on the following cultural resources: St. Joseph's Home (Former); Square 750 Rowhouse Development (K Street NE side); and Capitol Press Building (Former). The operational noise and vibration analysis conducted for Alternative A (see **Section 10.5.2.1**, *Direct Operational Impacts*) shows that increased street traffic would cause noise levels to exceed the FTA criterion for a moderate impact at or near these three resources. However, the resulting adverse impact on these resources would be minor because the noise increase would be less than 3 dBA, which would be imperceptible to most people. Such a change would not compromise the resources' integrity of setting, feeling, or association. Additionally, all three resources have experienced increased traffic on nearby streets and the construction of adjacent multi-story residential, commercial, and mixed-use developments, which have already altered their respective settings. The minimal additional noise from Alternative A would not compromise them further.

There would be negligible adverse impacts from increases in ambient noise relative to existing conditions at or near 15 cultural resources: WUS; the C&P Telephone Company Warehouse; the City Post Office/Postal Museum; GPO Warehouse No.4; Holodomor Ukrainian Holocaust Memorial; St. Aloysius Catholic Church; St. Phillip's Baptist Church; Thurgood Marshall Federal Judiciary Building; Topham's Luggage Factory (Former); Uline Ice Company and Arena Complex; Columbus Plaza; Woodward and Lothrop Service Warehouse; 901 Second Street NE; the Union Market Historic District; and the Capitol Hill Historic District (along 2nd Street NE). Noise impact analysis showed that everywhere increases would be less than 3 dBA and the resulting levels would not exceed FTA criteria. The change in noise would not compromise the resources' integrity of setting, feeling, or association.

The operational vibration analysis for Alternative A showed that changes in vibration levels throughout the Local Study Area would be negligible and would not affect the integrity of any cultural resource.

As explained for the No-Action Alternative (**Section 12.5.1.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration*), while noise and vibration are the main source of traffic-related impacts on cultural resources, increases in traffic volumes along nearby streets may cause visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses that can potentially affect the integrity of a cultural resource's setting, feeling, or association.

In general, urban resources and resources with periods of significance later than the generalization of motor vehicle travel may be assumed to be less sensitive to such impacts than rural resources or resources pre-dating the widespread use of the automobile. In urban settings, such as the District of Columbia, resources originally designed for institutional, commercial, and industrial uses, or those within long-established commercial, industrial, and high-density areas can be assumed to be less sensitive than resources originally intended for residential, cultural, or recreational uses, or resources located in residential or low-density neighborhoods.

Anticipated traffic impacts under Alternative A are addressed in **Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Traffic*, of this report. Relative to existing conditions, Alternative A, like all Action Alternatives, is anticipated to see an increase in traffic volumes in the vicinity of WUS caused by greater station activity in combination with the development of the private air rights above the rail terminal and general background economic and demographic growth. Traffic impact modeling indicates that adverse impacts would be concentrated along a few major thoroughfares, including North Capitol Street, H Street as well as, to a lesser extent, K Street and Massachusetts Avenue.

Eighteen cultural resources within the APE that are located along or close to those thoroughfares would experience minor or negligible noise and vibration impacts, as described above. For the same reasons as explained for the No-Action Alternative (**Section 12.5.1.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration*), additional impacts directly linked to traffic volumes are not anticipated to any of the 18 resources with the potential exception of the Capitol Hill Historic District.

In Alternative A, the pick-up and drop-off area on 2nd Street NE would generate additional station-related traffic along this street, which forms the northwestern edge of the historic district south of H Street. During peak hours, traffic on 2nd Street NE between Massachusetts Avenue and H Street would increase by approximately 22 percent relative to existing conditions, from approximately 1,400 trips to approximately 1,700 trips. Of the 300 additional trips, approximately 135 would be due to the Project.

The new east ramp providing access from the deck to F Street NE would also cause an increase in traffic traveling eastbound along F Street across the historic district except from 4 to 6:30 PM, when non-local traffic would continue to be required to turn left or right onto 2nd Street. During peak time, traffic on F Street NE east of 2nd Street would increase by approximately 37 percent relative to existing conditions, from approximately 550 trips to approximately 750 trips. Of the 200 additional trips, approximately 135 would be due to the Project.

Additionally, as previously noted for the No-Action Alternative, increased traffic along H Street and Massachusetts Avenue east of WUS, and the resulting congestion and delays, may prompt drivers to seek alternative routes that would take them through residential streets of the historic district such as 3rd Street, 5th Street, or G Street. As noted above, the modeling conducted for this DEIS, in coordination with DDOT, does not account for this type of reactive and discretionary behavior by drivers. Therefore, it is not known whether these potential increases would occur and, if they did, by how much they would change traffic along the affected streets. However, even relatively small changes may be noticeable given their predominantly residential character.

Visual impacts from increased traffic, along with the associated disturbance and conflicts with pedestrians and bicyclists along 2nd Street NE, F Street NE, and, potentially some local streets in the historic district may detract from the enjoyment residents and visitors derive from the neighborhood and from the peaceful setting some residents consider to be a defining character of their historic neighborhood.

The affected segment of 2nd Street is a designated collector road largely, though not exclusively, characterized by commercial and institutional uses.[17] The part of F Street between WUS and 6th Street NE is also a designated collector road. The historic significance of the Capitol Hill Historic District, as characterized in the NRHP nomination, is primarily derived from its architecture and contribution to the development of the District of Columbia. However, visual clutter, disturbance, and conflicts with pedestrians and bicyclist from increased traffic in collector and local roads have the potential to result in an adverse impact on the Capitol Hill Historic District.

12.5.2.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative A would have the following indirect operational impacts on cultural resources in addition to the direct impacts: moderate adverse visual impact on one cultural resource; minor adverse visual impacts on five cultural resources; and negligible adverse visual impacts on six cultural resources.

In Alternative A, the potential Federal air-rights development would sit atop the bus and parking facilities, not exceeding the 130-foot height limit allowing by the anticipated zoning for the area. The change would be small relative to the scale of the entire structure and the

[17] Collector roads serve both land access and traffic circulation in residential and commercial/industrial areas; penetrate residential neighborhoods; and distribute and channel trips between local roads and arterials (derived from: FHWA, *Highway Functional Classification Concepts, Criteria and Procedures, 2013 Edition*. Accessed from: https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/. Accessed on January 2, 2020.

impacts of Alternative A would remain the same as described in **Section 12.5.2.1**, *Direct Operational Impacts* with the following exceptions:

- Moderate adverse visual impacts on the U.S. Capitol Dome Viewshed.
- Minor adverse visual impacts on the City Post Office/Postal Museum; Senate Parks, Underground Garage and Fountains; Columbus Plaza; L'Enfant-McMillan Plan; and Capitol Hill Historic District.
- Negligible adverse visual impacts on Dirksen and Hart Senate Office Buildings; GPO; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Uline Ice Company Plant and Arena Complex; and Russel Senate Office Building.

Alternative A would have a moderate adverse visual impact on the U.S. Capitol Dome Viewshed. The potential Federal air-rights would be highly visible from the dome. However, even with it, the structure would not rise above the horizon or block any views along North Capitol Street. It would not disrupt views along Delaware Avenue toward Columbus Plaza and the historic station building. The sensitivity of the cultural viewshed to such changes is moderate, resulting in a moderate adverse impact.

The potential Federal air-rights development (in addition to the direct visual impacts of Alternative A) would affect vistas along several street corridors that are part of the L'Enfant-McMillan Plan. The visibility of the development would vary according to the street and distance. Of the 28 views assessed in **Section 5.11***, Aesthetic and Visual Quality* chapter, 19 contribute to the L'Enfant-McMillan Plan. The visibility of the potential Federal air-rights development from these 19 contributing views would vary for high to negligible. The visual assessment indicates that Alternative A would have a major impact on one of the 19 views, moderate impacts on four, minor impacts on four, negligible impacts on six, and a beneficial impact on one. In the aggregate, such changes in vistas would be visible from a few locations but they would not affect the L'Enfant-McMillan Plan's integrity of setting, feeling, or association. No views would be obstructed. The overall adverse impact on this resource would be minor.

There would also be minor adverse visual impacts on the City Post Office/Postal Museum; Senate Parks, Underground Garage and Fountains; Columbus Plaza; and the Capitol Hill Historic District. These resources would experience visual changes with low to moderate visibility and have low to moderate sensitivity to such changes. For Columbus Plaza, the potential Federal air-rights development would be distinctly visible above the west wing of the historic station building, introducing a small asymmetry in the view. The change would not compromise the plaza's integrity of setting, which is derived from its design as a forecourt to WUS.

The Dirksen and Hart Senate Office Buildings; GPO; Library of Congress Thomas Jefferson Building; St. Joseph's Home (Former); Uline Ice Company Plant and Arena Complex; and Russel Senate Office Building would experience negligible adverse visual impacts. The potential Federal air-rights development in Alternative A would be visible from these resources. However, because of distance and intervening structures or vegetation, the change would be barely noticeable and would not affect the resources' integrity. For the GPO building, while the combined parking facility and potential Federal air-rights would be highly visible, closing out the view down G Street NE, it would occupy almost the same space as the existing parking garage. With distance, the change would be little noticeable. Furthermore, the historic significance of the GPO does not depend on views of the existing WUS parking garage. Therefore, this resource has low sensitivity to the change.

12.5.2.3 Construction Impacts

Alternative A's construction would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction would result in moderate adverse impacts on three cultural resources; minor adverse impacts on one cultural resource; and negligible adverse impacts on 15 cultural resources. Noise and vibration from construction activities would result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on two cultural resources; and negligible adverse impacts on ten cultural resources.

Construction of Alternative A would require excavating most of the rail terminal to reconstruct the tracks and platforms, construct concourses, and set foundations and columns supporting the overbuilt structures south of H Street NE. Much of the terminal was identified as having moderate to high archaeological potential, although it contains no known archaeological resources. It is possible that excavations and ground disturbance could inadvertently damage or destroy unknown significant archaeological deposits, potentially resulting in an adverse impact.

Construction would take place in phases over approximately 11 years and 5 months, including the 12-month Intermediate Phase. During much of that time, fencing around the construction site, staging areas, heavy construction equipment, excavated areas, and structures under construction would affect the visual setting of the cultural resources from which they would be visible. Because the focus of construction activities would move across the Project Area depending on the phase of construction, the visually affected resources and the intensity of the impact would vary over time. During the entire construction period, construction activities would likely be visible for at least some time from the same resources that would experience operational visual impacts (see **Section 12.5.2.1**, *Direct Operational Impacts, Visual Impacts*).

WUS, the WUS Historic Site, and the REA Building would experience the greatest visual impacts because construction would occur within or directly adjacent next to them over the entire construction period. The reconstruction of the rail terminal and construction of the various Project elements to the north of the historic station building would turn the WUS Historic Site into an active construction site for more than a decade. Inside WUS, column removal work in the Retail and Ticketing Concourse would require setting up partitions to seal the work area from the rest of the station during part of Phases and 2, and during the Intermediate Phase. This would be a highly visible change that would affect the interior appearance of the station and how it is experienced by visitors and passengers. While the visibility of construction activities would be high, however, the three affected resources' sensitivity is moderate. Although construction would continue for several years, it would not be a permanent condition. The resources' significance and integrity of setting, feeling, and association do not depend on keeping them or their immediate surroundings permanently free of construction activities. Given the phased character of the work, large sections of WUS and the WUS Historic Site would remain operational and free of visual disruptions for much of the construction period. Visual impacts from construction would not in themselves cause a loss of historic integrity that could endanger the historic status of the affected resources. While construction work and associated disturbances would make WUS less attractive to visitors, it would not entirely prevent them from appreciating its architectural and historic importance. Impacts would be adverse but moderate.

The Capitol Dome Viewshed would also be affected, as construction activities at WUS would be highly visible from the dome. However, the sensitivity of the viewshed to such disruption is low, given the distance and the common character of construction in an urban setting such as the District. The resulting adverse impact would be minor.

Construction would be visible from 15 other cultural resources to a degree that would vary with distance and the phase of construction. These resources include: the City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; GPO; GPO Warehouse No. 4; Library of Congress, Thomas Jefferson Building; Russell Senate Office Building; Senate Parks, Underground Garage, and Fountains; Square 750 Rowhouse Development; St. Joseph's Home (Former); Thurgood Marshall Federal Judiciary Building; Uline Ice Company Plant and Arena Complex; Columbus Plaza; Woodward and Lothrop Service Warehouse; Capitol Hill Historic District; and L'Enfant-McMillan Plan. Distance combined with the moving focus of construction make the sensitivity of the affected cultural resources to construction activities at WUS low. Additionally, as previously noted, construction sites are a common sight in an urban environment. Visual impacts from construction would not affect the characteristics that give these resources their historic significance. Impacts would be negligible.

Construction of Alternative A would result in major adverse impacts from vibration on WUS and the REA Building. In this alternative, vibratory pile driving would occur within 10 to 16 feet of both resources, resulting in vibration levels of approximately 0.33 to 0.67 inches per second (in/s) (See **Section 10.5.2.3**, *Construction Impacts, Construction Vibration*). Depending on the sensitivity of the buildings, which has not been determined, this could exceed the threshold for structural damage and compromise the physical integrity of the buildings.

During support of excavation (SOE) construction activities, noise levels in the back of WUS and at the REA Building would reach up to 90.1 dBA and 92.9 dBA, respectively. This would be above the FTA criteria for severe noise impacts. These noise levels, while elevated, would not compromise the resources' integrity of setting, feeling, or association. WUS's has never been defined by its quiet setting and has always been a site of great activity and noise. Similarly, the REA Building's significance comes from its architectural design and association with WUS, not its quiet setting.

Construction-related noise and vibration from constructing Alternative A would result in moderate adverse impacts on the following five cultural resources: City Post Office/Postal Museum; GPO Warehouse No.4; St. Joseph's Home (Former); Square 750 Rowhouse Development (917-923 2nd Street NE; 208-224, 226-242, and 219-231 Parker Street NE); and 901 Second Street NE. During SOE construction and at the beginning of excavation activities, noise levels at or near these resources would exceed the FTA criteria for severe noise impacts. St. Joseph's Home and parts of Square 750 (203-219 K Street NE and 917-923 2nd Street NE) would also experience levels of construction vibration above the annoyance threshold.

These impacts would be noticeable, but they would not compromise the resources' integrity of setting, feeling, or association. The significance of none of these resources is dependent on a quiet environment. The City Post Office's significance is linked to its architecture and the history of the Postal Service. That of GPO Printing House No.4 is linked to its architecture and association with the GPO, WUS, and City Post Office. Square 750's significance depends on its architecture and connection with the rail terminal. The significance of St. Joseph's Home is connected to the historic development of the Swampoodle neighborhood. Finally, 901 Second Street NE is significant for its association with the early 20th century development of the neighborhood. Increased noise and vibration levels would not affect any of those characteristics. Additionally, all five resources already experience heavy traffic and associated noise and vibration.

Construction noise and vibration impacts would have minor adverse impacts on the following two cultural resources: C&P Telephone Company Warehouse and the Capitol Hill Historic District (northwestern edge).

At the C&P Telephone Company Warehouse, vibration from construction truck traffic would exceed the FTA threshold for annoyance. The adverse impact would be minor because, while noticeable, the projected level of vibration would not create any risk of structural damage and the integrity of the resource does not depend on a quiet and vibration-free setting.

During excavation activities, if trucks are used to haul away spoil, locations on the northwestern edge of the Capitol Hill Historic District would experience noise levels in excess of the FTA threshold for moderate impacts. These locations include 603-607 2nd Street NE and 521-527 2nd Street NE. The same locations, along with a third one, 205 F Street NE would experience vibrations above the FTA threshold for annoyance. This would result in minor adverse impacts on the Capitol Hill Historic District for the following reasons. The impacts would be localized and limited to locations on the edge of the Capitol Hill Historic District bordering 2nd Street NE. The majority of the historic district would experience no noise or vibration impacts. Outside of 2nd Street NE, construction trucks would only use designated truck routes to travel to and from the Project Area. They would not circulate along the residential streets that are one of the historic district's character-defining features. Although they would occur during a long period – construction of Alternative A would take approximately 11 years and 5 months to complete – impacts would not be continuous, and they would cease entirely after excavation operations are finished. Excavation operations would last approximately 5 months in Phase 1 (out of a total phase duration of 2 years and 5 months). Phase 1 is both the phase that would most affect conditions along 2nd Street and that with the shortest excavation period. Excavation would last approximately 8 months in Phase 2 (out of a total phase duration of 2 years and 5 months); approximately 1 year and 1 month in Phase 3 (out of a total phase duration of 2 years and 6 months); and approximately 1 year and 5 months in Phase 4)out of a total duration of 3 years and 1 month). Phase 4 would have the longest excavation period but, being located on the west side of the rail terminal, it also is the phase furthest from the Capitol Hill Historic District.

The noise and vibration from constructing Alternative A would not compromise or diminish the late 19th- and early 20th-century architectural characteristics of the Capitol Hill Historic District or its significance to the development of the District.

Adverse impacts from construction noise and vibration on the following resources would be negligible: Capitol Press Building (Former); Holodomor Ukrainian Holocaust Memorial; St. Aloysius Catholic Church; St. Phillip's Baptist Church; Thurgood Marshall Federal Judiciary Building; Topham's Luggage Factory (Former); Uline Ice Company and Arena Complex; Columbus Plaza; Woodward and Lothrop Service Warehouse; and the Union Market Historic District. These resources are within the Stationary and Mobile Source Construction Noise and Vibration Study Area (see **Section 10.3**, *Study Area*). However, because of their distance from the Project Area, any noise and vibration they may experience would be negligible and would not affect the integrity of their respective settings.

12.5.2.4 Comparison to the No-Action Alternative

The physical and noise and vibration-related operational impacts of Alternative A on cultural resources relative to the No-Action Alternative would generally be the same as those relative to existing conditions. Column removal, demolition of the Claytor Concourse, and reconstruction of the rail terminal would affect WUS and the WUS Historic Site in the same manner, regardless of the baseline. Noise-related impacts would also be the same because the operational noise and vibration impact analysis showed that noise levels in Alternative A would be within 1 or 2 dBA of what they would be in the No-Action Alternative. This difference is not likely to be noticeable. For the purposes of the analysis of noise-related impacts on cultural resources, therefore, the two baselines are equivalent.

With regard to traffic impacts on the Capitol Hill Historic District, the proportional increase in the traffic that would or may travel through the district would be smaller relative to the No-Action Alternative than relative to existing conditions. During peak time, traffic on F Street NE east of 2nd Street would increase by approximately 24 percent relative to the No-Action Alternative (from around 620 trips to around 750) against 37 percent relative to existing conditions. Peak time trips along 2nd Street NE would increase by 10 percent relative to the No-Action Alternative (from around 1,560 trips to around 1,700 trips) instead of 22 percent relative to existing conditions.

Visual impacts on cultural resources relative to the No-Action Alternative would generally be less than relative to existing conditions. This is because in the No-Action Alternative, the mass of the private air-rights development above the rail terminal would mask Project elements from certain locations, eliminating or reducing visual impacts on several resources. For this reason, in Alternative A relative to the No-Action Alternative, there would be:

- No visual impact on the Dirksen and Hart Senate Office Building (instead of a negligible indirect adverse impact relative to the existing conditions).
- No visual impact on the REA Building (instead of a major direct adverse impact relative to existing conditions).
- No visual impact on Square 750 Rowhouse Development (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on St. Joseph’s Home (Former) (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on the Thurgood Marshall Federal Judiciary Building (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the Uline Ice Company Plant and Arena Complex (instead of a negligible indirect adverse impact relative to existing conditions).
- No visual impact on Woodward and Lothrop Service Warehouse (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the U.S. Dome Viewshed (instead of a moderate indirect adverse impact relative to existing conditions).
- Negligible visual impact on the Capitol Hill Historic District (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the L’Enfant-McMillan Plan (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible impact on Senate Parks, Underground Garage and Fountains (instead of a minor indirect adverse impact relative to existing conditions).
- Minor visual adverse impact on the WUS Historic Site (instead of a major direct adverse impact relative to existing conditions).

All other visual impacts would remain the same.

12.5.3 Alternative B

12.5.3.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative B would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

Alternative B would have major physical direct adverse impacts on WUS. These impacts would be the same as those of Alternative A. This is because they would result from the removal of the Claytor Concourse, its replacement with Concourse A and a new train hall, and the column removal work in the Retail and Ticketing Concourse, which would occur in both alternatives. **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts*, describes these physical impacts.

Alternative B would also have major direct impacts on the WUS Historic Site. The same physical impacts that would occur in Alternative A, described in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts*, would occur in Alternative B. Although construction of two below-ground parking levels would require a deeper excavation, impacts to surface structures would be the same as in Alternative A, with one exception. Construction of the access ramp to the below-ground parking facility would require opening a wide portal in the retaining wall under the K Street Bridge, which is a contributing feature of the historic site.

The potential adverse physical impact of Alternative B on the REA Building would be the same as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts.*

Visual Impacts

Relative to existing conditions, in Alternative B, visual changes would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and REA Building; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct operational impacts on two cultural resources. They would also result in beneficial direct operational impacts on one cultural resource.

Like Alternative A, Alternative B would result in changes to the visual environment of eight cultural resources. These changes would have major adverse impacts on WUS, WUS Historic Site, and REA Building for the same reasons as Alternative A. These impacts are described in **Section 12.5.2.2**, *Indirect Operational Impacts, Visual Impacts*. The only difference is that in Alternative B, the new bus facility would not have parking above it, resulting in a lower structure than the existing parking garage. From the south of WUS, it would not be visible above the roofline of the historic station building but it would be visible from the west side of Columbus Circle. The replacement of the existing garage with a smaller bus facility would be highly visible. Given the high sensitivity of WUS and the WUS Historic Site to this change, it would have the potential to result in a major adverse visual impact.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative B would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 other cultural resources. Increased traffic volumes in Alternative B have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The noise and vibration impact of Alternative B on cultural resources would be the same as those of Alternative A, described in **Section 12.5.2.1** *Direct Operational Impacts, Traffic, Noise and Vibration Impacts*. The noise and vibration analysis for Alternative B documented in **Section 10.5.3.1**, *Direct Operational Impacts* shows that operational noise impacts everywhere in Alternative B would be within 0.2 dBA of those predicted for Alternative A, an imperceptible difference. In Alternative B, because of the entrance of the below-ground parking garage on K Street NE, more traffic would travel along K Street and L Street NE and less traffic would travel along H Street NE and North Capitol Street than in Alternative A. However, the operational noise analysis showed that this would not result in noticeably different ambient noise levels along those roadways.

Potential traffic impacts on the Capitol Hill Historic District would be as described for Alternative A (**Section 12.5.2.1** *Direct Operational Impacts, Traffic, Noise and Vibration Impacts*.) While the exact volumes of traffic that would travel along K Street NE and H Street NE may differ slightly between Alternative B and Alternative A, the difference would not be great enough to result in measurably greater or lesserer impacts on the historic district.

12.5.3.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative B would have the following indirect operational impacts on cultural resources in addition to the alternative's direct impacts: moderate adverse visual impact on one cultural resource; minor adverse visual impacts on five cultural resources; and negligible adverse visual impacts on six cultural resources.

In Alternative B, the Federal air rights unneeded to build the new bus facility would potentially be developed to the maximum extent allowed by the zoning. The resulting combined massing would be the same as in Alternative A, with the same potential impacts as described in **Section 12.5.2.2***, Indirect Operational Impacts*.

12.5.3.3 Construction Impacts

Alternative B's construction would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction would result in moderate adverse impacts on three cultural resources; minor adverse impacts on one cultural resource; and negligible adverse impacts on 15 cultural resources. Noise and vibration from construction activities would result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on three cultural resources; and negligible adverse impacts on nine cultural resources.

The potential impacts of Alternative B on archaeological resources, if any are present in the rail terminal, would be the same as those of Alternative A. Both alternatives would involve excavating the rail terminal and potentially damaging or destroying undiscovered archeological resources (**Section 12.5.2.3**, *Construction Impacts*).

Construction of Alternative B would take place in phases over approximately 14 years and 4 months. Other than the longer overall duration, changes to the visual environment and resulting impacts on cultural resources would be the same as in Alternative A and are described in **Section 12.5.2.3**, *Construction Impacts*.

Most construction activities that would generate noise and vibration impacts would be the same in Alternative B as in Alternative A. Alternative B would take longer to complete and, therefore, some impacts would last longer, especially those associated with Phase 4. Phase 1 and associated excavation activities, including truck traffic, which would affect 2nd Street and the Capitol Hill Historic District most directly, would have the same duration in all Action Alternatives (5 months of excavation operations out of a total phase duration of 2 years and 5 months). The longest excavation period would be in Phase 4 (approximately 2 years and 7 months out of a total phase duration of 4 years and 11 months). Regardless of the phase, duration would not affect the maximum noise and vibration levels experienced, which is what the evaluation of impacts on cultural resources is based on.

However, in Alternative B, SOE would involve the construction of a slurry cutoff wall, which would generate more noise and vibration than the secant pile wall that would be used in Alternative A. Therefore, the impacts of noise and vibration from the construction of Alternative B on cultural resources would the same as those of Alternative A, described in **Section 12.5.2.3**, *Construction Impacts,* with the following differences:

- There would be major adverse impacts from vibration on WUS and the REA Building because in Alternative B:
    - Clam shovel drops associated with slurry wall construction may occur within 10 feet of the historic station building, resulting in vibration levels of approximately 0.12 to 0.8 in/s.

- Drilling for secant pile walls may occur within 10 to 16 feet of the REA Building, resulting in vibration levels of approximately 0.17 to 0.35 in/s.

- Construction-related noise would have a minor adverse impact on Topham's Luggage Factory (instead of a negligible impact in Alternative A). During SOE construction, this resource would experience noise levels in excess of the FTA threshold for moderate noise impacts. Although noticeable, this impact would not compromise the resource's integrity of setting, feeling, or association, which is determined by its historic association with commercial development and industry in the District.

12.5.3.4 Comparison to the No-Action Alternative

The physical and noise and vibration-related operational impacts of Alternative B on cultural resources relative to the No-Action Alternative would be the same as those relative to existing conditions for the same reasons as explained for Alternative A (**Section 12.5.2.4,** *Comparison to the No-Action Alternative*). Differences in traffic impacts on the Capitol Hill Historic District and differences in visual impacts would also be as described for Alternative A.

12.5.4 Alternative C

12.5.4.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative C (either option) would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

Alternative C with the East or West Option would have major physical direct adverse impacts on WUS. The removal of the Claytor Concourse to make room for Concourse A and the bus pick-up and drop-off area, as well as the column removal work in the Retail and Ticketing Concourse, would have the same impacts on the historic station building as Alternative A (see **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts*).

Alternative C would also have a major physical direct impact on the WUS Historic Site because of the reconstruction of the rail terminal; the excavation for the below-ground parking level; and the construction of the overbuild deck to support the bus and parking facilities northeast or northwest of the H Street Bridge depending on the option. Physical impacts would be as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts*. Additionally, like all Action Alternatives that include below-ground parking, Alternative C would require altering a substantial part of the historic retaining wall under the K Street NE underpass (Burnham Wall) to provide access to the parking.

The potential adverse physical impact of Alternative C on the REA Building would be the same as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts.*

Visual Impacts

<u>**East Option**</u>

Relative to existing conditions, visual changes in Alternative C with the East Option would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and the REA Building; minor adverse direct operational impacts on five cultural resources; and negligible adverse direct operational impacts on one cultural resource. They would also result in beneficial direct operational impacts on two cultural resources.

Alternative C with the East Option would result in changes to the visual environment of 11 cultural resources. Such changes would have a major adverse impact on WUS. The bus pick-up and drop-off area and train hall behind the historic station building would not be visible above the roofline as seen from the south but they would be highly visible from First Street and 2nd Street NE. These changes would alter the visual environment of WUS in a manner that would alter its integrity of setting, feeling, and association, resulting in a major adverse impact. Another highly visible change would result from the demolition of the existing parking garage. However, the existing garage is a historically incompatible addition and its removal would not adversely affect WUS.

Visual changes under Alternative C with the East Option would also have a major adverse impact on the WUS Historic Site. The reconstruction of the railroad terminal and the erection of the bus pick-up and drop-off area and train hall would change the appearance of the historic site south of the H Street Bridge. Additionally, the construction on a deck of the bus facility and parking facility to the northeast of the H Street Bridge would create a highly noticeable visual obstruction in a currently open part of the rail terminal. The new structures would be generally compatible with the character of the site as a historic train station and rail terminal and the demolition of existing parking garage would remove from the terminal a historically incompatible structure and visual obstruction. However, taken together, the changes within the rail terminal would very noticeably alter existing visual connections between its various components both south and north of the H Street Bridge. This would compromise the WUS Historic Site’s integrity of setting, feeling, and association.

Visual changes in Alternative C with the East Option would also have a major adverse impact on the REA Building. The new bus facility and above-ground parking facility as well as the deck supporting them would rise just behind the building. On the west site, they would block the building’s existing visual connections with the rail terminal. This would be a highly visible change to which the resource would be highly sensitive, as it would compromise an essential aspect of its integrity of setting, feeling, and association. The East Option would also alter views toward the building from the east of WUS along I (Eye) Street NE, as the bus facility and parking facility would be highly visible above the roofline, altering the resource's integrity of setting and feeling.

Alternative C with the East Option would also result in changes to the visual environment of nine cultural resources. These changes would not compromise the respective character-defining features or integrity of setting, feeling, and association of these resources, as explained below.

They would result in minor impacts on the following five resources: Square 750 Rowhouse Development; Thurgood Marshall Federal Judiciary Building; Topham's Luggage Factory (Former); 901 Second Street NE; and the Woodward and Lothrop Service Warehouse.

The new bus facility and parking facility, rising above the nearby REA Building, would be highly visible from the Woodward and Lothrop Service Warehouse as well as 901 Second Street NE. They would also be highly visible from Square 750 Rowhouse Development, at the western end of Parker Street NE, where they would close the view. The sensitivity of the affected resources to these changes is low, however, as they have lost much of their integrity of feeling, association, and setting due to recent nearby developments.

Elements of the East Option would be partially visible from the Thurgood Marshall Federal Judiciary Building and the Topham's Luggage Factory. This would result in a minor impact because both resources have low sensitivity to these changes: their integrity does not depend on their visual relationship to WUS.

Alternative C with the East Option would result in negligible visual impacts on the St. Joseph's Home (Former). Project elements would be just visible from this resource, which has low sensitivity to such changes. Its integrity would not be diminished.

Finally, there would be beneficial impacts to the GPO and GPO Warehouse No. 4. This is because the Alternative C elements would be less visible from those resources than the existing parking garage, freeing views from an existing encumbrance.

West Option

Relative to existing conditions, visual changes in Alternative C with the West Option would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and the REA Building; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct operational impacts on two cultural resources. They would also result in beneficial direct operational impacts on two resources.

Visual changes in Alternative C with the West Option would result in generally similar impacts to those of Alternative C with the East Option. The same three resources (WUS, WUS Historic Site, and REA Building) would experience major adverse impacts although the change in the visual environment of the REA Building would be slightly less than under the East Option. This is because the bus facility and parking facility would be located across the rail terminal from the building, farther away than would be the case under the East Option. However, the change would still affect the visual relationship of the building to the terminal and the REA

Building has high sensitivity to such a change, which can alter its integrity of setting, feeling, and association.

Two cultural resources would experience minor adverse impacts under the West Option instead of five under the East Option: Thurgood Marshall Federal Judiciary Building and the Woodward and Lothrop Warehouse. Impacts on these two resources would be as described above for the East Option. There would be no impact on Topham's Luggage Factory or 901 Second Street, as no noticeable change to views from these resources would occur.

Visual changes under Alternative C with the West Option would result in negligible adverse impacts on Square 750 Rowhouse Development and St. Joseph's Home (Former). Compared with Alternative C East Option, changes would be much less noticeable from Square 750 Rowhouse Development because of the location of the bus facility and parking facility along the west side of the rail terminal. This would reduce the intensity of the impact from minor in the East Option to negligible in the West Option. Impacts on St. Joseph's Home would be the same under either option.

In the West Option, there would be beneficial impacts on the GPO and GPO Warehouse No. 4, as described above for the East Option.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative C (either option) would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 cultural resources. Increased traffic volumes in Alternative C have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The noise and vibration impacts of Alternative C on cultural resources would be the same as those of Alternative A (**Section 12.5.2.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration Impacts*). The noise and vibration analysis for Alternative C, documented in **Section 10.5.4.1**, *Direct Operational Impacts,* determined that everywhere operational noise impacts in Alternative C would be within 0.2 dBA of those predicted for Alternative A, an imperceptible difference.

In Alternative C, because of the entrance of the parking facility on K Street NE, more traffic would travel along K Street and L Street NE and less traffic would travel along H Street NE and North Capitol Street than in Alternative A. However, the operational noise analysis showed that this would not result in noticeably different ambient noise levels along those roadways.

Similarly, potential adverse traffic impacts on the Capitol Hill Historic District would be as described for Alternative A (**Section 12.5.2.1,** *Direct Operational Impacts, Traffic, Noise and Vibration Impacts*.) While the exact volumes of traffic that would travel along K Street NE and

H Street NE may differ slightly between Alternative C and Alternative A, the difference would not be great enough to result in measurably greater or lesser impacts on the historic district.

12.5.4.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative C (either option) would have the following indirect operational impacts on cultural resources in addition to the alternative's direct impacts: moderate adverse visual impacts on one cultural resource; minor adverse visual impacts on three cultural resources; and negligible adverse visual impacts on six cultural resources.

In Alternative C, the Federal air rights where the existing parking garage stands would potentially be developed to the maximum height allowed by the zoning. The structure would have the same height as in Alternative A, with similar impacts. However, because the east-west train hall and bus pick-up and drop-off area would push the potential Federal air-rights development further back from the station than under that alternative, it would be less visible from some resources, such as the City Post Office/Postal Museum and Columbus Plaza.

As a result, Alternative C would have the following indirect impacts:

- Moderate adverse visual impacts on the U.S. Capitol Dome Viewshed.
- Minor adverse visual impacts on the L'Enfant-McMillan Plan; Senate Parks, Underground Garage and Fountains; and Capitol Hill Historic District.
- Negligible adverse visual impacts on City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Russel Senate Office Building; and Uline Ice Company Plant and Arena Complex.

Alternative C would have a moderate adverse visual impact on the viewshed from the U.S. Capitol Dome. From the dome, the potential Federal air-rights development would be visible behind the historic station building. However, this structure would not block any views along North Capitol Street or Delaware Avenue toward Columbus Plaza and the historic station building. The sensitivity of the cultural viewshed to such changes is moderate, resulting in a moderate adverse impact

The potential Federal air-rights development (in addition to the direct visual impacts of Alternative C) would affect vistas along several street corridors that are part of the L'Enfant-McMillan Plan. The visibility of the development would vary according to the street and distance. Of the 28 views assessed in **Section 5.11**, *Aesthetic and Visual Quality* chapter, 19 contribute to the L'Enfant-McMillan Plan. The visibility of the potential Federal air-rights development from these 19 contributing views would vary for high to negligible. The visual assessment indicates that Alternative C would have major impacts on two of the 19 views, moderate impacts on four (East Option) or three (West Option), minor impacts on four, negligible impacts on three, and a beneficial impact on one. In the aggregate, such changes in vistas would be visible from a few locations but they would not affect the L'Enfant-McMillan Plan's integrity of setting, feeling, or association. No views would be obstructed. The overall adverse impact would be minor.

There would also be minor adverse visual impacts on the Senate Parks, Underground Garage and Fountains and the Capitol Hill Historic District. These resources would experience visual changes with low to moderate visibility and have low to moderate sensitivity to such changes.

The City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Russel Senate Office Building; and Uline Ice Company Plant and Arena Complex would experience negligible adverse visual impacts. The potential Federal air-rights development in Alternative C would be visible from these resources. However, because of distance and intervening structures or vegetation, the changes would be barely noticeable and would not affect the resources' integrity. For the City Post Office/Postal Museum, while the potential Federal air-rights development would be visible from it, it would occupy almost the same space as the existing parking garage and this resource's sensitivity to the change would be low.

12.5.4.3 Construction Impacts

Construction of Alternative C (either option) would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction would result in moderate adverse impacts on three cultural resources; minor adverse impacts on one cultural resource; and negligible adverse impacts on 16 (East Option) or 14 (West Option) cultural resources. Noise and vibration from construction activities in Alternative C (either option) would result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on two cultural resources; and negligible adverse impacts on ten cultural resources.

The potential impacts of Alternative C on archaeological resources, if any are present in the rail terminal, would be the same as those of Alternative A. Both alternatives would involve excavating the rail terminal and potentially damaging or destroying undiscovered archeological resources (see **Section 12.5.2.3**, *Construction Impacts*).

Construction of Alternative C would take place in phases over approximately 12 years and 3 months. Other than the longer overall duration, changes to the visual would be as described for Alternative A in **Section 12.5.2.3**, *Construction Impacts*.

As described for Alternative A, these changes would result in moderate adverse impact on WUS, the WUS Historic Site, and the REA Building and in a minor adverse impact on the U.S. Capitol Dome viewshed.

Construction would also be visible from 14 (West Option) or 16 (East Option) other cultural resources to a degree that would vary with distance and the phase of construction. Under both options, these resources include: City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; GPO; GPO Warehouse No. 4; Library of Congress, Thomas Jefferson Building; Russell Senate Office Building; Senate Parks, Underground Garage, and Fountains; Square 750; St. Joseph's Home (former); Thurgood Marshall Federal Judiciary Building; Uline Ice Company Plant and Arena Complex; Woodward and Lothrop Service Warehouse; Capitol Hill Historic District; and the L'Enfant-McMillan Plan. In Alternative C with the East Option, Topham's Luggage Factory and 901 Second Street would additionally be affected. Distance combined with the moving focus of construction make the sensitivity of the affected cultural resources to construction activities at WUS low. Additionally, as previously noted, construction sites are a common sight in an urban environment. Visual impacts from construction would not affect the characteristics that give these resources their historic significance. Adverse impacts on these 14 or 16 resources would be negligible.

Most construction activities that would generate noise and vibration impacts would be the same in Alternative C as in Alternative A. Alternative C would take longer to complete and, therefore, some impacts would last longer, but most of the additional time would be due to a longer Phase 4. Phase 1 and associated excavation activities, including truck traffic, which would affect 2nd Street and the Capitol Hill Historic District most directly, would have the same duration in all Action Alternatives (5 months of excavation operations out of a total phase duration of 2 years and 5 months). Phases 2 and 3 would be the same or slightly shorter in Alternative C than in Alternative A. The longest excavation period would be in Phase 4 (approximately 2 years out of a total phase duration of 4 years). Regardless of the phase, duration would not affect the maximum noise and vibration levels experienced on which the evaluation of impacts on cultural resources is based.

The SOE in Alternative C would involve the construction of a sheet pile cutoff wall rather a secant pile cutoff wall as in Alternative A, with only slight differences in noise and vibration impacts. SOE noise impacts in the back of WUS and at the REA Building would be slightly less than in Alternative A (89 dBA and 91.8 dBA, respectively, against 90.1 dBA and 92.9 dBA) but the difference is negligible and levels would remain above the threshold for severe impact.

Therefore, the impacts of noise and vibration from the construction of Alternative C on cultural resources would the same as those of Alternative A, described in **Section 12.5.2.3**, *Construction Impacts.*

12.5.4.4 Comparison to the No-Action Alternative

The physical and noise-related operational impacts of Alternative C (either option) on cultural resources relative to the No-Action Alternative would generally be the same as those relative to existing conditions for the same reason as explained for Alternative A (**Section 12.5.2.4**, *Comparison to the No-Action Alternative*). Visual impacts on cultural resources relative to the No-Action Alternative would generally be less than relative to existing conditions because the mass of the private air-rights development above the rail terminal would mask Project elements from certain locations, eliminating or reducing visual impacts on some resources.

Relative to the No-Action Alternative, in Alternative C there would be:

- No visual impact on the Dirksen and Hart Senate Office Building (instead of a negligible indirect adverse visual impact relative to the existing conditions).
- No visual impact on the REA Building (instead of a major direct adverse impact relative to existing conditions).
- Negligible visual impact on Senate Parks, Underground Garage and Fountains (instead of a minor indirect adverse impact relative to existing conditions).
- No visual impacts on Square 750 Rowhouse Development (instead of minor direct adverse impacts in Alternative C East Option and negligible direct adverse impacts in Alternative C West Option relative to existing conditions).
- No visual impact on St. Joseph's Home (Former) (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on the Thurgood Marshall Federal Judiciary Building (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the Uline Ice Company Plant and Arena Complex (instead of a negligible indirect adverse impact relative to existing conditions).
- No visual impact on Woodward and Lothrop Service Warehouse (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the U.S. Dome Viewshed (instead of a moderate indirect adverse impact relative to existing conditions).
- Negligible visual impact on the Capitol Hill Historic District (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the L'Enfant-McMillan Plan (instead of a minor indirect adverse impact relative to existing conditions).
- Minor adverse visual impact on the WUS Historic Site (instead of a major direct adverse impact relative to existing conditions). Visual changes due to the train hall and new bus facility and parking facility would be highly visible but the sensitivity of the WUS Historic Site to these changes after it is covered with the private air-rights development would be low.

All other visual impacts would remain the same.

12.5.5 Alternative D

12.5.5.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative D would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

Alternative D would have major physical direct adverse impacts on WUS. The removal of the Claytor Concourse to make room for Concourse A, the new train hall, and the new bus facility, as well as the column removal work in the Retail and Ticketing Concourse would have the same impacts on the historic station building as Alternative A (see **Section 12.5.2.1**, *Direct Operational Impacts*).

Alternative D would also have major physical direct impacts on the WUS Historic Site because of the reconstruction of the rail terminal, excavation for the below-ground parking, and construction of the deck to support the new above-ground parking facility just south of K Street NE. Like all Action Alternatives that include below-ground parking, Alternative D would also require substantially altering the historic retaining wall under the K Street NE underpass (Burnham Wall) to provide access to the parking.

The potential adverse physical impact of Alternative D on the REA Building would be the same as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts.*

Visual Impacts

Relative to existing conditions, visual changes in Alternative D would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and the REA Building; moderate adverse direct operational impacts on one cultural resource; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct operational impacts on two cultural resources. They would also result in beneficial direct operational impacts on two cultural resources.

Alternative D would result in changes to the visual environment of ten cultural resources. Major adverse visual impacts on WUS would result from the construction of the bus facility and train hall behind the historic station building. These elements would not be visible above the roofline seen from the south but they would be highly visible from First Street and 2nd Street NE. These changes would alter the visual environment of WUS in a manner that would alter its integrity of setting, feeling, and association, resulting in a major adverse impact. Another highly visible change would result from the demolition of the existing parking garage. However, the existing garage is a historically incompatible addition and its removal would not adversely affect WUS.

Visual changes in Alternative D would also have a major adverse impact on the WUS Historic Site. The reconstruction of the rail terminal and the erection of the new bus facility and train hall would change the appearance of the WUS Historic Site south of the H Street Bridge. Additionally, the construction of a new above-ground parking facility on a deck just south of K Street NE would create a highly noticeable visual obstruction in a currently open part of the rail terminal. The new structures would be generally compatible with the character of the site as a historic train station and rail terminal and the demolition of the existing parking garage would remove from the terminal a historically incompatible structure and visual obstruction. However, the changes within the rail terminal taken together would very noticeably alter existing visual connections between its various components both south and north of the H Street Bridge. This would compromise the WUS Historic Site's integrity of setting, feeling, and association.

Visual changes in Alternative D would also have a major adverse impact on the REA Building. On the rail terminal side, the above-ground parking facility would be highly noticeable just to the north. Although tracks and platforms would remain visible from the building, the new parking facility would affect the visual relationship of the building to the rail terminal, a change to which REA building is highly sensitive and that would alter its integrity of setting, feeling, and association.

Alternative D would further result in moderate adverse visual impacts on Square 750 Rowhouse Development. The above-ground parking facility would be highly visible from this resource. It would stand at the western end of Parker Street NE, where it would close the view, instead of Substation 25A, with a noticeable increase in the height of the structure. However, Square 750 Rowhouse Development's sensitivity to this change is low. It has lost much of its integrity of feeling, association, and setting due to recent development nearby. Additionally, the volume of the parking facility as seen from the resource would be generally compatible with that of the surrounding buildings, limiting the intensity of the visual change.

Alternative D would have minor adverse visual impacts on the following two resources: Thurgood Marshall Federal Judiciary Building and the Woodward and Lothrop Service Warehouse. Elements of Alternative D would have moderate to high visibility from these resources but their sensitivity to these visual changes is low. Adverse impacts would be minor.

Alternative D would also result in negligible visual impacts on the St. Joseph's Home (Former) and the Uline Ice Company Plant and Arena Complex. While visible from these resources, the Alternative D elements would be inconspicuous and the resources have low sensitivity to such changes.

Finally, there would be beneficial impacts to the GPO and GPO Warehouse No. 4. This is because from these resources, the Alternative D elements would be less visible than the current existing parking garage, which would be demolished.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative D would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 cultural resources. Increased traffic volumes in Alternative D have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The noise and vibration impacts of Alternative D on cultural resources would be the same as those of Alternative A, which are described in **Section 12.5.2.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration Impacts*. The noise and vibration analysis documented in **Section 10.5.5.1**, *Direct Operational Impacts,* shows that everywhere noise levels in Alternative D would be within 0.2 dBA of those predicted for Alternative A, an imperceptible difference.

In Alternative D, because of the entrance of the parking facility on K Street NE, more traffic would travel along K Street and L Street NE and less traffic would travel along H Street NE and North Capitol Street than in Alternative A. However, analysis showed that this would not result in noticeably different ambient noise levels along those roadways.

Similarly, potential traffic impacts on the Capitol Hill Historic District would be as described for Alternative A (**Section 12.5.2.1** *Direct Operational Impacts, Traffic, Noise and Vibration Impacts*.) While the exact volumes of traffic that would travel along K Street NE and H Street NE may differ slightly between Alternative D and Alternative A, the difference would not be great enough to result in measurably greater or lesser impacts on the historic district.

12.5.5.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative D would have the following indirect operational impacts on cultural resources in addition to the alternative's direct impacts: moderate adverse visual impacts on two cultural resources; minor adverse visual impacts on two cultural resources; and negligible adverse visual impacts on five cultural resources.

In Alternative D, the Federal air rights above the area where the existing parking garage stands would potentially be developed to the maximum extent allowed by the zoning. The structure would have the same height as in Alternative A, with similar impacts. Because the east-west train hall and bus facility would push the potential Federal air-rights development further back from the station than under that alternative, it would be less visible from some resources.

Alternative D would have the following indirect impacts:

- Moderate adverse visual impacts on the L'Enfant-McMillan Plan and U.S. Capitol Dome Viewshed.

- Minor adverse visual impacts on Senate Parks, Underground Garage and Fountains and the Capitol Hill Historic District.
- Negligible adverse visual impacts on the City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); and the Russell Senate Office Building.

The potential Federal air-rights development (in addition to the direct visual impacts of Alternative D) would affect vistas along several street corridors that are part of the L'Enfant-McMillan Plan. The visibility of the development would vary according to the street and distance. Of the 28 views assessed in **Section 5.11,** *Aesthetic and Visual Quality* chapter, 19 contribute to the L'Enfant-McMillan Plan. The visibility of the potential Federal air-rights development from these 19 contributing views would vary for high to negligible. The visual assessment indicates that Alternative D would have major impacts on two of the 19 views, moderate impacts on five, minor impacts on three, negligible impacts on two, and a beneficial impact on one. No views would be obstructed but, in the aggregate, the changes in vistas in Alternative D would be sufficiently noticeable to amount to a moderate adverse impact on the L'Enfant-McMillan Plan.

Alternative D would also have a moderate adverse visual impact on the viewshed from the U.S. Capitol Dome. The potential Federal air-rights development would be highly visible from the dome. However, the vista has only be moderate sensitivity to this change, as the development would not rise above the horizon or block views along North Capitol Street or Delaware Avenue toward Columbus Plaza and the historic station building.

The potential Federal air rights would have low to moderate visibility the Senate Parks, Underground Garage, and Fountains and the Capitol Hill Historic District. These resources would be little sensitive to these visual changes and adverse impacts would be minor.

The City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former), and Russel Senate Office Building would experience negligible adverse visual impacts. The potential Federal air-rights development in Alternative D would be visible from these resources. However, because of distance and intervening structures or vegetation, the changes would be barely noticeable and would not affect the resources' integrity. For the City Post Office/Postal Museum, while the Alternative D elements would be visible from this resource, they would occupy almost the same volume as the existing parking garage and this resource's sensitivity to the change would be low.

12.5.5.3 Construction Impacts

Construction of Alternative D would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction would result in moderate adverse impacts on three cultural resources; minor adverse impacts on three cultural resource; and negligible adverse impacts on 12 cultural resources.

Noise and vibration from construction activities in Alternative D would also result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on two cultural resources; and negligible adverse impacts on ten cultural resources.

The potential impacts of Alternative D on archaeological resources, if any are present in the rail terminal, would be the same as those of Alternative A, as both alternatives would involve excavating the rail terminal and potentially damaging or destroying undiscovered archeological resources (See **Section 12.5.2.3**, *Construction Impacts*).

Construction of Alternative D would take place in phases over approximately 12 years and 3 months. Other than the longer overall duration, changes to the visual would be as described for Alternative A in **Section 12.5.2.3**, *Construction Impacts*.

As described for Alternative A, these changes would result in moderate adverse impact on WUS, the WUS Historic Site, and the REA Building and in a minor adverse impact on the U.S. Capitol Dome Viewshed. They would also result in minor adverse impacts on Square 750 Rowhouse Development and the L'Enfant-McMillan Plan. From these resources, construction activities would be highly visible but the resources' sensitivity to such changes is low.

Construction of Alternative D would also have negligible visual impacts on the following 12 resources: City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; GPO; GPO Warehouse No. 4; Library of Congress, Thomas Jefferson Building; Russell Senate Office Building; Senate Parks, Underground Garage, and Fountains; St. Joseph's Home (Former); Thurgood Marshall Federal Judiciary Building; Uline Ice Company Plant and Arena Complex ; Woodward and Lothrop Service Warehouse; and Capitol Hill Historic District. Distance combined with the moving focus of construction make the sensitivity of these cultural resources to construction activities at WUS low. Additionally, as previously noted, construction sites are a common sight in an urban environment. Visual impacts from construction would not affect the characteristics that give these resources their historic significance. Adverse impacts on the 12 resources would be negligible.

Construction activities that would generate noise and vibration impacts would be the same in Alternative D as in Alternative C. These impacts are described in **Section 12.5.4.3**, *Construction Impacts*.

12.5.5.4 Comparison to the No-Action Alternative

The physical and noise-related operational impacts of Alternative D on cultural resources relative to the No-Action Alternative would generally be the same as those relative to existing conditions for the same reason as explained for Alternative A (**Section 12.5.2.4**, *Comparison to the No-Action Alternative*). Visual impacts on cultural resources relative to the No-Action Alternative would generally be less than relative to existing conditions because the mass of the private air-rights development above the rail terminal would mask Project elements from certain locations, eliminating or reducing visual impacts on some resources. Relative to the No-Action Alternative, in Alternative D there would be:

- No visual impact on the Dirksen and Hart Senate Office Building (instead of a negligible indirect adverse impact relative to the existing conditions).
- No visual impact on the REA Building (instead of a major direct adverse impact relative to existing conditions).
- No visual impact to Square 750 Rowhouse Development (instead of a moderate direct adverse impact relative to existing conditions).
- No visual impact on St. Joseph's Home (Former) (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on the Thurgood Marshall Federal Judiciary Building (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the Uline Ice Company Plant and Arena Complex (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on Woodward and Lothrop Service Warehouse (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the U.S. Dome Viewshed (instead of a moderate indirect adverse impact relative to existing conditions).
- Negligible visual impact on Senate Parks, Underground Garage and Fountains (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the Capitol Hill Historic District (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the L'Enfant-McMillan Plan (instead of a moderate indirect adverse impact relative to existing conditions).
- Minor visual adverse impact on the WUS Historic Site (instead of a major direct adverse impact relative to existing conditions).

All other visual impacts would remain the same.

12.5.6 Alternative E

12.5.6.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative E would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

Alternative E would have major physical adverse direct impacts on WUS. The removal of the Claytor Concourse to make room for Concourse A, the new train hall, and the new bus facility, as well as the column removal work in the Retail and Ticketing Concourse would have the same impacts on the historic station building as in Alternative A (see **Section 12.5.2.1**, *Direct Operational Impacts*).

Alternative E would also have a major physical direct impact on the WUS Historic Site because of the reconstruction of the rail terminal and excavation for the below-ground parking. Like all Action Alternatives that include below-ground parking, Alternative E would also require substantially altering the historic retaining wall under the K Street NE underpass (Burnham Wall) to provide access.

The potential adverse physical impact of Alternative E on the REA Building would be the same as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts.*

Visual Impacts

Relative to existing conditions, visual changes in Alternative E would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and the REA Building; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct operational impacts on two cultural resources. They would also result in beneficial direct operational impacts on two resources.

Alternative E would result in changes to the visual environment of nine cultural resources. On WUS, these changes would have the same major adverse impacts as in Alternative D, described in **Section 12.5.5.1**, *Direct Operational Impacts, Visual Impacts*. Visual changes in Alternative E would have the major adverse impacts on the WUS Historic Site similar to those of Alternative B, which are described in **Section 12.5.3.1**, *Direct Operational Impacts, Visual Impacts*. Major adverse impacts on the REA Building would be similar to those described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Visual Impacts*.

Alternative E would further result in minor adverse visual impacts on the following resources: the Thurgood Marshall Federal Judiciary Building and the Woodward and Lothrop Service Warehouse. Elements of Alternative E would be moderately to highly visible from these resources, but they have low sensitivity to such changes and their integrity of setting, feeling, or association would not be compromised. Alternative E would also result in negligible visual impacts on Square 750 Rowhouse Development and St. Joseph's Home (Former). Both the visibility of the alternative's element and the resources' sensitivity to them would be low.

Finally, there would be beneficial impacts on the GPO and GPO Warehouse No. 4. This is because the Alternative E elements would less visible from these resources than the existing parking garage, which would be demolished.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative E would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 cultural resources. Increased traffic volumes in Alternative E have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The noise and vibration impacts of Alternative E on cultural resources would be the same as those of Alternative A, which are described in **Section 12.5.2.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration Impacts*. The noise and vibration analysis for Alternative E, documented in **Section 10.5.6.1**, *Direct Operational Impacts*, shows that everywhere noise levels in this alternative would be within 0.2 dBA of those predicted for Alternative A, an imperceptible difference.

In Alternative E, because of the entrance of the parking facility on K Street NE, more traffic would travel along K Street and L Street NE and less traffic would travel along H Street NE and North Capitol Street than in Alternative A. However, analysis showed that this would not result in noticeably different ambient noise levels along those roadways.

Similarly, potential traffic impacts on the Capitol Hill Historic District would be as described for Alternative A (**Section 12.5.2.1** *Direct Operational Impacts, Traffic, Noise and Vibration Impacts*.) While the exact volumes of traffic that would travel along K Street NE and H Street NE may differ slightly between Alternative E and Alternative A, the difference would not be great enough to result in measurably greater or lesser impacts on the historic district.

12.5.6.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative E would have the following indirect operational impacts on cultural resources in addition to the alternative's direct impacts: moderate adverse visual impacts on one cultural resource; minor adverse visual impacts on three cultural resources; and negligible adverse visual impacts on six cultural resources.

In Alternative E, the Federal air rights in the area where the existing parking garage stands would potentially be developed to the maximum extent allowed by the zoning. The structure would have the same height as in Alternative A, with similar impacts. Because the east-west train hall and bus facility would push the potential Federal air-rights development further back from the station than under that alternative, it would be less visible from some resources.

As a result, Alternative E would have the following indirect impacts:

- Moderate adverse visual impacts on the U.S. Capitol Dome Viewshed.

- Minor adverse visual impacts on the L'Enfant-McMillan Plan; Senate Parks, Underground Garage and Fountains; and Capitol Hill Historic District.
- Negligible adverse visual impacts on City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Russel Senate Office Building; and Uline Ice Company Plant and Arena Complex.

Alternative E would have a moderate adverse visual impact on the viewshed from the U.S. Capitol Dome. The potential Federal air rights would be highly visible from the dome. However, the view would be only moderately sensitive to the change because the new structure would not rise above the horizon or block views along North Capitol Street or Delaware Avenue toward Columbus Plaza and the station building.

The potential Federal air-rights development (in addition to the direct visual impacts of Alternative E) would affect vistas along several street corridors that are part of the L'Enfant-McMillan Plan. The visibility of the development would vary according to the street and distance. Of the 28 views assessed in **Section 5.11**, *Aesthetic and Visual Quality* chapter, 19 contribute to the L'Enfant-McMillan Plan. The visibility of the potential Federal air-rights development from these 19 contributing views would vary for high to negligible. The visual assessment indicates that Alternative E would have major impacts on two of the 19 views, moderate impacts on three, minor impacts on four, negligible impacts on three, and a beneficial impact on one. In the aggregate, such changes in vistas would be visible from a few locations but they would not affect the L'Enfant-McMillan Plan's integrity of setting, feeling, or association. No views would be obstructed. The overall adverse impact would be minor.

The potential Federal air rights in Alternative E would have low to moderate visibility from the Senate Parks, Underground Garage, and Fountains and the Capitol Hill Historic District. These resources would be little sensitive to these visual changes and adverse impacts would be minor.

The City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Russel Senate Office Building; and Uline Ice Company Plant and Arena Complex would experience negligible adverse visual impacts. The potential Federal air-rights development in Alternative E would be visible from these resources. However, because of distance and intervening structures or vegetation, the changes would be barely noticeable and would not affect the integrity of the resources. For the City Post Office, while the Alternative E elements would be visible from this resource, they would occupy almost the same space as the existing parking garage and this resource's sensitivity to the change would be low.

12.5.6.3 Construction Impacts

Alternative E's construction would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction

would result in moderate adverse impacts on three cultural resources; minor adverse impacts on one cultural resource; and negligible adverse impacts on 14 cultural resources. Noise and vibration from construction activities would result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on three cultural resources; and negligible adverse impacts on nine cultural resources.

The potential impacts of Alternative E on archaeological resources, if any are present in the rail terminal, would be the same as those of Alternative A. Both alternatives would involve excavating the rail terminal and may potentially damage or destroy undiscovered archeological resources (see **Section 12.5.2.3**, *Construction Impacts*).

Construction of Alternative E would take place in phases over approximately 14 years and 4 months. Other than the longer overall duration, changes to the visual environment and resulting impacts on cultural resources would be the same as in Alternative A and are described in **Section 12.5.2.3**, *Construction Impacts*.

As described for Alternative A, these changes would result in moderate adverse impact on WUS, the WUS Historic Site, and the REA Building and in a minor adverse impact on the U.S. Capitol Dome Viewshed.

Construction of Alternative E would also be visible from 14 cultural resources: City Post Office/Postal Museum; Dirksen and Hart Senate Office Buildings; GPO Office; GPO Warehouse No. 4; Library of Congress, Thomas Jefferson Building; Russell Senate Office Building; Senate Parks, Underground Garage, and Fountains; Square 750 Rowhouse Development; St. Joseph's Home (Former); Thurgood Marshall Federal Judiciary Building; Uline Ice Company Plant and Arena Complex; Woodward and Lothrop Service Warehouse; Capitol Hill Historic District; and the L'Enfant-McMillan Plan.

Distance combined with the moving focus of construction make the sensitivity of these cultural resources to construction activities at WUS low. Additionally, as previously noted, construction sites are a common sight in an urban environment. Visual impacts from construction would not affect the characteristics that give these resources their historic significance. Adverse impacts on the 14 resources would be negligible.

Construction activities that would generate noise and vibration impacts would be the same in Alternative E as in Alternative B. Therefore, impacts from construction noise and vibration on cultural resources in Alternative E would be as described for Alternative B in **Section 12.5.3.3**, *Construction Impacts*.

12.5.6.4 Comparison to the No-Action Alternative

The physical and noise-related operational impacts of Alternative E on cultural resources relative to the No-Action Alternative would generally be the same as those relative to existing conditions for the same reason as explained for Alternative A (see **Section 12.5.2.4**, *Comparison to the No-Action Alternative*). Visual impacts on cultural resources relative to the

No-Action Alternative would generally be less than relative to existing conditions because the mass of the private air-rights development above the rail terminal would mask Project elements from certain locations, eliminating or reducing visual impacts on some resources. Relative to the No-Action Alternative, in Alternative E there would be:

- No visual impact on the Dirksen and Hart Senate Office Building (instead of a negligible indirect adverse impact relative to the existing conditions).
- No visual impact on the REA Building (instead of a major direct adverse impact relative to existing conditions).
- No visual impact to Square 750 Rowhouse Development (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on St. Joseph's Home (Former) (instead of a negligible direct adverse impact relative to existing conditions).
- No visual impact on the Thurgood Marshall Federal Judiciary Building (instead of a minor direct adverse impact relative to existing conditions).
- No visual impact on the Uline Ice Company Plant and Arena Complex (instead of a negligible indirect adverse impact relative to existing conditions).
- No visual impact on the U.S. Dome Viewshed (instead of a moderate indirect adverse impact relative to existing conditions).
- No visual impact on Woodward and Lothrop Service Warehouse (instead of a minor direct adverse impact relative to existing conditions).
- Negligible impact on Senate Parks (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the Capitol Hill Historic District (instead of a minor indirect adverse impact relative to existing conditions).
- Negligible visual impact on the L'Enfant-McMillan Plan (instead of a minor indirect adverse impact relative to existing conditions).
- Minor visual adverse impact on the WUS Historic Site (instead of a major direct adverse impact relative to existing conditions).

All other visual impacts would remain the same.

12.5.7 Alternative A-C (Preferred Alternative)

12.5.7.1 Direct Operational Impacts

Physical Impacts

Relative to existing conditions, Alternative A-C would have major adverse direct operational physical impacts on WUS and the WUS Historic Site. It would have a potential adverse direct operational physical impact on the REA Building.

Alternative A-C would have major physical adverse direct impacts on WUS. The removal of the Claytor Concourse to make room for Concourse A and the new train hall, as well as the column removal work in the Retail and Ticketing Concourse, would have the same impacts on the historic station building as in Alternative A. Like Alternative A as well, Alternative A-C would have a major direct impact on the WUS Historic Site because of the reconstruction of the rail terminal. These impacts are described in **Section 12.5.2.1**, *Direct Operational Impacts*. Alternative A-C would have the same potential adverse physical impact on the REA Building Alternative A, described in **Section 12.5.2.1**, *Direct Operational Impacts, Physical Impacts.*

Visual Impacts

Relative to existing conditions, visual changes in Alternative A-C would result in major adverse direct operational impacts on WUS, the WUS Historic Site, and the REA Building; minor adverse direct operational impacts on two cultural resources; and negligible adverse direct operational impacts on two cultural resources. They would also result in beneficial direct operational impacts on one cultural resource.

Alternative A-C would cause changes in the visual environment of eight cultural resources. These changes would have a major adverse impact on the WUS Historic Site. With the reconstruction of the rail terminal and the erection of the east-west train hall, bus facility, and parking facility, Alternative A-C would change the appearance of the historic site and alter existing visual connections between its various components.

The change would be especially noticeable from the north. Seen from there, the new bus facility and parking facility would partially hide the rail terminal and the back of the historic station building. The existing parking garage, a historically incompatible addition, already masks part of the historic station building. The new structure, while taller and highly visible, would be compatible with the character of the site as a historic train station and rail terminal. However, the sensitivity of the WUS Historic Site to these changes is high and they would compromise its character-defining features and integrity of setting, feeling, and association.

Visual changes would also result in major adverse impacts on WUS. The top of the new parking facility would be visible above the historic station building’s roofline from Delaware and Louisiana Avenues. From that perspective, this would introduce a noticeable asymmetry in the view of the station. This visual change would be highly noticeable and the sensitivity of this resource is high. Therefore, adverse visual impacts would be major.

Alternative A-C would also have a major adverse visual impact on the REA Building. The building stands to the north of H Street NE, along the eastern edge of the Project Area. The above-ground elements of Alternative A-C would all be south of H Street NE. Views toward the REA Building from the east would not change. However, on the rail terminal side, while the building would maintain a visual connection with the tracks, the reconstruction of the rail terminal would change the character of this connection as in the other Action Alternatives. The bus facility and parking facility to the southwest would be visible, although the H Street Bridge and the existing parking garage would partly obstruct views in that direction. The changes in the visual environment would be highly noticeable and the resource's sensitivity to these changes is high, resulting in major adverse visual impacts.

Alternative A-C would have minor adverse visual impacts on the Thurgood Marshall Federal Judiciary Building and the Woodward and Lothrop Service Warehouse, negligible adverse impacts on Square 750 Rowhouse Development and St. Joseph's Home (Former), and a beneficial impact on GPO Warehouse No. 4, as described for Alternative A in **Section 12.5.2.1**, *Direct Operational Impacts, Visual Impacts*.

Traffic, Noise, and Vibration Impacts

Relative to existing conditions, noise and vibration in Alternative A-C would result in minor adverse direct operational impacts on three cultural resources and negligible adverse direct operational impacts on 15 other cultural resources. Increased traffic volumes in Alternative A-C have the potential to further result in an adverse direct operational impact on the Capitol Hill Historic District from visual impacts, conflicts with pedestrians and bicyclists, and disturbances affecting access to homes and businesses.

The traffic, noise, and vibration-related impacts of Alternative A-C on cultural resources would be the same as those of Alternative A, described in **Section 12.5.2.1**, *Direct Operational Impacts, Traffic, Noise, and Vibration Impacts*.

12.5.7.2 Indirect Operational Impacts

Relative to existing conditions, with the potential Federal air-rights development, visual changes in Alternative A-C would have the following indirect operational impacts on cultural resources in addition to the direct impacts: moderate adverse visual impact on one cultural resource; minor adverse visual impacts on five cultural resources; and negligible adverse visual impacts on six cultural resources.

In Alternative A-C, the remaining Federal air rights above and next to the bus facility and parking facility would potentially be developed, to a height not exceeding the 130-foot height limit allowing by the anticipated zoning for the area. The change would be small relative to the scale of the entire structure and the volume of space occupied by the entire structure would be similar to what it would be in Alternative A. Therefore, the indirect visual impacts of Alternative A-C would be the same as Alternative A. In addition to the direct impacts, Alternative A-C would have the following indirect impacts:

- Moderate adverse visual impacts on the U.S. Capitol Dome Viewshed.
- Minor adverse visual impacts on the City Post Office/Postal Museum; Senate Parks, Underground Garage and Fountains; Columbus Plaza; L'Enfant-McMillan Plan; and Capitol Hill Historic District.
- Negligible adverse visual impacts on Dirksen and Hart Senate Office Buildings; GPO; Library of Congress, Thomas Jefferson Building; St. Joseph's Home (Former); Uline Ice Company Plant and Arena Complex; and Russel Senate Office Building.

Impacts would be as described for Alternative A in **Section 12.5.2.2**, *Indirect Impacts*.

12.5.7.3 Construction Impacts

Alternative A-C's construction would potentially result in an adverse impact on unidentified archaeological resources within the WUS rail terminal. Visual changes during construction would result in moderate adverse impacts on three cultural resources; minor adverse impacts on one; and negligible adverse impacts on 15. Noise and vibration from construction activities would result in major adverse impacts on WUS and the REA Building; moderate adverse impacts on five cultural resources; minor adverse impacts on two cultural resources; and negligible adverse impacts on ten cultural resources.

Construction of Alternative A-C would involve activities similar to those of Alternative A and would take the same amount of time. Impacts to cultural resources would be the same as in Alternative A and are described in **Section 12.5.2.3**, *Construction Impacts*.

12.5.7.4 Comparison to the No-Action Alternative

Because the impacts of Alternative A-C relative to existing conditions would be the same or similar to those of Alternative A, impacts relative to the No-Action Alternative would also be the same. These impacts are addressed in **Section 12.5.2.4**, *Comparison to the No-Action Alternative* above.

12.6 Comparison of Alternatives

Table 12-2 presents a comparison of the impacts of the No-Action Alternative and the Action Alternatives on each of the 55 cultural resources in the Study Area.

All Action Alternatives would result in major adverse direct operational physical impacts on WUS and the WUS Historic Site, and a potential adverse operational physical impact on the REA Building. This is because these impacts would be caused by elements that are common to all Action Alternatives.

Table 12-2. Summary of Assessment of Impacts by Alternative

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
1. Acacia Building	**All**		No impact							
2. August Apartment Building	**All**		No impact							
3. C&P Telephone Company Warehouse	**Operational Direct**	**Physical**	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	No impact							
		T/N/V	Potential adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
4. Capitol Press Building (former)	**Operational Direct**	**Physical**	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	No impact							
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
5. City Post Office/Postal Museum	**Operational Direct**	**Physical**	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	Minor adverse	Minor adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Minor adverse
	Construction	**Physical**	No impact							
		Visual	No impact	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
6. Dirksen and Hart Senate Office Buildings	Operational Direct	Physical	No impact							
		Visual	Negligible adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	Physical	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	No impacts							
7. Eckington Power Plant; Coach Yard Power Plant	All		No impact							
8. Engine Company No. 3	All		No impact							
9. Garfield Memorial	All		No impact							
10. Gonzaga College High School	All		No impact							
11. Government Printing Office (GPO)	Operational Direct	Physical	No impact							
		Visual	No impact	No impact	No impact	Beneficial	Beneficial	Beneficial	Beneficial	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	No impact	No impact	No impact	No impact	Negligible adverse
	Construction	Physical	No impact							
		Visual	No impact	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	No impact							
12. Government Printing Office Warehouse No. 4	Operational Direct	Physical	No impact							
		Visual	No impact	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	Construction	Physical	No impact							
		Visual	No impact	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
		T/N/V	Undetermined	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
13. Haye School	All		No impact							
14. Holodomor Ukrainian Holocaust Memorial	Operational Direct	Physical	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	Construction	Physical	No impact							
		Visual	No impact							
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
15. Japanese American Memorial to Patriotism During WWII	All		No impact							
16. Joseph Gales School	All		No impact							
17. Library of Congress, Thomas Jefferson Building	Operational Direct	Physical	No impact							
		Visual	Negligible adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	Physical	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	No impact							
18. M Street High School (Perry School)	All		No impact							
19. Major General Nathanael Greene Statue	All		No impact							
20. Mountjoy Bayly House	All		No impact							
21. Peace Memorial	All		No impact							
22. REA Building	Operational Direct	Physical	No impact	Potential adverse						
		Visual	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
		T/N/V	No impact							
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
		T/N/V	Potential adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
23. Robert A. Taft Memorial	**All**		No impact							
24. Russell Senate Office Building	**Operational Direct**	**Physical**	No impact							
		Visual	Negligible adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	No impact							
25. Senate Parks, Underground Garage and Fountains	**Operational Direct**	**Physical**	No impact							
		Visual	Minor adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	No impact							
26. Sewall-Belmont House	**All**		No impact							
27. Square 750 Rowhouse Development	**Operational Direct**	**Physical**	No impact							
		Visual	Moderate adverse	Negligible adverse	Negligible adverse	Minor adverse	Negligible adverse	Moderate adverse	Negligible adverse	Negligible adverse
		T/N/V	Negligible adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Minor adverse	Negligible adverse	Negligible adverse
		T/N/V	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
28. St. Aloysius Catholic Church	Operational Direct	Physical	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
		Visual	No impact							
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
29. St. Joseph's Home (Former)	Operational Direct	Physical	No impact							
		Visual	Minor adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	Negligible adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	Physical	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
30. St. Phillip's Baptist Church	Operational Direct	Physical	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
		Visual	No impact							

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
31. Sun Trust Building (Former Child's Restaurant)	All		No impact							
32. The Summerhouse	All		No impact							
33. Thurgood Marshall Federal Judiciary Building	Operational Direct	Physical	No impact							
	Operational Direct	Visual	Moderate adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Operational Direct	T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
	Construction	Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
34. Topham's Luggage Factory (Former)	Operational Direct	Physical	No impact							
	Operational Direct	Visual	Moderate adverse	No impact	No impact	Minor adverse	No impact	No impact	No impact	No impact
	Operational Direct	T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
	Construction	Visual	Potential adverse	No impact	No impact	Negligible adverse	No impact	No impact		
	Construction	T/N/V	Potential adverse	Negligible adverse	Minor adverse	Negligible adverse	Negligible adverse	Negligible adverse	Minor adverse	Negligible adverse
35. Uline Ice Company Plant and Arena Complex	Operational Direct	Physical	No impact							
	Operational Direct	Visual	Minor adverse	No impact	No impact	No impact	No impact	Negligible adverse	No impact	No impact
	Operational Direct	T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	No impact	Negligible adverse	Negligible adverse
	Construction	Physical	No impact							
	Construction	Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Construction	T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
36. United States Capitol	**All**		No impact							
37. United States Capitol Square	**All**		No impact							
38. United States Supreme Court	**All**		No impact							
39. Victims of Communism Memorial	**All**		No impact							
40. Washington Union Station	**Operational Direct**	**Physical**	Potential adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
		Visual	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
		T/N/V	Potential adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
41. Washington Union Station Plaza (Columbus Plaza) and Columbus Fountain	**Operational Direct**	**Physical**	No impact							
		Visual	Minor adverse		Indirect	No impact	No impact	No impact	No impact	No impact
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	Minor adverse	Minor adverse	No impact	No impact	No impact	No impact	Minor adverse
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	No impact	No impact	No impact	No impact	Negligible adverse
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
42. Woodward and Lothrop Service Warehouse	**Operational Direct**	**Physical**	No impact							
		Visual	Moderate adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
43. 901 Second Street NE	**Operational Direct**	**Physical**	No impact							
		Visual	Moderate adverse	No impact	No impact	Minor adverse	No impact	No impact	No impact	No impact
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	**Physical**	No impact							
		Visual	Potential adverse	No impact	No impact	Negligible adverse	No impact	No impact	No impact	No impact
		T/N/V	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
44. Capitol Hill Historic District	**Operational Direct**	**Physical**	No impact							
		Visual	Minor adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse
	Operational Indirect		N/A	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
		T/N/V	Potential adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
45. L'Enfant-McMillan Plan	**Operational Direct**	**Physical**	No impact							
		Visual	Moderate adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Moderate adverse	Minor adverse	Minor adverse
	Construction	**Physical**	No impact							
		Visual	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Minor adverse	Negligible adverse	Negligible adverse
		T/N/V	No impact							
46. National Mall District	**All**		No impact							
47. Pennsylvania Avenue National Historic Site	**All**		No impact							

Cultural Resource	Impact Type		No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
48. Union Market Historic District	Operational Direct	Physical	No impact							
		Visual	No impact							
		T/N/V	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical	No impact							
		Visual	No impact							
		T/N/V	Potential adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse
49. Washington Union Station Historic Site (Expanded Boundary)	Operational Direct	Physical	Potential adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
		Visual	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse	Major adverse
		T/N/V	No impact							
	Operational Indirect		N/A	No impact	No impact	No impact	No impact	No impact	No impact	No impact
	Construction	Physical (archaeology)	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse	Potential adverse
		Visual	Potential adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
		T/N/V	No impact							
50. Arlington National Cemetery Viewshed	Visual		No impact							
51. Old Post Office Building Viewshed	Visual		Negligible adverse							
52. St. Elizabeth's West Campus Viewshed	Visual		No impact							
53. U.S. Capitol Dome Viewshed	Operational Direct	Physical	No impact							
		Visual	Moderate adverse	No impact	No impact	No impact	No impact	No impact	No impact	No impact
		T/N/V	No impact							
	Operational Indirect		N/A	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
	Construction	Physical	No impact							
		Visual	Potential adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse	Minor adverse
		T/N/V	No impact							

Cultural Resource	Impact Type	No-Action	Alternative A	Alternative B	Alternative C East	Alternative C West	Alternative D	Alternative E	Alternative A-C
54. Washington National Cathedral Viewshed	**Visual**	No impact							
55. Washington National Monument Viewshed	**Visual**	Negligible adverse							

All Action Alternatives would involve the removal of the Claytor Concourse and construction of various Project elements (Concourse A, bus facility, train hall) adjacent to the historic station building as well as partial demolition and replacement of the floor structure in the Retail and Ticketing Concourse to allow for the removal of columns from the underlying First Street Tunnel. All Action Alternatives would also involve excavating and reconstructing the rail terminal, as well as placing overbuilt Project elements within portions of the terminal that are currently open. All Action Alternatives would also require using land within the REA Building historic property parcel to build the H Street Concourse and modifying or eliminating the connection between the H Street Tunnel and the building.

In all Action Alternatives as well, excavation could result in the destruction or damage of archaeological resources if any are present. The depth of excavation would vary depending on the Action Alternative (least deep in Alternatives A and A-C, most deep in Alternatives B and E). However, any archaeological resources, if present, would be just below the fill that underlies the existing rail terminal. Even the less deep excavation in Alternatives A and A-C would disturb this potentially sensitive layer. Deeper excavation in the other Alternatives would not increase the likelihood of encountering archaeological remnants.

All Action Alternatives would also have adverse direct and indirect visual impacts on several cultural resources in and near the Project Area. As shown in **Table 12-3**, the alternatives would all have direct visual impacts on a similar number of resources, with Alternative C East Option affecting the most (adverse impacts on nine resources) and Alternative A, B, C West Option, E, and A-C affecting the least (adverse impacts on seven resources each). All Action Alternatives would result in major adverse direct visual impacts on WUS, the WUS Historic Site, and the REA Building because the reconstruction of the rail terminal and construction of above-ground project elements would substantially alter the visual environment of these resources and alter significant visual connections.

Table 12-4 presents the resources that would experience indirect visual impacts from the potential Federal air-rights development. Alternatives A, B, and A-C would have indirect visual impacts on twelve resources, Alternative C and Alternative E on ten, and Alternative D on nine.

Table 12-3. Summary of Direct Visual Impacts by Action Alternative

Intensity of Impact	Number of impacted Resources						
	Alternative A	Alternative B	Alternative C, East Option	Alternative C, West Option	Alternative D	Alternative E	Alternative A-C (Preferred)
Beneficial	1	1	2	2	2	2	1
Negligible	2	2	1	2	2	2	2
Minor	2	2	5	2	2	2	2
Moderate	0	0	0	0	1	0	0
Major	3	3	3	3	3	3	3

Table 12-4. Summary of Indirect Visual Impacts by Action Alternative

Intensity of Impact	Number of impacted Resources						
	Alternative A	Alternative B	Alternative C, East Option	Alternative C, West Option	Alternative D	Alternative E	Alternative A-C (Preferred)
Negligible	6	6	6	6	5	6	6
Minor	5	5	3	3	2	3	5
Moderate	1	1	1	1	2	1	1

All Action Alternatives would result in similar impacts from noise and vibration. There would be differences in traffic patterns between the alternatives with only below-ground parking accessed via K Street NE in Alternatives B and E; both below-ground parking accessed via K Street NE and above-ground parking accessed via H Street NE in Alternatives C and D; and only above-ground parking accessed via H Street NE in Alternatives A and A-C. However, noise impact analysis showed that the resulting differences in ambient noise levels would be too small to be perceptible (see **Section 10**, *Noise and Vibration*, of this report). In all Action Alternatives, construction vibration could exceed the threshold for structural damage at WUS and the REA Building and to result in major adverse impacts. However, this would depend on the sensitivity of the buildings, which has not been determined.

All Action Alternatives would generate additional traffic along the northwestern edge of the Capitol Hill Historic District (2nd Street NE and H Street NE) and create a ramp connecting the deck to F Street NE eastbound. Congestion near WUS could potentially also result in some traffic seeking alternative routes through the historic district. The potential for such impacts to affect the Capitol Hill Historic District's integrity of setting or feeling would be the same in all Action Alternatives.

The No-Action Alternative would cause less physical adverse impacts to WUS than the Action Alternatives. It would also have less potential to affect undiscovered archaeological resources because it would involve much less ground-disturbing work in the rail terminal. However, its visual impacts would be greater than in all the Action Alternatives because, in the No-Action Alternative, the private air-rights development project would cover the entirety of the rail terminal south of K Street NE with highly visible structures. Additionally, the existing WUS parking garage, a structure incompatible with the historic character of WUS, would remain in place in the No-Action Alternative. In the Action Alternatives, it would be either replaced with a new structure or removed.

12.7 Avoidance, Minimization, and Mitigation Evaluation

Adverse impacts would be avoided, minimized, or mitigated through the Section 106 process. Resources on which the Action Alternatives may have a major adverse impact (WUS, WUS Historic Site, and REA Building) are those that would experience an adverse effect under

Section 106. Per 36 CFR 800.6, a finding of adverse effect requires that Section 106 consultation continue to avoid, minimize, or mitigate effects to historic properties that would alter the characteristics that qualify the properties for inclusion in the NRHP.

Because the design of the Project is in its early stages, FRA anticipates preparing a Programmatic Agreement (PA) to establish a process to resolve the known adverse effects of the Project in accordance with 36 C.F.R. § 800.14(b)(1)(ii). This would include the exploration of avoidance and minimization measures. In addition, the PA would establish a process for on-going consultation and review as the level of design progresses following the Final EIS and a Record of Decision (ROD) (and subject to funding) to ensure that form, materials, architectural features, and connections (visual and physical) to surrounding development are considered. FRA anticipates the PA would outline coordinated design review in the context of Federal and District regulations and guidelines.

FRA would develop the PA in consultation with the DC SHPO and the Section 106 Consulting Parties. Members of the public and the Consulting Parties are being invited to comment on the adverse effects to historic properties documented in the Draft AOE and the impacts on cultural resources presented in this DEIS. They are also invited to express their views on resolving adverse effects.

12.8 Permits and Regulatory Compliance

After the ROD and execution of the PA, Project design would proceed and undergo further review by the National Capital Planning Commission and the Commission of Fine Arts in the context of Federal and District of Columbia regulations and guidelines including:

- The National Capital Planning Commission, *The Comprehensive Plan for the National Capital Urban Design Element* and *Historic Preservation Element*;
- Executive Order (EO) 1259, *Commission of Fine Arts Review of Public Buildings in the District of Columbia Proposed by the Federal or DC governments*;
- EO 1862, *CFA Review of New Structures and Matters of Art Proposed by the Federal Government in DC*;
- EO 11593, *Protection and Enhancement of the Cultural Environment*;
- The Historic Landmark and Historic District Protection Act of 1978 (D. Law 2-144, as amended through October 1, 2016);
- The Height of Buildings Act of 1910; and
- District of Columbia Municipal Regulations, Zoning Regulations Special Purpose Zones, 11-K DCMR 305.

13 Parks and Recreation Areas

13.1 Overview

This section addresses the potential impacts of the No-Action Alternative and the Action Alternatives on parks and recreation areas. These include public parks, private parks open to the public, off-street bicycle trails and walking paths, and other areas used for general recreation. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies relevant permitting and regulatory compliance requirements.

13.2 Regulatory Context

Relevant Federal and District policies, regulations, and guidance pertaining to parks and recreation areas include:

- National Park Service (NPS) Organic Act of 1916 (16 USC Sections 1-4). NPS, an agency within the Department of the Interior, was created under the NPS Organic Act (16 USC Sections 1-4) to administer the nation's national parks, which are areas of national significance afforded special recognition and protection. NPS is a cooperating agency for the Environmental Impact Statement (EIS) for the Project. NPS has jurisdiction over some of the parks and recreation areas near the proposed Project.
- NPS Director's Order 12.[1] This order sets the policies and procedures by which the NPS complies with the National Environmental Policy Act (NEPA).
- NPS NEPA Handbook.[2] This handbook sets the policies and procedures by which the NPS complies with NEPA.

1 United States Department of the Interior, National Park Service. October 5, 2011. *Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-Making.* Accessed from https://www.nps.gov/policy/dorders/do_12.pdf. Accessed on June 11, 2018.

2 United States Department of the Interior, National Park Service. 2015. *NEPA Handbook.* Accessed from https://www.nps.gov/subjects/nepa/upload/NPS_NEPAHandbook_Final_508.pdf. Accessed on June 7, 2017.

- National Capital Planning Commission and District of Columbia Parks and Recreation, *Comprehensive Plan for the National Capital* (2011)[3]. The plan contains both Federal and District specific elements. The Federal elements include a section on parks and open space, and the District elements include additional guidance on parks and recreation areas at a higher resolution than the Federal elements.

13.3 Study Area

The Study Area for parks and recreation areas includes the Project Area and the part of the District within up to two city blocks of the Project Area (**Figure 13-1**). Because impacts to parks and recreation areas on a regional scale are not anticipated, there is no Regional Study Area.

13.4 Methodology

Section 13 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on parks and recreation areas. A summary is below.

13.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. Potential operational impacts on parks and recreation areas in the Study Area were qualitatively assessed by reviewing how changes in activities and land use at WUS in the various alternatives would affect these resources. The assessment considered physical integrity (use or taking of parkland), usage (number of visitors), access, and visitor experience.

13.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts were assessed by reviewing the potential for construction activities to affect the use of a park or recreation area. Such activities include ground-disturbing work; use of park areas for staging or parking; limitations in use or access; and other factors that may interfere with user experience or the physical integrity of the park.

3 Title 10, Part A8, published pursuant to Section 9a of the District of Columbia Comprehensive Plan Act of 1994, effective April 10, 1984 (D.C. Law 5-76; D.C. Official Code Section 1-301.66).

Figure 13-1. Parks and Recreation Areas Study Area

13.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on parks and recreation areas. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

13.5.1 No-Action Alternative

13.5.1.1 Direct Operational Impacts

Relative to existing conditions, the No-Action Alternative would have no direct operational impacts on parks and recreation areas.

The projects included in the No-Action Alternative would all take place within the Project Area, which contains no parks or recreation areas. Therefore, there would be no direct operational impacts on these resources.

13.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail due to increased usage.

In the No-Action Alternative, WUS would continue to serve as a transportation hub for District residents and visitors. Although the station would not be expanded, the annual number of train and bus passengers would increase from approximately 16.3 million to approximately 20.7 million, as shown in **Section 1.7.1**, *No-Action Alternative,* **Table 1-2**. WUS is also a major touristic attraction, with approximately 8 million tourists visiting it every year. [4] This number would grow along with tourism in the District. Finally, the private air-rights development would bring approximately 2,150 new residents and 6,300 new workers to the Project Area.[5]

There would be an adverse impact on nearby parks and recreation areas because the greater number of people passing through or residing in the Project Area would likely lead to an increase in the number of visitors to these parks and areas. Columbus Plaza and the Upper and Lower Senate Parks would likely see the greatest increase in visits due to their proximity

[4] Washington Union Station. 2017. Demographics. Accessed from https://www.unionstationdc.com/demographics/. Accessed on June 11, 2018.

[5] See **Section 14.5.1.1**, *Direct Operational Impacts*, of this report.

to WUS and because they lie between the station and the U.S. Capitol complex, a major destination for both commuters and visitors. The Metropolitan Branch Trail may also see an increase in users if WUS commuters or the residents and employees of the private air-rights development use it for local travel or recreation. Private resources open to the public, such as the Plaza at 899 North Capitol Street NE and the Plaza at 750 First Street NE, may also experience some increase in users, as could the planned Plaza at Storey Park, when completed. The planned NoMA Green is too far from the station to be affected. Access to the Capitol Hill Montessori Playground is controlled by the school.

More visits and greater foot traffic would result in accelerated wear and tear of pavements and landscaped areas in the affected parks and would increase maintenance costs. This impact would be minor for the following reasons. Although it is not possible to reliably quantify the increase in park usage that would occur because of the No-Action Alternative, it would be much smaller than the increase in the number of WUS users and private air-rights development residents and employees. This is because most new WUS users would just be commuters or travelers passing through the station on their way to another destination and only a portion of the few thousands new residents and employees in the Study Area would likely make use of the local parks and recreation areas at any given time. In the context of the millions of people who visit the District and its parks every year, the contribution of the No-Action Alternative would be small[6].

13.5.1.3 Construction Impacts

The No-Action Alternative would result in minor adverse impacts on the Metropolitan Branch Trail.

In the No-Action Alternative, the Project would not be constructed. The other projects included in this No-Action Alternative would be built at various times and on different schedules that are not known at this time. These projects are all located within the Project Area and their construction would not physically affect, or completely block access to, any parks or recreation areas. Construction-related traffic and sidewalk closures may have minor adverse impacts on part of the Metropolitan Branch Trail along 2nd Street NE during the construction of the private air-rights development and replacement of the H Street Bridge. Minimization or mitigation of the potential impacts would be the responsibility of the projects' respective owners.

[6] For instance, 3 to 5 million people visit the U.S. Capitol every year (https://www.aoc.gov/capitol-buildings/about-us-capitol-building. Accessed on April 13, 2020), many of whom may be reasonably assumed to visit or walk through the Upper and Lower Senate Parks as well.

13.5.2 Alternative A

13.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A would have a minor beneficial direct operational impact on Columbus Plaza due to improved access from Columbus Circle.

Alternative A would not physically affect any parks or recreation areas. It would not require using or taking any part of a park or recreation area, or permanently incorporating it into the Project. The First Street NE cycle track to K Street would be reconstructed along its existing alignment up to K Street NE. Improvements, such as a railing to separate the track from the new pick-up and drop-off medians, would be included to minimize potential conflicts with pedestrians crossing to or from the H Street Concourse entrance. This would not reduce or otherwise affect the overall connectivity or functionality of the trail or the cycle track. It would not have an adverse impact.[7]

Alternative A includes improvements to Columbus Circle in front of WUS. These improvements would facilitate access to Columbus Plaza from the station, resulting in a minor beneficial impact on Columbus Plaza because of improved access. Alternative A would eliminate the ramp connecting southbound First Street NE and Massachusetts Avenue. This would make it easier and safer for pedestrians and bicyclists to reach Columbus Plaza from WUS because they would need to cross only one roadway instead of two, as would be the case in the No-Action Alternative. The larger pedestrian zone created by the removal of the ramp would generally make Columbus Plaza feel more accessible and integrated with WUS, enhancing visitor experience.

13.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

Relative to the No-Action Alternative, Alternative A would result in an increase in the number of passengers transiting through WUS. Annual train and bus passengers would change from approximately 20.8 million in the No-Action Alternative to approximately 35 million, as shown in **Table 1-5** above. The number of visitors may also increase because of the additional retail that would be available in the various concourses.

Like in the No-Action Alternative, this may result in more people using or passing through nearby parks, especially Columbus Plaza and the Upper and Lower Senate Parks. It may also generate additional traffic along the Metropolitan Branch Trail if visitors or commuters use it for local travel. The provision of additional Bikeshare capacity and bike storage spaces may encourage use of the trail for local travel to and from WUS. Private resources open to the

[7] Impacts pertaining to bicycle safety are addressed in **Section 5.5.2.1**, *Direct Operational Impacts, Bicycle Activity*.

public, such as the Plaza at 899 North Capitol Street NE and the Plaza at 750 First Street NE, may also experience some increase in users, as could the planned Plaza at Storey Park, when completed. The planned NoMA Green is too far from the station to be affected. Access to the Capitol Hill Montessori Playground is controlled by the school.

As explained for the No-Action Alternative, increases use would result in accelerated wear and tear of pavements and landscaped areas in the affected parks and in increased maintenance costs. For the same reasons as explained for the No-Action Alternative, this impact would be minor. Only a small part of the additional passengers and visitors would likely make use of the nearby parks and recreation areas. Most would only transit through WUS toward other destinations in and outside the District. Alternative A would be a small contributor to the general visitations to parks and recreation area in the Study Area.[8] By itself, Alternative A would not cause a marked degradation of user experience.

Relative to the No-Action Alternative, In Alternative A, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

In Alternative A, it is assumed for the purposes of the DEIS impact analyses that the Federal air rights above the new parking facility would potentially be developed as additional parking. This would potentially encourage more people to visit WUS and nearby parks and recreational areas. The increase in park visitors that would result from this development cannot be determined but is likely to be very small, as it can be reasonably assumed that only a portion of parking users would visit Study Area parks as part of their trip. In the context of the millions of annual visits to the District and its parks, the adverse impact from these additional visitations would be negligible.

13.5.2.3 Construction Impacts

Construction of Alternative A would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

In Alternative A, construction-related traffic and sidewalk or lane closures 2nd Streets NE would affect the Metropolitan Branch Trail and may lead to temporary closures or rerouting of the trail at this location and diminish the connectivity of the trail to the front of WUS and points south. These disruptions would adversely affect the experience of users at the south end of the trail. Closure of the First Street cycle tract during its reconstruction would also reduce connectivity. However, these impacts would occur at different times, with those along 2nd Street concentrated during parts of Phase 1 (first 2 years and 5 months of construction) and those along First Street concentrated during Phase 4 (last 3 years and 1 month of construction). When one of the two facilities would be closed, the other would be

8 For instance, 3 to 5 million people visit the U.S. Capitol every year (https://www.aoc.gov/capitol-buildings/about-us-capitol-building. Accessed on April 13, 2020), many of whom may be reasonably assumed to visit or walk through the Upper and Lower Senate Parks as well.

operational and could provide an alternative route. Only a small portion of the eight-mile Metropolitan Branch Trail would be affected. Between Phases 1 and 4 (approximately 6 years), disruptions would be minimal though adjacent construction traffic and activities may detract from user experience. Overall, the anticipated disruptions would be a moderate adverse impact.

Alternative A would include the realignment of the roadways in front of WUS, adjacent to Columbus Plaza. This would result in a moderate adverse impact on this resource. While Columbus Plaza itself would not be physically affected, construction would temporarily limit pedestrian access from the front of WUS to the park, although access would remain available from the south. In general, construction activities on the adjacent roadways would make Columbus Plaza less attractive to visit and diminish visitor experience. The impact would be moderate because, although it has not been established how long the construction of the Columbus Circle improvements would take, it would be much less than the entire construction period. All other construction activities associated with Alternative A would take place to the north of the historic station building and would not cause impacts on Columbus Plaza.

13.5.2.4 Comparison to Existing Conditions

The impacts of Alternative A relative to existing conditions would be the same as those relative to the No-Action Alternative. The increase in the numbers of visitors or users of Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail would represent a larger increment relative to existing conditions, but the total number would remain small and the adverse impact would be negligible.

The beneficial impact on Columbus Plaza would be the same because there is no difference between the two baselines with respect to this impact.

13.5.3 Alternative B

13.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a minor beneficial direct operational impact on Columbus Plaza due to improved access across Columbus Circle.

The direct operational impact of Alternative B would be the same as Alternative A's (**Section 13.5.2.1**, *Direct Operational Impacts)*.

13.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

The indirect impact of Alternative B from the increase in visitors or users of parks and recreation areas would be the same as in Alternative A. See **Section 13.5.2.2***, Indirect Operational Impacts*.

Relative to the No-Action Alternative, in Alternative B, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

In Alternative B, it is assumed for the purposes of the DEIS impact analyses that the potential development of the Federal air rights would consist of approximately 917,420 square feet of office space. This would bring an additional 3,670 employees to the Project Area.[9] Some of them may make use of nearby parks and recreation areas during the day. However, at any given time, the number of additional visitors attributable to the development would be a fraction of the few thousands new workers in the Project Area and any adverse impacts would be negligible in the context of the millions of visits to District and its Parks.[10]

13.5.3.3 Construction Impacts

Construction of Alternative B would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

The impacts of constructing Alternative B would generally be the same as those of constructing Alternative A (see **Section 13.5.2.3**, *Construction Impacts*). Impacts would be moderate adverse for the reasons explained for Alternative A, although timing and duration would be slightly different. Disruptions along 2nd Street would be concentrated during parts of Phase 1 (first 2 years and 5 months of construction, as in Alternative A and the other Action Alternatives) and impacts along First Street concentrated during Phase 4 (last 4 years and 11 months of construction). Disruptions would be minimal between Phases 1 and 4 (approximately 7 years), though adjacent construction traffic and activities may detract from user experience.

The Columbus Circle improvements would be the same as in Alternative A and take the same time to construct. Impacts on Columbus Plaza would be as described for Alternative A.

13.5.3.4 Comparison to Existing Conditions

Alternative B would compare to existing conditions as Alternative A does. See **Section 13.5.2.4**, *Comparison to Existing Conditions*.

[9] Assumes 1 employee per 250 square feet of office space.

[10] For instance, 3 to 5 million people visit the U.S. Capitol every year (https://www.aoc.gov/capitol-buildings/about-us-capitol-building. Accessed on April 13, 2020), many of whom may be reasonably assumed to visit or walk through the Upper and Lower Senate Parks as well.

13.5.4 Alternative C (Either Option)

13.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative C would have a minor beneficial direct operational impact on Columbus Plaza due to improved access across Columbus Circle.

The direct operational impact of Alternative C would be the same as that of Alternative A. See **Section 13.5.2.1**, *Direct Operational Impacts*.

13.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

The indirect impact of Alternative C from the increase in visitors or users of parks and recreation areas would be the same as in Alternative A. See **Section 13.5.2.2**, *Indirect Operational Impacts*.

Relative to the No-Action Alternative, in Alternative C, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

In Alternative C, it is assumed for the purposes of the DEIS impact analyses that the potential development of the Federal air rights would consist of into approximately 952,600 square feet of office space. This would bring an additional 3,800 employees to the Project Area.[11] Some of them may make use of nearby parks and recreation areas during the day. The resulting adverse impacts on parks and recreation areas would be negligible for the same reasons as explained for Alternative B (**Section 13.5.3.2**, *Indirect Impacts*).

13.5.4.3 Construction Impacts

Construction of Alternative C would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

The impacts of constructing Alternative C would generally be the same as those of constructing Alternative A (see **Section 13.5.2.3**, *Construction Impacts*) and would be moderate adverse for the reasons explained for Alternative A although timing and duration would be slightly different. Disruptions along 2nd Street would be concentrated during parts of Phase 1 (first 2 years and 5 months of construction, as in Alternative A and the other Action Alternatives) and impacts along First Street concentrated during Phase 4 (last 4 years of construction). Disruptions would be minimal between Phases 1 and 4 (approximately 5

[11] Assumes 1 employee per 250 square feet of office space.

years and 10 months), though adjacent construction traffic and activities may detract from user experience.

The Columbus Circle improvements would be the same as in Alternative A and take the same time to construct. Impacts on Columbus Plaza would be as described for Alternative A.

13.5.4.4 Comparison to Existing Conditions

Alternative C would compare to existing conditions as in Alternative A. See **Section 13.5.2.4**, *Comparison to Existing Conditions*.

13.5.5 Alternative D

13.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a minor beneficial direct operational impact on Columbus Plaza due to improved access across Columbus Circle.

The direct operational impact of Alternative D would be the same as that of Alternative A. See **Section 13.5.2.1**, *Direct Operational Impacts*.

13.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

The indirect impact of Alternative D from the increase in visitors or users of parks and recreation areas would be the same as in Alternative A. See **Section 13.5.2.2**, *Indirect Operational Impacts*.

Relative to the No-Action Alternative, In Alternative D, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

In Alternative D, it is assumed for the purposes of the DEIS impact analyses that the potential development of the Federal air rights would consist of approximately 688,050 square feet of office space. This would bring an additional 2,800 employees to the Project Area.[12] Some of them may make use of nearby parks and recreation areas during the day. The resulting adverse impacts on parks and recreation areas would be negligible for the same reasons as explained for Alternative B (**Section 13.5.3.2**, *Indirect Impacts*).

[12] Assumes 1 employee per 250 square feet of office space.

13.5.5.3 Construction Impacts

Construction of Alternative D would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

The construction-related impacts of Alternative D would be the same as those of constructing Alternative C (see **Section 13.5.4.3**, *Construction Impacts*). Construction activities and durations would be the same.

13.5.5.4 Comparison to Existing Conditions

Alternative D would compare to existing conditions as Alternative A does. See **Section 13.5.2.4**, *Comparison to Existing Conditions*.

13.5.6 Alternative E

13.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative E would have a minor beneficial direct operational impact on Columbus Plaza due to improved access across Columbus Circle.

The direct operational impact of Alternative E would be the same as in Alternative A. See **Section 13.5.2.1**, *Direct Operational Impacts*.

13.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

The indirect impact of Alternative E from the increase in visitors or users of parks and recreation areas would be the same as that of Alternative A. See **Section 13.5.2.2**, *Indirect Operational Impacts*.

Relative to the No-Action Alternative, In Alternative E, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

The impacts from the potential development of the Federal air rights would be the same as in Alternative D. The developable envelope would be the same in both alternatives. See **Section 13.5.5.2**, *Indirect Operational Impacts.*

13.5.6.3 Construction Impacts

Construction of Alternative E would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

The impacts of constructing Alternative E would be the same as those of constructing Alternative B (see **Section 13.5.3.3**, *Construction Impacts*). Construction activities and durations would be the same.

13.5.6.4 Comparison to Existing Conditions

Alternative E would compare to existing conditions as Alternative A does. See **Section 13.5.2.4**, *Comparison to Existing Conditions*.

13.5.7 Alternative A-C (Preferred Alternative)

13.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a minor beneficial direct operational impact on Columbus Plaza due to improved access across Columbus Circle.

The direct operational impact of Alternative A-C would be the same as that of Alternative A. See **Section 13.5.2.1**, *Direct Operational Impacts*.

13.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a minor adverse indirect operational impact on parks and recreation areas, including Columbus Plaza, the Upper and Lower Senate Parks, and the Metropolitan Branch Trail.

The indirect impact of Alternative A-C from the increase in visitors or users of parks and recreation areas would be the same as that of Alternative A. See **Section 13.5.2.2***, Indirect Operational Impacts*.

Relative to the No-Action Alternative, in Alternative A-C, the potential development of the Federal air rights would have a negligible adverse indirect operational impact on parks and recreation areas.

In Alternative A-C, it is assumed for the purposes of the DEIS impact analyses that the potential development of the Federal air rights would consist of approximately 380,000 square feet of office space. This would bring an additional 1,520 employees to the Project Area.[13] Some of them may make use of nearby parks and recreation areas during the day. The resulting adverse impacts on parks and recreation areas would be negligible for the same reasons as explained for Alternative B (**Section 13.5.3.2**, *Indirect Impacts*).

[13] Assumes 1 employee per 250 square feet of office space.

13.5.7.3 Construction Impacts

Construction of Alternative A-C would cause moderate adverse impacts on Columbus Plaza and the Metropolitan Branch Trail.

The impacts of constructing Alternative A-C would be the same as those of constructing Alternative A (see **Section 13.5.2.3**, *Construction Impacts*). Construction activities and durations would be the same.

13.5.7.4 Comparison to Existing Conditions

Alternative A-C would compare to existing conditions as Alternative A does. See **Section 13.5.2.4**, *Comparison to Existing Conditions*.

13.6 Comparison of Alternatives

With regard to impacts on parks and recreation areas, all the Action Alternatives would generally have the same impacts (**Table 13-1**). This is because these impacts would arise from features that are common to all Action Alternatives, including the increase in the number of WUS passengers and visitors, and the improvements to Columbus Circle in the front of WUS. The Action Alternatives would also have similar construction-related impacts, with impacts on the Metropolitan Branch Trail varying slightly depending on the duration of the construction period but remaining moderate.

Table 13-1. Comparison of Alternatives

Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
Direct Operational	No impacts	Minor beneficial on Columbus Plaza. No impacts on other parks					
Indirect Operational	Minor adverse impacts from increased number of visitors Negligible adverse impacts from the potential Federal air-rights development.						
Construction	Minor Adverse Impacts	Moderate adverse impacts on Columbus Plaza and Metropolitan Branch Trail					

The No-Action Alternative primarily differs from the Action Alternatives in that it would not provide improvements to Columbus Circle and would have fewer construction impacts. In the No-Action Alternative, WUS passengers and visitors would also be less numerous than in the Action Alternatives, resulting in slightly smaller impacts on nearby parks.

13.7 Avoidance, Minimization and Mitigation Evaluation

To avoid or minimize construction impacts on Columbus Plaza and the Metropolitan Branch Trail, FRA is considering the following measures:

- The Project Proponents would coordinate with NPS during construction planning to develop measures to maintain as much as possible access to Columbus Plaza during the construction of the Columbus Circle improvements.
- The Project Proponents would prohibit the construction contractor from using Columbus Plaza as a staging area during construction.
- The Project Proponents would coordinate with DDOT to plan and maintain alternative routes for users of the Metropolitan Branch Trail when parts of the trail would be closed.
- The Project Proponents would work with DDOT to appropriately advertise construction-related closures of the Metropolitan Branch Trail and establish alternative routes, as needed.

13.8 Permits and Regulatory Compliance

The Project is subject to Section 4(f) of the United States Department of Transportation Act of 1966 which requires avoidance and minimization of impacts to public park and recreation lands, wildlife and waterfowl refuges, and public or private historic properties, during the planning and design of transportation projects. A Section 4(f) Evaluation and determination has been prepared for the Project.

Section 6(f) of the Land and Water Conservation Act requires that the conversion to anything other than public outdoor recreational use of lands or facilities acquired with Land and Water Conservation Act (LWCA) funds under the State Assistance program be coordinated with NPS.[14] The Project would not require the conversion of any land, including land acquired with LWCA funds. Therefore, a Section 6(f) evaluation is not required.

[14] 16 U.S.C 460-4 to 460-11.

14 Social and Economic Conditions

14.1 Overview

This section addresses the potential impacts on social and economic conditions of the No-Action Alternative and the Action Alternatives. These include impacts on demographics, jobs, taxes, community disruption, commercial activity, and local government services. If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies relevant permitting and regulatory compliance requirements.

14.2 Regulatory Context

The following are District regulations and guidance pertaining to social and economic conditions that are most relevant to the Project.

- DC Code 8-109.01 – 8.109.12, Subchapter V: Environmental Impact Statements;
- DC Workforce Investment Council, Workforce Innovation and Opportunity Act (WIOA) 2016-2020 Unified State Plan;[1] and
- DC Office of the Deputy Mayor for Planning and Economic Development, *DC's Economic Strategy: Strategy Report*.[2]

14.3 Study Area

The Local Study Area, shown in **Figure 14-1**, includes the Project Area from the historic station building to K Street NE as well as the 21, 2010 U.S. Census block groups within one half-mile of the Project Area. The Regional Study Area is comprised of the entirety of the District.

1 D.C. Workforce Investment Council. 2016. *Workforce Innovation & Opportunity Act (WIOA) 2016-2020 Unified State Plan.* https://dcworks.dc.gov/sites/default/files/dc/sites/dcworks/publication/attachments/WIOA_DC_Unified_State_Plan_Final.pdf. Accessed on June 6, 2017.

2 D.C. Office of the Deputy Mayor for Planning & Economic Development. 2017. *DC's Economic Strategy, Strategy Report.* http://dceconomicstrategy.com/wp-content/uploads/2017/03/Econ-Strategy_Full-Report-for-Distribution_03.07.17-1-1.pdf. Accessed on June 6, 2017.

14.4 Methodology

Section 14 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on social and economic conditions. A summary is below.

Social and economic impacts were assessed by considering how the No-Action and Action Alternatives would affect the following socioeconomic factors: demography; community disruption and benefits; employment; WUS revenue; and other economic measures, as applicable. The analysis used both quantitative and qualitative methods. Modeling software analysis provided quantitative data such as construction job projections. Impacts not readily measurable, such as for instance fiscal impacts due to lack of key information on future taxable population or activities, were considered qualitatively.

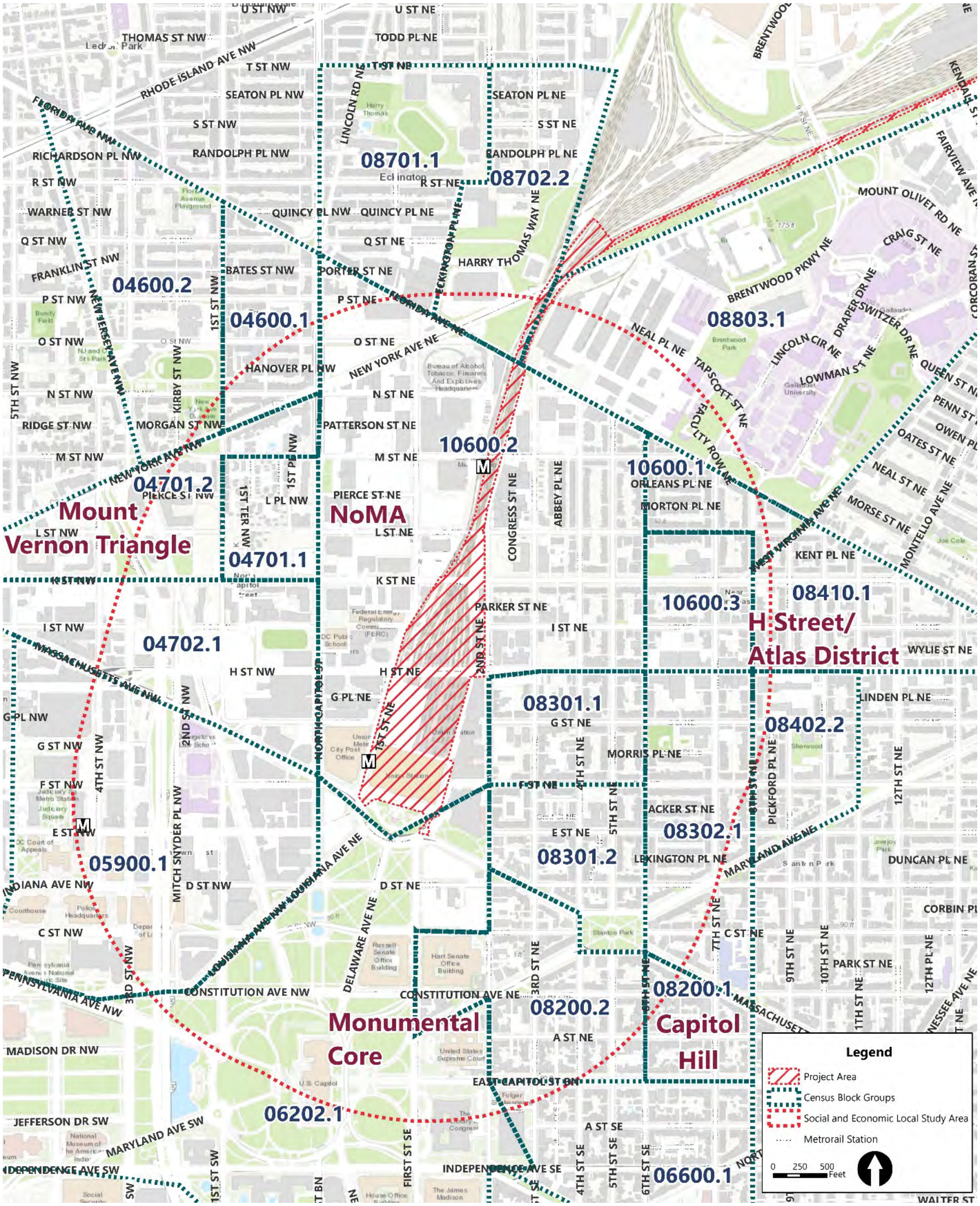
14.4.1 Operational Impacts

Operational impacts are those long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. Impacts on demography and employment were quantitatively assessed based on planning multipliers for specific land uses (1 employee per 250 square feet of office space; 3 employees per 1,000 square feet of retail use; and 1 employee per 2.67 hotel rooms). Impacts on WUS revenues were assessed using order-of-magnitude estimates based on anticipated changes in the amount of revenue-generating retail and parking at WUS. Other operational impacts were assessed qualitatively.

14.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Construction impacts on socioeconomic factors other than employment were assessed qualitatively. Impacts on employment were assessed quantitatively using IMPLAN, an economic input-output model software system.

Figure 14-1. Social and Economic Local Study Area



Construction employment impacts are typically regional in scope, especially in a metropolitan area where construction workers often live outside of the city. Purchases of construction materials and other business-to-business transactions also may take place outside of the city. Additionally, large infrastructure projects require specialized labor and equipment, more likely to be available at the regional level. Therefore, the IMPLAN analysis of construction employment generation encompassed the Washington-Arlington-Alexandria, DC-VA-MD-WV metropolitan statistical area. This area includes the following jurisdictions: District of Columbia; Frederick, Montgomery, Calvert, Charles, and Prince George's Counties in Maryland; Arlington, Clarke, Culpeper, Fairfax, Fauquier, Loudoun, Prince William, Rappahannock, Spotsylvania, Stafford, and Warren Counties, and Alexandria City, Fairfax City, Falls Church City, Fredericksburg City, Manassas City, and Manassas Park City in Virginia; and, Jefferson County in West Virginia[3].

IMPLAN projects construction employment, wages, and economic output based on estimated construction costs. The estimates are calculated based on multipliers and datasets for various industries identified in IMPLAN. They reflect typical spending patterns by these industries and workers. IMPLAN outputs include direct jobs (the number of jobs directly associated with the construction of the Project); indirect jobs (jobs supported by business-to-business transactions); and induced jobs (jobs supported by the spending of direct wages by households). IMPLAN also models total wage income from the generated jobs; annual value added, which is the combination of labor income, other property type income and indirect business taxes; and total output, or value of production.[4]

14.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For each Action Alternative, a brief assessment of the impacts relative to existing conditions is also provided.

[3] These jurisdictions make up the Washington-Arlington-Alexandria, DC-VA-MD-WV metropolitan statistical area as defined by the U.S. Office of Management and Budget and used by the U.S. Census Bureau.

[4] Construction-impact modeling was performed on the basis of the rough-order-of magnitude combined construction cost estimates developed by Amtrak, which are the only estimates available at the phase level (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*; the combined estimates include costs associated with the private air-rights development deck and potential Federal air-rights development deck).

14.5.1 No-Action Alternative

14.5.1.1 Direct Operational Impacts

Demographics

Relative to existing conditions, in the No-Action Alternative, there would be a minor direct operational impact on demographic conditions from the private air-rights development. [5]

In the No-Action Alternative, development of the private air rights above the WUS rail terminal would include approximately 1,050,000 square feet of residential uses. This would add approximately 2,150 residents to the Local Study Area. [6]

This would amount to a minor impact on local demography for the following reasons. According to the 2011-2015 American Community Survey (ACS) 5-Year Estimates, the total population of the Local Study Area in 2015 was 34,895. The residents of the private air-rights development would represent an increase of approximately 6 percent relative to this total. Compared to the increase in the Local Study Area population between 2010 and 2015, which was approximately 10 percent,[7] a 6 percent increase over 20 years would be a minor change. In the context of the District, the population of the private air-rights development would represent a minute fraction of the total population: District of Columbia Office of Planning (DCOP) projections show a total population of approximately 941,000 in 2040, with an average growth of 11,000 a year.[8]

Community Disruption and Other Social Benefits or Impacts

Relative to existing conditions, the No-Action Alternative would have moderate beneficial direct operational impacts on local communities.

The projects in the No-Action Alternative, including the DC Streetcar extension and improvements to the Union Station Metrorail station, would result in a beneficial impact on local communities because they would improve connections between WUS and the surrounding neighborhoods. The Amtrak and Union Station Redevelopment Corporation (USRC)-led projects to address Americans with Disabilities Act compliance and other issues at WUS would improve access to transportation facilities and retail (see **Table 1-3** above). None of the projects would reduce access between neighborhoods; erect permanent barriers

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5 This demographic impact is not characterized as adverse or beneficial because a proportionately small change in residential population does not in itself represent a favorable or unfavorable outcome.

6 Calculated by deducting square footage for mechanical shafts, articulation and massing, applying a ratio of 950 sf per unit, and using a multiplier of 2.10 persons per household (weighted average of average household size of the census tracts in the Local Study Area based on 2011-2015 ACS 5-year estimates).

7 **Appendix C2**, *Washington Union Station Expansion Project, Affected Environment Report*, **Section 14.5.1**, *Demographics*.

8 DCOP. *Forecasting the District's Growth. 2015-2045. Results and Methodology*. November 2016. Accessed from https://planning.dc.gov/node/1212966. Accessed on January 30, 2019.

among communities; or result in any other condition that would permanently disrupt neighborhoods and communities around WUS. The private air-rights development would create new connections between the areas on either side of the rail terminal as well as provide new retail opportunities and other urban amenities.

The beneficial impact would be moderate because the No-Action Alternative would leave many existing access and connectivity issues unresolved. Pedestrian connections to WUS from the surrounding neighborhoods are currently inadequate and would remain so. This would also be the case for the private air-rights development, which would not have direct connections to the station. Entrances would remain concentrated on or near the south side of the station. The only entrance from H Street NE would continue to be through the parking garage, making it difficult for travelers to access adjacent neighborhoods and employment centers northwest and east of WUS.

Employment

Relative to existing conditions, the No-Action Alternative would have a moderate beneficial direct operational impact on employment.

The new office, retail, and hotel space in the private air-rights development would add jobs in the Local Study Area, a beneficial impact. Based on the estimated square footage for these uses (**Table 1-3** of this report), the private air-rights development would support approximately 8,500 jobs.[9] Currently, there are approximately 400 Amtrak employees working at WUS and 624 employees working in the existing retail and commercial space in WUS. These numbers would likely remain approximately the same in the No-Action Alternative.[10]

The beneficial impact on employment would be moderate because of its relatively small size relative to existing employment in the Local Study Area and projected 2040 employment in the Regional Study Area. As of 2015, there were an estimated 120,032 jobs in the Local Study Area. The increase attributable to the No-Action Alternative would represent 7 percent of this number.

According to the Deputy Mayor for Planning and Economic Development (DMPED) Economic Intelligence Dashboard, as of July 2019, there were an estimated 802,000 jobs in the District. [11] The jobs associated with the private air-rights development would represent approximately one percent of this total. As another benchmark for comparison, DCOP projections indicate that the District would have a total of 1,012,000 jobs by 2040, with an

9 Assumes 1 employee per 250 square feet of office space, 3 employees per 1,000 square feet of retail use, and 1 employee per 2.67 hotel rooms. Hotels room are assumed to be 850 square feet per key.

10 Email Correspondence. September 27, 2017. Amtrak to VHB.

11 *DMPED Economic Intelligence Dashboard*. Accessed from http://open.dc.gov/economic-intelligence/. Accessed on September 23, 2019.

average growth of 8,995 jobs per year during the 2015-2035 period. [12] The jobs associated with the private air-rights development would amount to a little less than an average year worth of projected growth but only 0.8 percent of the total projected 2040 employment.

Washington Union Station Revenue

Relative to existing conditions, the No-Action Alternative would have no direct operational impact on WUS Revenue.

USRC, which manages WUS, has two primary sources of revenue: revenue derived from the Union Station Investco (USI) sublease for retail space; and revenue from the parking garage, operated by Union Station Parking Garage LLC. In the No-Action Alternative, there would be no change in the amount of retail or parking at WUS relative to existing conditions. Existing leases would continue. There would be no changes in WUS's revenue from those leases other than what would result from their respective terms.

Other Direct Economic Impacts

Relative to existing conditions, the No-Action Alternative would have a minor beneficial direct operational impact on retail and parking at WUS.

In the No-Action Alternative, neither the amount of retail nor the number of parking spaces at WUS would change. However, the greater number of passengers and visitors would benefit WUS's retail outlets through increased sales. It would also benefit the WUS parking garage operator because of greater demand, potentially leading to higher rates. Persons living or working in the private air-rights development would also provide an expanded customer base for retail outlets at WUS.

This beneficial impact is not readily quantifiable. However, it would be minor because the amount of both retail and parking at WUS would remain as it is currently. This would put a limit on the potential growth in revenue for the lease holders.

14.5.1.2 Indirect Operational Impacts

Demographics

Relative to existing conditions, the No-Action Alternative would have negligible indirect operational impacts on demographic conditions. [13]

The private air-rights development project may encourage further development in the Local Study Area, as explained in **Section 9.5.1.2**, *Indirect Operational Impacts* of this report. Some

[12] DCOP. *Forecasting the District's Growth. Results and Methodology*. November 2016. Accessed from https://planning.dc.gov/node/1212966. Accessed on January 30, 2019.

[13] This demographic impact is not characterized as adverse or beneficial because a proportionately small change in residential population does not in itself represent a favorable or unfavorable outcome.

of that development may be residential and result in an increase in the population of the Local Study Area and the District. This impact would be negligible. It is not readily quantifiable but likely would be very small relative to the anticipated demographic growth of the District through 2040.

Community Disruption and Other Social Benefits or Impacts

Relative to existing conditions, the No-Action Alternative would have no indirect operational impacts on local communities, including impacts related to gentrification.

A potential indirect adverse impact of an influx of residential population in an urban area is gentrification. The US Department of Housing and Urban Development defines gentrification as "the process by which a neighborhood occupied by lower-income households undergoes revitalization or reinvestment through the arrival of upper-income households."[14] While there are generally recognized benefits to gentrification, including increased amenities within an area, increased and/or improved public services, and rehabilitated housing, the process is also often associated with the threat and fear of displacement of long-time residents forced to move out of an area they can no longer afford to live in.

An accepted approach to assess potential gentrification impacts involves first determining if an area is eligible to gentrify based on census tract-level data. A census tract is eligible to gentrify if it meets the following criteria: (1) the census tract has a population of at least 500 residents, (2) the census tract's median household income is in the bottom 40th percentile when compared to all tracts within the reference area, and (3) the census tract's median home value is in the bottom 40th percentile when compared to all tracts within the reference area. [15]

The private air-rights development would be in Census Tract (CT) 106 of the District. Adjacent census tracts include CT 47.01, 47.02, 59, 62.02, 82, and 83.01. 106. Based on 2013-2017 ACS data, and using the District as the reference area, none of those census tracts meet all three criteria, as shown in **Table 14-1**. Therefore, the private air-rights development is not located in an area where it could induce gentrification.

[14] Freeman, L. "Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods." *Urban Affairs Review*, 463-491. 2005.

[15] Freeman, L. "Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods." *Urban Affairs Review*, 463-491. 2005; Maciag, M. *Gentrification in America Report*. Accessed from http://www.governing.com/gov-data/census/gentrification-in-cities-governing-report.html. Accessed on January 30, 2019.

Table 14-1. Eligibility for Gentrification of Census Tracts in Local Study Area

Census Tract	At least 500 Residents?	Median Household Income in Bottom 40th Percentile ($67,171.4)?	Median Home Value in Bottom 40th Percentile ($438,460)?
106	Yes: 7,167	No: $110,469	No: $599,300
47.01	Yes: 4,888	Yes: $40,378	No: $513,900
47.02	Yes: 3,144	No: $101,891	No: $478,700
59	Yes: 2,682	No: $101,553	No: $455,200
62.02[1]	No: 72	N/A	N/A
82	Yes: 3,056	No: $115,742	No: $989,800
83.01	Yes: 2,423	No: $147,989	No: $798,300

Source: American FactFinder, 2013-2017 ACS.
1. This census tract consists of the National Mall and U.S. Capitol grounds.

Employment

Relative to existing conditions, the No-Action Alternative would have a minor beneficial indirect operational impact on employment in the Local Study Area.

A beneficial indirect impact on employment would result from the private air-rights development because new residents and employees would support new jobs in the Local and Regional Study Areas through typical household spending and local business-to-business spending. Additionally, the private air-rights development and increased ridership and visits at WUS may encourage further residential or office development near WUS, with a similar beneficial impact on local businesses and jobs, as new residents and workers spend money in the local community.

This beneficial impact cannot be readily quantified but would be minor in the context of the current and projected future employment in the Local Study Area and the District.

Washington Union Station Revenue

Relative to existing conditions, the No-Action Alternative would have a negligible beneficial indirect operational impact on WUS Revenue.

The No-Action Alternative would have a beneficial impact on WUS revenue if greater activity in the Project Area (due to both ridership increase and the private air-rights development) results, in the long term, in an increase in demand for services that generate revenue for WUS, such as retail and parking. This potential impact cannot be quantified but can be considered to be negligible in the context of WUS's total revenues.

Other Indirect Economic Impacts

Relative to existing conditions, the No-Action Alternative would have a moderate beneficial indirect operational impact on tax revenues in the District.

There would be a beneficial impact from increased tax revenue in the District. The private air-rights development would generate new property taxes from parcels that currently do not produce any. Those residents who would be new to the District would pay income tax. New air-rights retail would generate additional sales tax revenue, as would the larger number of people patronizing the existing WUS retail stores. Induced residential and economic growth in the Local Study Area and the District at large would generate further increases in revenue.

While the net increase in tax revenue that would result cannot be estimated, it is likely to amount to a moderate beneficial impact in the context of the District as a whole, whose total tax revenue in fiscal year 2018 was $7.5 billion.[16] Property taxes from the private air rights development would be new but income taxes may not be, if residents moved to the new development from elsewhere in the District. Also, increases in the number of visitors or residents would create new demands on municipal services, whose cost would partially offset the increase in tax revenue.

14.5.1.3 Construction Impacts

Demographics

Construction of the projects included in the No-Action Alternative would not have impacts on demography.

The construction of the No-Action Alternative projects would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of the No-Action Alternative projects would have minor adverse impacts on local communities.

Construction activities associated with the No-Action projects would create various degrees of disruption within the Local Study Area, resulting in adverse impacts on the local communities. These impacts would be minor because they would be spread across several years and take place according to different schedules. They are not likely to keep significant numbers of people from using WUS multi-modal facilities or to force the relocation of businesses or residents in a manner that could disrupt the local neighborhoods or communities.

The most noticeable disruption would arise from the partial closure of sidewalks and roadways at various times, depending on the schedule of the various projects. The replacement of the H Street Bridge would have the most noticeable impact as it would make travel between the east and west sides of the Local Study Area more difficult for both cars

[16] Government of the District of Columbia, Office of Chief Financial Officer, Office of Revenue Analysis. *D.C. Tax Facts. 2018*. https://cfo.dc.gov/node/1351591. Accessed January 30, 2019.

and pedestrians during the entire construction period. It can be anticipated that the District Department of Transportation would implement measures to minimize this impact. Construction of the private air-rights development would likely require temporary sidewalks and roadways closures along 2nd Street NE and First Street NE (north of H Street) and generate construction vehicle traffic along those streets. No information is available to assess the intensity and duration of those impacts, but they would generally be like those associated with medium- to large-scale construction projects in a dense urban area.

Construction of the private air-rights development and VRE Midday Storage Replacement Facility would take place within the footprint of the rail terminal and have the potential to affect the terminal's operations. Travelers and commuters may experience some delays and increased commuting times. As explained in **Section 9.5.1.3**, *Construction Impacts*, of this report, Amtrak must authorize work in the rail terminal. The permitting process would help minimize impacts to rail operations.

Construction Employment

Construction of the No-Action Alternative projects would have minor beneficial impacts on employment.

Construction of the projects included in the No-Action Alternative would have a beneficial impact on employment. Construction spending would likely further support business establishments in the Local Study Area through worker spending. Businesses throughout the District and Washington metro area would benefit through additional household spending supported by construction wages and the purchase of construction materials, with a spin-off effect on job generation. This beneficial impact, which would be spread over many years between now and 2040, would be minor in the context of overall employment and economic activity in the District.

Washington Union Station Revenue

Construction of the projects included in the No-Action Alternative would have minor adverse impacts on WUS revenue.

There would be minor adverse impacts on WUS revenue for the following reasons. Construction activities that would require restricting or modifying access to the parking garage – especially during the replacement of the H Street Bridge - would likely result in a loss of revenue, as fewer cars would use the garage. This impact would be minor as the garage would remain open and alternative access points would be available. Construction activities could also adversely affect the station's retail and service establishments if they led to a reduction in visitors and a decrease in spending at the station. Such short-term fluctuations do not affect WUS's revenue from retail. Construction activities in the No-Action Alternative are not likely to result in long-term or permanent store closures.

Other Economic Benefits or Impacts

Construction of the project included in the No-Action Alternative would have a moderate beneficial impact on the regional economy.

Construction of the various projects included in the No-Action Alternative would have a beneficial economic impact at the regional level from the spending of the income generated by the construction and other jobs it would generate. A quantitative estimate is not possible, but given the scale of several of the projects, especially the private air-rights development and replacement of the H Street Bride, a moderate beneficial impact is likely.

14.5.2 Alternative A

14.5.2.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative A would have no direct operational impact on demographic conditions.

Alternative A would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative A would have major beneficial direct operational impacts on local communities.

Relative to the No-Action Alternative, Alternative A would have a major beneficial impact because it would improve community cohesion by providing new pedestrian connections between WUS and the surrounding neighborhoods. The new street-level pedestrian entry points along First Street NE and 2nd Street NE under the H Street Bridge as well as new entry points from the bridge would make WUS easier to access from both the east and west neighborhoods while also improving the connectivity between neighborhoods on either side of the station and connectivity with the private air-rights development.

Alternative A would also provide approximately 72,000 square feet of new retail space in WUS. The provision of additional shopping opportunities and services located in WUS would benefit neighborhood residents as well as travelers and commuters. The access improvements mentioned in the previous paragraph would make it easier for residents to use these new amenities.

At the regional level, expanded and improved multimodal connections at WUS would result in easier and more efficient travel in and out of the District. This would benefit all District residents and visitors.

Employment

Relative to the No-Action Alternative, Alternative A would have a minor beneficial direct operational impact on employment.

Alternative A would have a beneficial impact on employment because it would add up to an estimated 1,445 jobs at WUS relative to the No-Action Alternative. Alternative A would add approximately 72,000 square feet of WUS retail space to WUS, which would generate approximately 216 new jobs, for a total of approximately 840 WUS retail jobs.[17] Alternative A would also provide additional space for Amtrak to support expanded rail operations. The expanded Amtrak support area would be approximately 297,400 square feet in size and staffed with approximately 1,629 persons. [18] This would be an approximately 1,229-employee increase over the No-Action Alternative.

This beneficial impact would be minor because while large in the context of WUS, it would be small in the larger context of the District. The 1,445 jobs that Alternative A would support would represent an increase of 141 percent in WUS jobs relative to the No-Action Alternative. Regionally, DCOP projections indicate that the District would have a total of approximately 1,012,000 jobs by 2040, with an average growth of 8,995 jobs per year during the 2015-2035 period. [19] The jobs associated with Alternative A would represent about 0.15 percent of the total projected 2040 employment.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative A would have a moderate adverse operational direct impact on WUS revenue.

Alternative A would reduce the number of revenue-generating parking spaces at the station from approximately 2,205 in the No-Action Alternative to 1,750, or a reduction of approximately 21 percent. For the purposes of developing an order-of-magnitude estimate of this impact, it can be assumed that there would be a proportional decrease in revenue from parking. Based on USRC's revenue from parking in fiscal year 2016, this would amount to approximately $1.79 million (2017 dollars) in lost revenue. [20] This order-of-magnitude estimate does not account for the fact that decreasing the total number of spaces may increase the revenue generated by each space due to reduced supply and steady or increasing demand.

[17] The retail job generation is based on a standard planning multiplier of 3 employees per 1,000 square feet of retail space.

[18] Amtrak. 2018. *WUS-TI Space Program*.

[19] DCOP. 2017. DC Forecasts. Accessed from https://planning.dc.gov/publication/dc-forecasts. Accessed on February 15, 2019.

[20] In fiscal year 2016, WUS revenue from the parking garage operations was $8,532,403: *USRC Annual Report* 2016. Accessed from https://www.usrcdc.com/wp-content/uploads/2017/02/usrc_annual_report_2016_final_spreads.pdf. Accessed on July 18, 2017.

Revenue from retail would remain approximately the same as or be less than in the No-Action Alternative. The new retail provided in Alternative A would be outside of the WUS lease area and, as such, would generate no additional revenue for the station. Revenue from existing retail could decrease if some of the outlets displaced during construction (see **Section 14.5.3**, *Construction Impacts, Washington Union Station Revenue*) do not return after completion of the work and are not replaced. How this would affect WUS' revenue from retail would depend on current and future USI lease conditions.

Altogether, Alternative A would cause a net loss in revenue for WUS. The loss would be moderate because all parking, which is the main source of WUS revenue, would be within the station's lease area and continue to generate revenue for WUS while the permanent loss of existing retail, if it occurs, would likely be small.

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative A would have a minor beneficial direct operational impact on the local and regional economy.

Alternative A would have a minor beneficial impact on the local and regional economy because it would add approximately 72,000 square feet of retail at WUS. This new retail would generate revenue for its operators as well as new jobs and sales taxes, which in turn would generate further economic activity. Existing retail and services at WUS would also benefit from anticipated increases in sales due to greater Amtrak, MARC, VRE, and intercity bus ridership. Relative to the No-Action Alternative, approximately 50,700 additional passengers would transit through WUS daily. This would likely increase activity and spending at WUS's retail and service establishments, which in turn would stimulate demand for retail space and potentially drive rents up.[21] These impacts would be minor in the context of the local and regional economy.

14.5.2.2 Indirect Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative A would have a negligible indirect operational impact on demography. [22]

As explained in **Section 9.5.2.2**, *Indirect Operational Impacts*, *Regional Study Area,* the improved connectivity and activity at WUS promoted by Alternative A, as well as increased employment opportunities, may indirectly encourage or accelerate medium- or high-density

[21] These beneficial impacts may be partially offset by a reduction in existing retail space if some of the outlets displaced during construction (see *Washington Union Station Revenue* above and **Section 14.5.3**, *Construction Impacts, Washington Union Station Revenue*) do not return after completion of the work and are not replaced.

[22] This demographic impact is not qualified as adverse or beneficial because a small change in residential population does not in itself represent a favorable or unfavorable outcome.

development near WUS, including residential development, in addition to what would occur in the No-Action Alternative. This would result in an increase in the population of the Local Study Area and the District. This impact is not readily quantifiable but likely would negligible in the context of anticipated demographic growth in the District through 2040.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative A would have no adverse indirect operational impacts on local communities.

As noted above, Alternative A may indirectly encourage development near WUS. This would not result in adverse impacts on local communities. As explained in **Section 9.5.2.2**, *Indirect Operational Impacts, Regional Study Area*, the District's zoning regulations and applicable plans would continue to guide the density and character of potential future development, including the assumed development of the Federal air rights into parking space. This would avoid the development of land uses that could disrupt or dislocate local communities. As explained in **Section 14.5.1.2**, *Indirect Operational Impacts*, *Community Disruption and Other Social Benefits or Impacts*, the census tracts in the Local Study Area lack the typical characteristics of neighborhoods susceptible to gentrification.

Employment

Relative to the No-Action Alternative, Alternative A would have a minor beneficial indirect operational impact on employment.

Alternative A would have a beneficial indirect impact on employment because new retail and station workers at WUS and greater numbers of passengers and visitors would increase consumer demand for goods and services in the Local and Regional Study Areas. This would support employment both locally and regionally. Purchases of materials and supplies to support increased retail and transportation operations would also indirectly support employment in other sectors.

This beneficial impact is not quantifiable. It likely would be minor in the context of the current and projected future employment in the Local Study Area and the District, as it would represent a small increment over the No-Action Alternative.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative A would have no indirect operational impact on WUS Revenue.

Alternative A would have no indirect operational impacts on WUS revenue. The loss of parking and retail revenue described above in **Section 14.5.2.1**, *Direct Operational Impacts, Washington Union Station Revenue* would cancel out any marginal increase in revenue that greater activity at the station could generate.

Other Indirect Economic Impacts

Relative to the No-Action Alternative, Alternative A would have a minor beneficial indirect operational impact on tax revenues in the District.

Relative to the No-Action Alternative, Alternative A would have a beneficial impact from increased sales tax revenue for the District. The additional retail uses would generate new sales and new sales tax revenues. Additionally, income from the jobs directly and indirectly created by Alternative A likely would partially be spent in the District, generating further sales tax revenue. Some of the employees at WUS may move to Washington from other jurisdictions, increasing the District's income tax base.

More generally, Alternative A would contribute to expanding tourism and economic activity in the Regional Study Area by making it possible for WUS to overcome existing capacity constraints and resolve operational inefficiencies. Thanks to these improvements, WUS would continue to be a major transportation hub that supports and bolsters the local and regional economy, with attendant tax benefits.

The net benefit in tax revenue that would result is not quantifiable, but it is likely to amount to a minor beneficial impact compared to the tax revenue increase from the private air-rights development in the No-Action Alternative. It also would be small in the larger context of the District as a whole, whose total tax revenue in fiscal year 2018 was $7.5 billion.[23]

Potential Federal Air-rights Development

Relative to the No-Action Alternative, in Alternative A, the potential development of the Federal air rights as additional parking would result in no indirect operational impacts on demography, local communities. It would have a negligible beneficial indirect operational impact on employment and the regional economy, and a beneficial indirect operational impact on WUS revenue.

The assumed provision of additional parking space would not affect demography in the Local or Regional Study Area. It would not cause disruption to local communities, as it would occur within the footprint of a pre-existing facility. It would support a small number of maintenance and management jobs, but this would be a negligible beneficial impact in the context of the Local and Regional Study Areas. The development of the remaining Federal air rights would have a beneficial impact on WUS revenue through the lease of the space (or other mechanism through which development would be achieved). This impact cannot be quantified at this time but it would at least partially offset the loss of revenue from the reduction in parking capacity.

[23] Government of the District of Columbia, Office of Chief Financial Officer, Office of Revenue Analysis. *D.C. Tax Facts. 2018*. Accessed from https://cfo.dc.gov/node/1351591. Accessed on January 30, 2019.

14.5.2.3 Construction Impacts

Demographics

Construction of Alternative A would have no impacts on demography.

The construction of Alternative A would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative A would have moderate adverse impacts on local communities.

There would be adverse impacts on local communities at various times throughout the construction of Alternative A. Construction would take place over an estimated span of approximately 11 years and 5 months (including the 12-month Intermediate Phase). Throughout, to accommodate construction activities, there would be periods of rerouting passengers, closing off sections of WUS, and closing some retail space. The column removal component of the Project would close part of the Retail and Ticketing Concourse. Retail outlets located within this part of the concourse and the mezzanine above would have to close for at least the duration of the work, which is anticipated to take place over approximately 2 years and 6 months, overlapping with Phases 1 and 2 of construction.[24] Parking and bus loading and unloading activities would be displaced between the demolition of the existing garage and the completion of the new parking facility. Outside of WUS proper, construction traffic and noise as well as partial closures of sidewalks and traffic lanes would adversely affect residents, commuters and workers. These impacts are described in greater detail in other sections of this report, including **Section 5**, *Transportation;* **Section 9**, *Land Use, Land Planning, and Property*; **Section 10**, *Noise and Vibration;* **Section 13**, *Parks and Recreation Areas*; and **Section 15**, *Public Health, Elderly, and Persons with Disabilities*.

The impact from this disruption on local communities would be moderate for the following reasons. Although various disruptive activities would occur during the entire construction period, most would last for only a part of it and would be localized. The displacement of parking and bus activities would occur only in Phase 4 (last 3 years and 1 month of construction). Outside of WUS, disruptions would largely concentrate along 2nd Street NE (south of K Street) during Phase 1 of construction (lasting approximately 2 years and 5 months) and along First Street NE (also south of K Street) during Phase 4. Although adversely affected, access to WUS would remain available throughout the construction period and the phased construction would help minimize reductions in rail operations. While the various inconveniences construction of Alternative A would create would be highly noticeable and would make WUS and the parts of the Local Study Area closest to WUS less attractive to new

[24] The retail outlets that would be impacted includes UNIQLO, Victoria's Secret, Comfort One Shoes, Verizon, Hudson News, America!, Kashmir, Einstein Bros. Bagels, and Jamba Juice.

residents or businesses while construction is ongoing, the directly affected areas would be small and the adverse impacts would decrease quickly with distance.

Construction Employment

Construction of Alternative A would have a minor beneficial impact on employment.

Construction of Alternative A would support numerous jobs during the entire construction period. While this would be a beneficial impact, it would be minor in the context of regional employment in the Washington-Arlington-Alexandria Metropolitan Statistical Area, where most of the induced jobs are likely to be located.

Table 14-2 shows the cost of constructing Alternative A, broken down by phase.[25] Escalation costs are factored in to account for changes in cost over the duration of the construction period. Alternative A would cost approximately $7.24 billion (in 2017 dollars) over a construction period of 10 years and 5 months, broken into four phases.

Table 14-2. Estimated Construction Duration and Costs, Alternative A

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Construction Duration	2.42 Years	2.42 Years	2.58 Years	3.00 Years	10.42 Years
Total Construction Cost	$1,133,956,466	$1,576,142,107	$1,403,584,834	$3,121,028,382	$7,234,711,789

Values in 2017 dollars.
Intermediate Phase not included.

Construction activities and costs would vary over the course of construction. Therefore, the number of jobs supported by construction spending would vary depending on the year of the construction period. The analysis considers full- and part-time annual average jobs for both employees and self--employed workers, including seasonal workers. **Table 14-3** shows the estimated annual number of jobs that construction of Alternative A would support. These estimates were developed using the software model IMPLAN as described in **Section 14.4.2**, *Construction Impacts*.

On average, Alternative A would support annually approximately 4,614 direct jobs and 1,929 indirect and induced jobs, for a total of 6,543 jobs. Direct jobs would occur within the construction and architectural, engineering and related services industries. The indirect and

[25] As noted above, the modeling of construction impacts was based on Amtrak's rough-order-of magnitude combined estimates, which include the private and potential Federal overbuild deck but exclude the column removal work (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*).

induced jobs would occur in a wider range of industries such as wholesale trade; restaurants; real estate; hospitals; retail; and physicians.

For purposes of comparison, the total annual average number of direct jobs that Alternative A would support for the duration of the construction period represent approximately 0.6 percent of total employment in the two relevant sectors in the Washington-Arlington-Alexandria Metropolitan Statistical Area as of early 2019. [26]

Table 14-3. Construction Employment Estimates, Alternative A

Phase	Construction Year	Direct Employment	Indirect Employment	Induced Employment	Total Employment
1	**1**	3,466	324	1,138	4,928
1	**2**	3,466	324	1,138	4,928
1 and 2	**3**	4,247	401	1,395	6,043
2	**4**	4,377	415	1,439	6,231
2 and 3	**5**	4,256	402	1,398	6,055
3	**6**	3,708	346	1,217	5,271
3	**7**	3,704	350	1,217	5,271
3	**8**	5,607	563	1,852	8,022
3 and 4	**9**	6,535	647	2,156	9,338
4	**10**	6,547	635	2,156	9,338
4	**11**	2,784	214	900	3,898
Annual Average[1]		4,614	418	1,511	6,543

1. Construction Year 11 is a partial year and not included in the annual average.
Intermediate Phase not included.

Washington Union Station Revenue

Construction of Alternative A would have a major adverse impact on WUS revenue.

Construction of Alternative A would affect the two main sources of WUS revenue: retail and parking. The retail closures due to the column removal work would affect the revenue derived from the USI retail lease. At this stage, it is not possible to quantify the resulting financial impact on the affected retail outlets, USI, and USRC. However, given the duration of the anticipated closure (at least approximately 2 years and 6 months overlapping with Phases 1 and 2 of construction), it is likely to be major.

[26] Bureau of Labor Statistics *Economy at a Glance. Washington-Arlington-Alexandria, DC-VA-MD-WV.* Accessed from https://www.bls.gov/eag/eag.dc_washington_md.htm. Accessed on April 13, 2019. The two sectors taken into account in the comparison are Mining, Logging, and Construction (122,800 persons as of January 2019) and Professional and Business Services (632,400 persons as of January 2019).

There is also the possibility that, given the duration of the closure, the displaced outlets would not return to WUS after the completion of the work. If this occurs, and if the displaced businesses are not replaced by new tenants, the construction impacts could become permanent, as noted in **Section 14.5.2.1**, *Direct Operational Impacts*, *Washington Union Station Revenue*.

Construction-related disruptions in WUS access and the demolition of the parking garage would further cause a major reduction in the revenue accruing to WUS from parking operations. During the first three phases of construction, parking would remain available but changes in access and rerouting may reduce the number of users and the revenue generated by parking. During Phase 4, which would start approximately 8 years and 4 months after the beginning of construction and last approximately 3 years and 1 month, parking would not be available. Based on fiscal year 2016 revenue from parking, this is would represent a loss of approximately $25.5 million for WUS.

Other Economic Benefits or Impacts

Construction of Alternative A would have a moderate beneficial impact on the regional economy.

Construction of Alternative A would have a moderate regional beneficial economic impact from the spending of the income generated by the jobs construction of the Project would generate. **Table 14-4** shows annual estimates of this income. Alternative A construction would produce from $254 to $609 million in estimated annual labor income (including employee compensation and proprietor income) depending upon the year. Annual value added, which is the combination of labor income, other property type income and indirect business taxes, would range from $355 million to $851 million depending upon the year. Annual total output, or the value of production, would range from $586 to $1,405 million depending upon the year. These economic outputs would spread benefits throughout the Washington DC metropolitan region.

Table 14-4. Construction Annual Labor Income, Value and Output, Alternative A

Phase	Construction Year	Annual Labor Income	Annual Value	Annual Total Output
1	**1**	$321,467,648	$449,408,225	$741,851,819
1	**2**	$321,467,648	$449,408,225	$741,851,819
1 and 2	**3**	$394,174,196	$551,051,176	$909,636,928
2	**4**	$406,458,676	$568,224,743	$937,985,858
2 and 3	**5**	$395,012,574	$552,223,220	$911,571,657
3	**6**	$343,877,491	$480,736,938	$793,567,078
3	**7**	$343,877,491	$480,736,938	$793,567,078
3 and 4	**8**	$523,276,372	$731,534,593	$1,207,566,392
4	**9**	$609,145,078	$851,578,096	$1,405,725,852
4	**10**	$609,145,078	$851,578,096	$1,405,725,852
4	**11**	$254,249,209	$355,437,588	$586,731,632

Values in 2019 dollars.
Intermediate Phase not included.

While substantial, the impact would be moderate in the context of the Washington-Arlington-Alexandria Metropolitan Area. In 2017, the gross domestic product of this area was approximately $17.5 trillion. [27]

14.5.2.4 Comparison to Existing Conditions

The impacts of Alternative A on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative A would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the existing economy and the impacts, the difference would be small and would not affect impact intensities.

[27] U.S. Bureau of Economic Analysis. *Gross Domestic Product by Metropolitan Area, 2017*. https://www.bea.gov/data/gdp/gdp-metropolitan-area. Accessed February 4, 2019.

14.5.3 Alternative B

14.5.3.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative B would have no direct operational impact on demographic conditions.

Like Alternative A and the other Action Alternatives, Alternative B would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative B would have major beneficial direct operational impacts on local communities.

The impacts of Alternative B would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts*.

Employment

Relative to the No-Action Alternative, Alternative B would have a minor beneficial direct operational impact on employment.

The impacts of Alternative B would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Employment*.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative B would have a major adverse operational direct impact on WUS revenue.

Alternative B would entirely eliminate the station's revenue stream from parking, which represent the majority of its total revenue. This is because in Alternative B, all parking would be in two below-ground levels under the rail terminal, in an area that is not within the station's lease area. Therefore, WUS would not receive any revenue from the new parking. Based on numbers for fiscal year 2016, this would represent a loss of approximately $8.5 million. In that year, parking revenue represented 59 percent of the station's total revenue. [28]

[28] In fiscal year 2016, WUS revenue from the parking garage operations was $8,532,403 out of a total revenue of $14,381,916: *USRC Annual Report* 2016. Accessed from https://www.usrcdc.com/wp-content/uploads/2017/02/usrc_annual_report_2016_final_spreads.pdf. Accessed on July 18, 2017.

Revenue from retail would remain approximately the same as or be less than in the No-Action Alternative for the same reasons as explained for Alternative A in **Section 14.5.2.1**, *Direct Operational Impacts, Washington Union Station Revenue*.

Altogether, Alternative B would cause a net loss in revenue for WUS. This would be a major adverse impact, as the loss from parking alone would represent more than half the station's total revenue.

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative B would have a minor beneficial direct operational impact on the local and regional economy.

The impact of Alternative B on the local and regional economy from additional retail at WUS would be the same as that of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Other Direct Economic Impacts*.

14.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a negligible indirect operational impact on demography; no adverse indirect operational impact on local communities; a minor beneficial indirect operational impact on employment; no indirect operational impact on WUS revenue; and a minor beneficial indirect operational impact on tax revenues in the District.

The indirect operational impacts of Alternative B would be the same as those of Alternative A (see **Section 14.5.2.2**, *Indirect Operational Impacts*) except for the impacts associated with the potential development of the Federal air rights, described below.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative B would have no indirect operational impacts on WUS revenue.

Alternative B has no potential for indirect impacts to WUS revenues. Because in this alternative, WUS would lose all parking revenue, it would derive no benefit from any potential upward pressure on parking rates from increased local activity.

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, in Alternative B, the potential development of the Federal air right as office space would result in a negligible indirect operational impact on demography; no indirect operational impact on local communities; a moderate beneficial indirect operational impact on employment; a beneficial indirect impact on WUS revenue; and a minor beneficial indirect operational impact on District tax revenue.

The assumed development of the remaining Federal air rights as approximately 917,420 square feet of office space would have a beneficial impact on WUS revenue through the lease of the space (or other mechanism through which development would be achieved). This impact cannot be quantified at this time but it would at least partially offset the loss of revenue from the reduction in parking capacity.

The provision of this office space would have an impact on demography in the Local Study Area if some employees move to the area to be closer to their workplace. Given WUS's accessibility by transit and the moderate number of employees at the site (see below), this impact would likely be small and negligible.

Development of the Federal air rights into office space would not cause disruptions to local communities, as it would occur within the footprint of a pre-existing facility. It would bring approximately 3,670 additional new jobs to the Local Study Area, a moderate beneficial impact in the context of the Local and Regional Study Areas.[29] These jobs would generate tax revenue for the District. This beneficial impact would be minor in the context of the District as a whole.

14.5.3.3 Construction Impacts

Demographics

Construction of Alternative B would have no impacts on demography.

Like the construction of Alternative A and the other Action Alternatives, the construction of Alternative B would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative B would have moderate adverse impacts on local communities.

Construction of Alternative B would take place over approximately 14 years and 4 months (including the 12-month Intermediate Phase). Throughout the construction period, to accommodate construction activities, there would be periods of rerouting passengers, losing off sections of WUS, and closing some retail outlets. As in all Action Alternatives, the column removal component of the Project would close part of the Retail and Ticketing Concourse and displace the retail outlets located there for at least the duration of the work (approximately 2 years and 6 months, overlapping with Phases 1 and 2 of construction) [30].

[29] Assumes 1 employee per 250 square feet of office space.

[30] The retail outlets that would be impacted includes UNIQLO, Victoria's Secret, Comfort One Shoes, Verizon, Hudson News, America!, Kashmir, Einstein Bros. Bagels, and Jamba Juice.

Parking and bus loading and unloading activities would be displaced between the demolition of existing garage and the completion of the new facilities. Construction traffic and noise as well as partial closures of sidewalks and traffic lanes would adversely affect residents, commuters, and workers. These impacts are described in greater detail in other sections of this report, including **Section 5**, *Transportation;* **Section 9**, *Land Use, Land Planning, and Property*; **Section 10**, *Noise and Vibration;* **Section 13**, *Parks and Recreation Areas*; and **Section 15**, *Public Health, Elderly, and Persons with Disabilities*.

The resulting adverse impact on local communities would be moderate. Although various disruptive activities would take place over the entire construction period, most would last for a shorter time and would be localized. The displacement of the parking and bus facility would occur only in Phase 4 (last 4 years and 11 months of construction). Outside of WUS, disruptions would largely concentrate along 2nd Street NE (south of K Street) during Phase 1 of construction (lasting approximately 2 years and 5 months) and along First Street NE (also south of K Street) during Phase 4. There would also be disruptions on K Street NE to construct the below-ground parking facility access ramp in the underpass below the rail terminal. Although adversely affected, access to WUS would remain available throughout the construction period and the phased construction would help minimize reductions in rail operations. While the various inconveniences construction of Alternative B would create would be highly noticeable and would make the parts of the Local Study Area closest to WUS less attractive to new residents or businesses while construction is ongoing, the affected areas would be small and the adverse impacts would fade quickly with distance.

Construction Employment

Construction of Alternative B would have a minor beneficial impact on employment.

Construction of Alternative B would support numerous jobs during the entire construction period, resulting in a beneficial impact on regional employment. This beneficial impact would be minor in the context of regional employment in the Washington-Arlington-Alexandria Metropolitan Statistical Area, where most of the induced jobs are likely to be located.

The jobs that construction of Alternative B would support were estimated using the methodology described in **Section 14.4.2**, *Construction Impacts*. **Table 14-5** shows the cost of constructing Alternative B, broken down by phase. [31] Alternative B would cost approximately $8.63 billion (in 2017 dollars) over a construction period of 13 years and 4 months broken into four phases.

[31] As noted above, the modeling of construction impacts was based on Amtrak's rough-order-of magnitude combined estimates, which include the private and potential Federal overbuild deck but exclude the column removal work (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*).

Table 14-5. Estimated Construction Duration and Costs, Alternative B

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Construction Duration	2.42 Years	3.00 Years	3.00 Years	4.92 Years	13.34 Years
Total Construction Cost	$1,124,899,927	$1,808,070,249	$1,604,280,656	$4,088,686,449	$8,625,937,281

Values in 2017 dollars.
Intermediate Phase not included.

Table 14-6 shows the estimated annual number of jobs construction of Alternative B would support. On average., Alternative B would support annually approximately 4,282 direct jobs (including jobs in the construction and architectural, engineering and related services industries) and 1,806 indirect and induced jobs (including industries such as wholesale trade; restaurants; real estate; hospitals; retail; and physicians) for a total of 6,088 jobs.

Table 14-6. Construction Employment Estimates, Alternative B

Phase	Construction Year	Direct Employment	Indirect Employment	Induced Employment	Total Employment
1	**1**	3,439	321	1,129	4,889
1	**2**	3,439	321	1,129	4,889
1 and 2	**3**	4,030	376	1,323	5,729
2	**4**	4,055	379	1,331	5,766
2	**5**	4,055	379	1,331	5,766
2 and 3	**6**	3,743	350	1,229	5,322
3	**7**	3,510	328	1,152	4,990
3	**8**	3,510	328	1,152	4,990
3 and 4	**9**	4,608	431	1,513	6,552
4	**10**	5,320	497	1,746	7,563
4	**11**	5,320	497	1,746	7,563
4	**12**	5,320	497	1,746	7,563
4	**13**	5,320	497	1,746	7,563
4	**14**	1,787	167	586	2,540
Annual Average[1]		4,282	400	1,406	6,088

1. Construction year 14 is a partial year and not included in the annual average.
Intermediate Phase not included.

For purposes of comparison, the total annual average number of direct jobs that Alternative B would support for the duration of the construction period represent approximately 0.57 percent of total employment in the two relevant sectors in the Washington-Arlington-Alexandria Metropolitan Statistical Area as of early 2019. [32].

Washington Union Station Revenue

Construction of Alternative B would have a major adverse impact on WUS revenue.

In Alternative B as in Alternative A (see **Section 14.5.2.3**, *Construction Impacts, Washington Union Station Revenue*), construction-related disruptions, including the closure of retail space during column removal work and the demolition of the parking garage, would cause a major reduction in WUS revenue. As in all Action Alternatives, retail closures would at least last for the entire duration of the column removal work, or approximately 2 years and 6 months, overlapping with construction Phases 1 and 2. Parking would remain available during the first three phases of construction but changes in access and rerouting may reduce the number of users and the revenue generated by parking. During Phase 4, which would start around 9 years and 5 months after the beginning of construction and last for approximately 4 years and 11 months, parking would not be available. Based on fiscal year 2016 revenue from parking, this would represent a loss of approximately $42.5 million for WUS.

Other Economic Benefits or Impacts

Construction of Alternative B would have a moderate beneficial impact on the regional economy.

Construction of Alternative B would have a moderate regional beneficial economic impact from the spending of the income generated by the jobs the construction of the Project would generate. **Table 14-7** shows annual estimates of this income. Alternative B construction would produce from $166 to $493 million in estimated annual labor income (including employee compensation and proprietor income) depending upon the year. Annual value added would range from $232 million to $690 million depending upon the year. Annual total output, or the value of production, would range from $382 to $1,139 million depending upon the year. These economic outputs would spread benefits throughout the Washington DC metropolitan region. The impact would be moderate in the context of the Washington-Arlington-Alexandria Metropolitan Area. In 2017, the gross domestic product of this area was approximately $17.5 trillion. [33]

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32 Bureau of Labor Statistics *Economy at a Glance. Washington-Arlington-Alexandria, DC-VA-MD-WV.* Accessed from https://www.bls.gov/eag/eag.dc_washington_md.htm. Accessed on April 13, 2019. The two sectors taken into account in the comparison are Mining, Logging, and Construction (122,800 persons as of January 2019) and Professional and Business Services (632,400 persons as of January 2019).

33 U.S. Bureau of Economic Analysis. *Gross Domestic Product by Metropolitan Area, 2017*. https://www.bea.gov/data/gdp/gdp-metropolitan-area. Accessed February 4, 2019.

Table 14-7. Construction Annual Labor Income, Value and Output, Alternative B

Phase	Construction Year	Annual Labor Income	Annual Value	Annual Total Output
1	1	$318,900,192	$445,818,949	$735,926,892
1	2	$318,900,192	$445,818,949	$735,926,892
1 and 2	3	$373,754,159	$522,504,189	$862,513,550
2	4	$376,123,473	$525,816,465	$867,981,224
2	5	$376,123,473	$525,816,465	$867,981,224
2 and 3	6	$347,174,782	$485,346,514	$801,176,246
3	7	$325,502,052	$455,048,276	$751,162,024
3	8	$325,502,052	$455,048,276	$751,162,024
3 and 4	9	$427,422,286	$597,531,639	$986,363,643
4	10	$493,368,671	$689,723,957	$1,138,548,305
4	11	$493,368,671	$689,723,957	$1,138,548,305
4	12	$493,368,671	$689,723,957	$1,138,548,305
4	13	$493,368,671	$689,723,957	$1,138,548,305
4	14	$165,664,549	$231,597,211	$382,304,557

Values in 2019 dollars.
Intermediate Phase not included.

14.5.3.4 Comparison to Existing Conditions

The impacts of Alternative B on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative B would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the existing economy and the impacts, the difference would be small and would not affect impact intensities.

14.5.4 Alternative C

14.5.4.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative C (either option) would have no direct operational impact on demographic conditions.

Like Alternative A and the other Action Alternatives, Alternative C would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have major beneficial direct operational impacts on local communities.

The impacts of Alternative C would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts*.

Employment

Relative to the No-Action Alternative, Alternative C (either option) would have a minor beneficial direct operational impact on employment.

The impacts of Alternative C would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Employment*.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative C (either option) would have a major adverse operational direct impact on WUS revenue.

Like Alternative B, and for the same reasons, Alternative C would have a major adverse direct operational impact on WUS revenue because it would eliminate the station's revenue stream from parking, which represent the majority of its total revenue. All new parking would be located below ground or above ground north of H Street NE, outside the stations' lease area. This would eliminate the main source of WUS's revenue (see **Section 14.5.3.1**, *Direct Operational Impacts, Washington Union Station Revenue)*. As in the other Action Alternatives, the loss could be aggravated if some of the retail displaced during construction does not return (see **Section 14.5.2.1**, *Direct Operational Impacts, Washington Union Station Revenue*).

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have a minor beneficial direct operational impact on the local and regional economy.

The impact of Alternative C on the local and regional economy from additional retail at WUS would be the same as in Alternative A: see **Section 14.5.2.1**, *Direct Operational Impacts, Other Direct Economic Impacts*.

14.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have a negligible indirect operational impact on demography; no adverse indirect operational impact on local communities; a minor beneficial indirect operational impact on employment; no

impact on WUS revenue; and a minor beneficial indirect operational impact on tax revenues in the District.

The indirect operational impacts of Alternative C would be as described for Alternative A (see **Section 14.5.2.2**, *Indirect Operational Impacts*), except for the indirect impacts associated with the potential development of the Federal air rights, described separately below.

Potential Federal Air-rights Development

Relative to the No-Action Alternative, in Alternative C (either option), the potential development of the Federal air right as office space would result in a negligible indirect operational impact on demography; no indirect operational impact on local communities; a moderate beneficial indirect operational impact on employment; a beneficial indirect impact on WUS revenue; and a minor beneficial indirect operational impact on District tax revenue.

The assumed development of the remaining Federal air rights as approximately 952,600 square feet of office space would have a beneficial impact on WUS revenue through the lease of the space (or other mechanism through which development would be achieved). This impact cannot be quantified at this time but it would at least partially offset the loss of revenue from the reduction in parking capacity.

The provision of this office space would have an impact on demography in the Local Study Area if some employees move to the area to be closer to their workplace. Given WUS's accessibility by transit and the moderate number of employees at the site (see below), this impact would likely be small and negligible.

Development of the Federal air rights into office space would not cause disruptions to local communities, as it would occur within the footprint of a pre-existing facility. It would bring approximately 3,810 additional new jobs to the Local Study Area, a moderate beneficial impact in the context of the Local and Regional Study Areas.[34] These jobs would generate tax revenue for the District. This beneficial impact would be minor in the context of the District as a whole.

14.5.4.3 Construction Impacts

Demographics

Construction of Alternative C (either option) would have no impacts on demography.

Like the construction of all Action Alternatives, the construction of Alternative C would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

[34] Assumes 1 employee per 250 square feet of office space.

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative C would have moderate adverse impacts on local communities.

Construction of Alternative C would take place over approximately 12 years and 3 months (including the 12-month Intermediate Phase). Throughout, to accommodate construction activities, there would be periods of rerouting passengers and closing off sections of WUS. As in all Action Alternatives, column removal work would close part of the Retail and Ticketing Concourse and displace the retail outlets located there for the duration of the work (approximately 2 years and 6 months, overlapping with Phases 1 and 2 of construction).[35] Parking and bus loading and unloading activities would be displaced between the demolition of existing garage and the completion of the new facilities. Construction traffic and noise as well as partial closures of sidewalks and traffic lanes would adversely affect residents, commuters, and workers. These impacts are described in greater detail in other sections of this report, including **Section 5**, *Transportation;* **Section 9**, *Land Use, Land Planning, and Property*; **Section 10**, *Noise and Vibration;* **Section 13**, *Parks and Recreation Areas*; and **Section 15**, *Public Health, Elderly, and Persons with Disabilities*.

The resulting adverse impact on local communities would be moderate. Although various disruptive activities would take place over the entire construction period, most would last for a shorter time and would be localized. The displacement of the parking and bus facility would occur only in Phase 4 (last 4 years of construction). It would be total under the West Option but partial under the East Option, as the new bus facility and above-ground parking facility would be operational by the time the existing structures are demolished. Outside of WUS, disruptions would largely concentrate along 2nd Street NE (south of K Street) during Phase 1 of construction (lasting approximately 2 years and 5 months) and along First Street NE (also south of K Street) during Phase 4. There would also be disruptions on K Street NE to construct the below-ground parking facility access ramp in the underpass below the rail terminal. Although adversely affected, access to WUS would remain available throughout the construction period and the phased construction would help minimize reductions in rail operations. While the various inconveniences construction of Alternative C would create would be highly noticeable and would make WUS and the parts of the Local Study Area closest to WUS less attractive to new residents or businesses while construction is ongoing, the affected areas would be small and the adverse impacts would fade quickly with distance.

[35] The retail outlets that would be impacted includes UNIQLO, Victoria's Secret, Comfort One Shoes, Verizon, Hudson News, America!, Kashmir, Einstein Bros. Bagels, and Jamba Juice.

Construction Employment

Construction of Alternative C (either option) would have a minor beneficial impact on employment.

Like that of the other Action Alternatives, construction of Alternative C would support numerous jobs during the entire construction period, resulting in a beneficial impact on regional employment. This beneficial impact would be minor in the context of regional employment in the Washington-Arlington-Alexandria Metropolitan Statistical Area, where most of the induced jobs are likely to be located.

The jobs that construction of Alternative C would support were estimated using the methodology described in **Section 14.4.2**, *Construction Impacts*. **Table 14-8** shows the cost of constructing Alternative C, broken down by phase. [36] Alternative C would cost approximately $7.55 billion (in 2017 dollars) over a construction period of 11 years and 3 months broken into four phases.

Table 14-8. Estimated Construction Duration and Costs, Alternative C

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Construction Duration	2.42 Years	2.33 Years	2.50 Years	4.00 Years	11.25 Years
Total Construction Cost	$1,063,350,449	$1,549,959,258	$1,371,950,759	$3,564,777,067	$7,550,037,533

Values in 2017 dollars.
Intermediate Phase not included.

Table 14-9 shows the estimated annual number of jobs construction of Alternative C would support. On average, Alternative C would support annually approximately 4,483 direct jobs (including jobs in the construction and architectural, engineering and related services industries) and 1,891 indirect and induced jobs (including industries such as wholesale trade; restaurants; real estate; hospitals; retail; and physicians), for a total of 6,374 jobs.

For purposes of comparison, the total annual average number of direct jobs that Alternative C would support for the duration of the construction period represent approximately 0.6 percent of total employment in the two relevant sectors in the Washington-Arlington-Alexandria Metropolitan Statistical Area as of early 2019. [37]

[36] As noted above, the modeling of construction impacts was based on Amtrak's rough-order-of magnitude combined estimates, which include the private and potential Federal overbuild deck but exclude the column removal work (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*).

[37] Bureau of Labor Statistics *Economy at a Glance. Washington-Arlington-Alexandria, DC-VA-MD-WV.* Accessed from https://www.bls.gov/eag/eag.dc_washington_md.htm. Accessed on April 13, 2019. The two sectors taken into account in

Table 14-9. Construction Employment Estimates, Alternative C

Phase	Construction Year	Direct Employment	Indirect Employment	Induced Employment	Total Employment
1	**1**	3,251	304	1,067	4,621
1	**2**	3,251	304	1,067	4,621
1 and 2	**3**	4,219	394	1,385	5,999
2	**4**	4,476	418	1,469	6,364
2 and 3	**5**	4,254	397	1,396	6,048
3	**6**	3,624	339	1,190	5,153
3	**7**	3,624	339	1,190	5,153
3 and 4	**8**	5,288	494	1,736	7,517
4	**9**	5,777	539	1,896	8,212
4	**10**	5,777	539	1,896	8,212
4	**11**	5,777	539	1,896	8,212
4	**12**	1,427	133	468	2,028
Annual Average		4,483	419	1,472	6,374

Intermediate Phase not included.

Washington Union Station Revenue

Construction of Alternative C (either option) would result in a major adverse impact on WUS revenue.

In Alternative C, as in Alternative A (see **Section 14.5.2.3**, *Construction Impacts, Washington Union Station Revenue*) construction-related disruptions, including the closure of retail space during column removal work and the demolition of the parking garage during Phase 4 of construction, would cause a major reduction in WUS revenue. As in all Action Alternatives, the retail closures would last for at least the duration of the column removal work, or approximately 2 years and 6 months. Parking would remain available during the first three phases of construction but changes in access and rerouting may reduce the number of users and the revenue generated by parking. During Phase 4, which would start approximately 8 years and 3 months after the beginning of construction and last for approximately 4 years, parking would not be available (West Option) or would be partially available in the new above-ground facility but outside the lease area (East Option). Based on fiscal year 2016 revenue from parking, this would represent a loss of approximately $42.5 million for WUS.

the comparison are Mining, Logging, and Construction (122,800 persons as of January 2019) and Professional and Business Services (632,400 persons as of January 2019).

Other Economic Benefits or Impacts

Construction of Alternative C (either option) would have a moderate beneficial impact on the regional economy.

Construction of Alternative C would have a moderate regional beneficial economic impact from the spending of the income generated by the jobs the construction of the Project would support. **Table 14-10** shows annual estimates of this income. Alternative C construction would produce from $132 to $536 million in estimated annual labor income (including employee compensation and proprietor income) depending upon the year. Annual value added would range from $185 million to $749 million depending upon the year. Annual total output, or the value of production, would range from $305 to $1,236 million depending upon the year. These economic outputs would spread benefits throughout the Washington DC metropolitan region. The impact would be moderate in the context of the Washington-Arlington-Alexandria Metropolitan Area. In 2017, the gross domestic product of this area was approximately $17.5 trillion.[38]

Table 14-10. Construction Annual Labor Income, Value and Output, Alternative C

Phase	Construction Year	Annual Labor Income	Annual Value	Annual Total Output
1	1	$301,451,404	$421,425,735	$695,660,273
1	2	$301,451,404	$421,425,735	$695,660,273
1 and 2	3	$391,306,342	$547,041,947	$903,018,773
2	4	$415,145,901	$580,369,388	$958,033,393
2 and 3	5	$394,509,551	$551,519,998	$910,410,827
3	6	$336,127,161	$469,902,061	$775,681,618
3	7	$336,127,161	$469,902,061	$775,681,618
3 and 4	8	$490,353,323	$685,508,534	$1,131,589,778
4	9	$535,730,191	$748,944,895	$1,236,306,107
4	10	$535,730,191	$748,944,895	$1,236,306,107
4	11	$535,730,191	$748,944,895	$1,236,306,107
4	12	$132,271,189	$184,913,662	$305,242,604

Values in 2019 dollars.
Intermediate Phase not included.

14.5.4.4 Comparison to Existing Conditions

The impacts of Alternative C (either option) on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action

38 U.S. Bureau of Economic Analysis. *Gross Domestic Product by Metropolitan Area, 2017*. https://www.bea.gov/data/gdp/gdp-metropolitan-area. Accessed February 4, 2019.

Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative C would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the existing economy and the impacts, the difference would be small and would not affect impact intensities.

14.5.5 Alternative D

14.5.5.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative D would have no direct operational impact on demographic conditions.

Like Alternative A and the other Action Alternatives, Alternative D would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative D would have major beneficial direct operational impacts on local communities.

The impacts of Alternative D would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts.*

Employment

Relative to the No-Action Alternative, Alternative D would have a minor beneficial direct operational impact on employment.

Alternative D would have a beneficial impact on employment because it would add 1,529 jobs at WUS relative to the No-Action Alternative. Alternative D would add 100,000 additional square feet of WUS retail space to WUS, which would generate approximately 300 new jobs, for a total of approximately 924 WUS retail jobs.[39] Alternative D, like the other Action Alternatives, would also provide additional space for Amtrak to support expanded rail operations. The expanded Amtrak support area would be approximately 297,400 square feet in size and staffed with approximately 1,629 persons. [40] This would be an approximately 1,229-employee increase over the No-Action Alternative.

[39] The retail job generation is based on a standard planning multiplier of 3 employees per 1,000 square feet of retail space.

[40] Amtrak. 2018. *WUS-TI Space Program*.

This beneficial impact would be minor because while large in the context of WUS, it would be small in the larger context of the District. The 1,529 jobs that Alternative D would support would represent an increase of 149 percent in WUS jobs relative to the No-Action Alternative. Regionally, DCOP projections indicate that the District would have a total of 1,012,000 jobs by 2040, with an average growth of 8,995 jobs per year during the 2015-2045 period. The jobs associated with Alternative D would represent about 0.15 percent of the total projected 2040 employment and 17 percent of the projected average yearly growth through 2045.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative D would have a major adverse operational direct impact on WUS revenue.

Like Alternatives B and C, and for the same reasons, Alternative D would have a major adverse direct operational impact on WUS revenue because it would eliminate the station's revenue stream from parking, which represent the majority of its total revenue. All new parking would be located below ground or above ground north of H Street NE, outside the stations' lease area. This would eliminate the main source of WUS's revenue (see **Section 14.5.3.1**, *Direct Operational Impacts, Washington Union Station Revenue*. As in the other Action Alternatives, the loss could be aggravated if some of the retail displaced during construction does not return (see **Section 14.5.2.1**, *Direct Operational Impacts, Washington Union Station Revenue*).

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative D would have a minor beneficial direct operational impact on the local and regional economy.

Alternative D would have a minor beneficial impact on the local and regional economy because it would add approximately 100,000 square feet of retail at WUS. This new retail would generate revenue for its operators as well as new jobs and sales taxes, which in turn would generate further economic activity. Like in the other Action Alternatives, existing retail and services at WUS would also benefit from anticipated increases in sales due to greater Amtrak, MARC, VRE, and intercity bus ridership (approximately 50,700 additional daily passengers relative to the No-Action Alternative). The beneficial impacts would be minor in the context of the local and regional economy.

14.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a negligible indirect operational impact on demography; no adverse indirect operational impact on local communities; a minor beneficial indirect operational impact on employment; no indirect operational impact on WUS revenue; and a minor beneficial indirect operational impact on tax revenues in the District.

The indirect operational impacts of Alternative D would be the same as those of Alternative A (see **Section 14.5.2.2**, *Indirect Operational Impacts*) except for the indirect impacts associated with the potential development of the Federal air rights, described below.

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, in Alternative D, the potential development of the Federal air right as office space would result in a negligible indirect operational impact on demography; no indirect operational impact on local communities; a moderate beneficial indirect operational impact on employment; a beneficial indirect impact on WUS revenue; and a minor beneficial indirect operational impact on District tax revenue.

The assumed development of the remaining Federal air rights as approximately 688,000 square feet of office space would have a beneficial impact on WUS revenue through the lease of the space (or other mechanism through which development would be achieved). This impact cannot be quantified at this time but it would at least partially offset the loss of revenue from the reduction in parking capacity.

The provision of this office space would have an impact on demography in the Local Study Area if some employees move to the area to be closer to their workplace. Given WUS's accessibility by transit and the moderate number of employees at the site (see below), this impact would be small and negligible.

Development of the Federal air rights into office space would not cause disruptions to local communities, as it would occur within the footprint of a pre-existing facility. It would bring approximately 2,752 additional new jobs to the Local Study Area, a moderate beneficial impact in the context of the Local and Regional Study Areas.[41] These jobs would generate tax revenue for the District. This beneficial impact would be minor in the context of the District as a whole.

14.5.5.3 Construction Impacts

Demographics

Construction of Alternative D would have no impact on demography.

Like the construction of all Action Alternatives, the construction of Alternative D would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative D would have moderate adverse impacts on local communities.

[41] Assumes 1 employee per 250 square feet of office space.

The impacts of constructing Alternative D would be the same as those of constructing Alternative C with the West Option. See **Section 14.5.4.3**, *Construction Impacts, Community Disruption and Other Social Benefits or Impacts*.

Construction Employment

Construction of Alternative D would have a minor beneficial impact on employment.

Like that of the other Action Alternatives, construction of Alternative D would create numerous jobs during the entire construction period, resulting in a beneficial impact on regional employment. This beneficial impact would be minor in the context of regional employment in the Washington-Arlington-Alexandria Metropolitan Statistical Area, where most of the induced jobs are likely to be located. The jobs that construction of Alternative D would support were estimated using the methodology described in **Section 14.4.2**, *Construction Impacts*.

Table 14-11 shows the cost of constructing Alternative D, broken down by phase.[42] Alternative D would cost approximately $7.61 billion (in 2017 dollars) over a construction period of 11 years and 3 months broken into four phases.

Table 14-11. Estimated Construction Duration and Costs, Alternative D

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Construction Duration	2.42 Years	2.58 Years	2.58 Years	4.42 Years	12.00 Years
Total Construction Cost	$1,044,560,062	$1,528,977,169	$1,377,728,776	$3,658,835,341	$7,610,101,348

Values in 2017 dollars.
Intermediate Phase not included.

Table 14-12 shows the estimated annual number of jobs construction of Alternative D would create. On average., Alternative D would support annually approximately 4,513 direct jobs (including jobs in the construction and architectural, engineering and related services industries) and 1,902 indirect and induced jobs (including industries such as wholesale trade; restaurants; real estate; hospitals; retail; and physicians), for a total of 6,416 jobs.

42 As noted above, the modeling of construction impacts was based on Amtrak's rough-order-of magnitude combined estimates, which include the private and potential Federal overbuild deck but exclude the column removal work (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*).

Table 14-12. Construction Employment Estimates, Alternative D

Phase	Construction Year	Direct Employment	Indirect Employment	Induced Employment	Total Employment
1	**1**	3,193	298	1,048	4,539
1	**2**	3,193	298	1,048	4,539
1 and 2	**3**	4,157	388	1,364	5,909
2	**4**	4,416	413	1,450	6,278
2	**5**	4,213	393	1,383	5,989
3	**6**	3,639	340	1,195	5,174
3	**7**	3,639	340	1,195	5,174
3 and 4	**8**	5,407	505	1,775	7,687
4	**9**	5,929	554	1,946	8,429
4	**10**	5,929	554	1,946	8,429
4	**11**	5,929	554	1,946	8,429
4	**12**	1,464	137	481	2,081
Annual Average		4,513	421	1,481	6,416

Intermediate Phase not included.

For purposes of comparison, the total annual average number of direct jobs that Alternative D would support for the duration of the construction period represent approximately 0.6 percent of total employment in the two relevant sectors in the Washington-Arlington-Alexandria Metropolitan Statistical Area as of early 2019. [43]

Washington Union Station Revenue

Construction of Alternative D would result in a major adverse impact on WUS revenue.

The impact of constructing Alternative D on WUS revenue would be like those of constructing Alternative C (**Section 14.5.4.3**, *Construction Impacts, Washington Union Station Revenue)*. Construction durations would be the same in both alternatives.

Other Economic Benefits or Impacts

Construction of Alternative D would have a moderate beneficial impact on the regional economy.

[43] Bureau of Labor Statistics *Economy at a Glance. Washington-Arlington-Alexandria, DC-VA-MD-WV.* Accessed from https://www.bls.gov/eag/eag.dc_washington_md.htm. Accessed on April 13, 2019. The two sectors taken into account in the comparison are Mining, Logging, and Construction (122,800 persons as of January 2019) and Professional and Business Services (632,400 persons as of January 2019).

Construction of Alternative D would have a moderate regional beneficial economic impact from the spending of the income generated by the jobs the construction of the Project would support. **Table 14-13** shows annual estimates of this income. Alternative D construction would produce from $136 to $550 million in estimated annual labor income (including employee compensation and proprietor income) depending upon the year. Annual value added would range from $190 million to $769 million depending upon the year. Annual total output, or the value of production, would range from $313 to $1,269 million depending upon the year. These economic outputs would spread benefits throughout the Washington DC metropolitan region. The impact would be moderate in the context of the Washington-Arlington-Alexandria Metropolitan Area. In 2017, the gross domestic product of this area was approximately $17.5 trillion. [44]

Table 14-13. Construction Annual Labor Income, Value and Output, Alternative D

Phase	Construction Year	Annual Labor Income	Annual Value	Annual Total Output
1	1	$296,124,478	$413,978,752	$683,367,312
1	2	$296,124,478	$413,978,752	$683,367,312
1 and 2	3	$385,485,783	$538,904,871	$889,586,654
2	4	$409,525,993	$572,512,819	$945,064,315
2	5	$390,679,191	$546,165,198	$901,571,496
3	6	$337,542,771	$471,881,069	$778,948,426
3	7	$337,542,771	$471,881,069	$778,948,426
3 and 4	8	$501,439,798	$701,007,304	$1,157,174,068
4	9	$549,865,677	$768,706,148	$1,268,926,608
4	10	$549,865,677	$768,706,148	$1,268,926,608
4	11	$549,865,677	$768,706,148	$1,268,926,608
4	12	$135,761,225	$189,792,694	$313,296,570

Values in 2019 dollars.
Intermediate Phase not included.

14.5.5.4 Comparison to Existing Conditions

The impacts of Alternative D on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative D would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the

[44] U.S. Bureau of Economic Analysis. *Gross Domestic Product by Metropolitan Area, 2017*. Accessed from https://www.bea.gov/data/gdp/gdp-metropolitan-area. Accessed on February 4, 2019.

existing economy and the impacts, the difference would be minimal and would not affect impact intensities.

14.5.6 Alternative E

14.5.6.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative E would have no direct operational impact on demographic conditions.

Like Alternative A and the other Action Alternatives, Alternative E would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative E would have major beneficial direct operational impacts on local communities.

The impacts of Alternative E would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts*.

Employment

Relative to the No-Action Alternative, Alternative E would have a minor beneficial direct operational impact on employment.

The impact of Alternative E on employment would be the same as those of Alternative D. See **Section 14.5.5.1**, *Direct Operational Impacts, Employment*.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative E would have a major adverse operational direct impact on WUS revenue.

Alternative E would result in the same major adverse direct operational impact as Alternative B. See **Section 14.5.3.1**, Direct Operational Impacts, Washington Union Station Revenue.

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative E would have a minor beneficial direct operational impact on the local and regional economy.

Alternative E would result in the same minor beneficial direct operational impact as Alternative D. See **Section 14.5.5.1**, *Direct Operational Impacts*, *Other Direct Economic Impacts*.

14.5.6.2 Indirect Impacts

Relative to the No-Action Alternative, Alternative E would have a negligible indirect operational impact on demography; no adverse indirect operational impact on local communities; no impact on WUS revenue; and a minor beneficial indirect operational impact on employment.

The indirect operational impacts of Alternative E would be the same as those of Alternative A (see Section **14.5.2.2**, *Indirect Operational Impacts*) except that Alternative E would have no impact on WUS revenue like Alternative B (**Section 14.5.3.2**, *Indirect Operational Impacts*, *Washington Union Station Revenue*). The indirect impacts associated with the potential development of the Federal air rights are described separately below.

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, in Alternative E, the potential development of the Federal air right as office space would result in a negligible indirect operational impact on demography; no indirect operational impact on local communities; a moderate beneficial indirect operational impact on employment; a beneficial indirect impact on WUS revenue; and a minor beneficial indirect operational impact on District tax revenue.

In Alternative E, the potential Federal air-rights development would be the same as in Alternative D. Indirect operational impacts from this development would be the same. See **Section 14.5.5.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*.

14.5.6.3 Construction Impacts

Demographics

Construction of Alternative E would have no impact on demography.

Like the construction of all Action Alternatives, the construction of Alternative E would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative E would have moderate adverse impacts on local communities.

The impacts of constructing Alternative E would be the same as those of constructing Alternative B. See **Section 14.5.3.3**, *Construction Impacts, Community Disruption and Other Social Benefits or Impacts*.

Construction Employment

Construction of Alternative E would have a minor beneficial impact on employment.

Like that of the other Action Alternatives, construction of Alternative E would support numerous jobs during the entire construction period, resulting in a beneficial impact on regional employment. This beneficial impact would be minor in the context of regional employment in the Washington-Arlington-Alexandria Metropolitan Statistical Area, where most of the induced jobs are likely to be located. The jobs that construction of Alternative E would support were estimated using the methodology described in **Section 14.4.2**, *Construction Impacts*.

Table 14-14 shows the cost of constructing Alternative E, broken down by phase. [45] Alternative E would cost approximately $8.69 billion (in 2017 dollars) over a construction period of 13 years and 4 months broken into four phases.

Table 14-14. Estimated Construction Duration and Costs, Alternative E

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Construction Duration	2.42 Years	2.92 Years	3.00 Years	5.08 Years	13.42 Years
Total Construction Cost	$1,127,893,076	$1,857,905,914	$1,624,128,860	$4,082,944,682	$8,692,872,532

Values in 2017 dollars.
Intermediate Phase not included.

Table 14-15 shows the estimated annual number of jobs construction of Alternative E would create. On average., Alternative E would support annually approximately 4,314 direct jobs (including jobs in the construction and architectural, engineering and related services industries) and 1,818 indirect and induced jobs (including industries such as wholesale trade; restaurants; real estate; hospitals; retail; and physicians), for a total of 6,132 jobs.

[45] As noted above, the modeling of construction impacts was based on Amtrak's rough-order-of magnitude combined estimates, which include the private and potential Federal overbuild deck but exclude the column removal work (see **Appendix A8**, *Station Expansion Project Action Alternatives Cost Estimates Memorandum*).

Table 14-15. Construction Employment Estimates, Alternative E

Phase	Construction Year	Direct Employment	Indirect Employment	Induced Employment	Total Employment
1	**1**	3,448	322	1,132	4,902
1	**2**	3,448	322	1,132	4,902
1 and 2	**3**	4,105	384	1,348	5,836
2	**4**	4,142	387	1,359	5,888
2	**5**	4,142	387	1,359	5,888
2 and 3	**6**	3,815	357	1,252	5,424
3	**7**	3,553	332	1,166	5,052
3	**8**	3,553	332	1,166	5,052
3 and 4	**9**	4,623	431	1,517	6,572
4	**10**	5,312	496	1,744	7,552
4	**11**	5,312	496	1,744	7,552
4	**12**	5,312	496	1,744	7,552
4	**13**	5,312	496	1,744	7,552
4	**14**	1,784	166	586	2,536
Annual Average[1]		4,314	402	1,416	6,132

1. Construction year 14 is a partial year and not included in the annual average.
Intermediate Phase not included.

For purposes of comparison, the total annual average number of direct jobs that Alternative E would support for the duration of the construction period represent approximately 0.57 percent of total employment in the two relevant sectors in the Washington-Arlington-Alexandria Metropolitan Statistical Area as of early 2019. [46]

Washington Union Station Revenue

Construction of Alternative E would result in a major adverse impact on WUS revenue.

The impact of constructing Alternative E on WUS revenue would be like Alternative B's. See **Section 14.5.3.3,** *Construction Impacts, Washington Union Station Revenue*. The duration of construction would be the same in both alternatives.

46 Bureau of Labor Statistics *Economy at a Glance. Washington-Arlington-Alexandria, DC-VA-MD-WV.* Accessed from https://www.bls.gov/eag/eag.dc_washington_md.htm. Accessed on April 13, 2019. The two sectors taken into account in the comparison are Mining, Logging, and Construction (122,800 persons as of January 2019) and Professional and Business Services (632,400 persons as of January 2019).

Other Economic Benefits or Impacts

Construction of Alternative E would have a moderate beneficial impact on the regional economy.

Construction of Alternative E would have a moderate regional beneficial economic impact from the spending of the income generated by the jobs the construction of the Project would support. **Table 14-16** shows annual estimates of this income. Alternative E construction would produce from $165 to $493 million in estimated annual labor income (including employee compensation and proprietor income) depending upon the year. Annual value added would range from $231 million to $689 million depending upon the year. Annual total output, or the value of production, would range from $382 to $1,137 million depending upon the year. These economic outputs would spread benefits throughout the Washington DC metropolitan region. The impact would be moderate in the context of the Washington-Arlington-Alexandria Metropolitan Area. In 2017, the gross domestic product of this area was approximately $17.5 trillion. [47]

Table 14-16. Construction Annual Labor Income, Value and Output, Alternative E

Phase	Construction Year	Annual Labor Income	Annual Value	Annual Total Output
1	1	$319,748,726	$447,005,190	$737,885,056
1	2	$319,748,726	$447,005,190	$737,885,056
1 and 2	3	$380,720,570	$532,243,155	$878,589,957
2	4	$384,085,970	$536,947,947	$886,356,300
2	5	$384,085,970	$536,947,947	$886,356,300
2 and 3	6	$353,840,002	$494,664,417	$816,557,592
3	7	$329,529,172	$460,678,146	$760,455,421
3	8	$329,529,172	$460,678,146	$760,455,421
3 and 4	9	$428,693,711	$599,309,077	$989,297,713
4	10	$492,675,830	$688,755,374	$1,136,949,434
4	11	$492,675,830	$688,755,374	$1,136,949,434
4	12	$492,675,830	$688,755,374	$1,136,949,434
4	13	$492,675,830	$688,755,374	$1,136,949,434
4	14	$165,431,905	$231,271,978	$381,767,684

Values in 2019 dollars.
Intermediate Phase not included.

[47] U.S. Bureau of Economic Analysis. *Gross Domestic Product by Metropolitan Area, 2017*. Accessed from https://www.bea.gov/data/gdp/gdp-metropolitan-area. Accessed on February 4, 2019.

14.5.6.4 Comparison to Existing Conditions

The impacts of Alternative E on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative E would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the existing economy and the impacts, the difference would be small and would not affect impact intensities.

14.5.7 Alternative A-C (Preferred Alternative)

14.5.7.1 Direct Operational Impacts

Demographics

Relative to the No-Action Alternative, Alternative A-C would have no direct operational impact on demographic conditions.

Like Alternative A and the other Action Alternatives, Alternative A-C would not directly add or displace any residential populations in the Local Study Area or the Regional Study Area.

Community Disruption and Other Social Benefits or Impacts

Relative to the No-Action Alternative, Alternative A-C would have major beneficial direct operational impacts on local communities.

The impacts of Alternative A-C would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts*.

Employment

Relative to the No-Action Alternative, Alternative A-C would have a minor beneficial direct operational impact on employment.

The direct operational impacts of Alternative A-C on employment would be the same as those of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Employment*.

Washington Union Station Revenue

Relative to the No-Action Alternative, Alternative A-C would have a moderate adverse direct operational impact on WUS revenue.

Alternative A-C would reduce the number of revenue-generating parking spaces at the station from approximately 2,205 in the No-Action Alternative to 1,600, a reduction of approximately 27 percent. For the purposes of generating an order-of-magnitude estimate of this impact, it can be assumed that there would be a proportional decrease in revenue from parking. Based on USRC's revenue from parking in fiscal year 2016, this would amount to approximately $2.3 million (2017 dollars) in lost revenue. [48] This order-of-magnitude estimate does not account for the fact that decreasing the total number of spaces may increase the revenue generated by each space due to reduced supply and steady or increasing demand.

Revenue from retail would remain approximately the same as or be less than in the No-Action Alternative for the same reasons as explained for Alternative A in **Section 14.5.2.1**, *Direct Operational Impacts, Washington Union Station Revenue*.

Altogether, Alternative A-C would cause a net loss in revenue for WUS. This would be a moderate adverse impact because all parking, which is the main source of WUS revenue, would remain within the station's lease area and continue to generate revenue for WUS while the permanent loss of existing retail, if it occurs, would likely be small.

Other Direct Economic Impacts

Relative to the No-Action Alternative, Alternative A-C would have a minor beneficial direct operational impact on the local and regional economy.

The impact of Alternative A-C on the local and regional economy from additional retail at WUS would be the same as that of Alternative A. See **Section 14.5.2.1**, *Direct Operational Impacts, Other Direct Economic Impacts*.

14.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a negligible indirect operational impact on demography; no adverse indirect operational impact on local communities; a minor beneficial indirect operational impact on employment; no indirect operational impact on WUS revenue; and a minor beneficial indirect operational impact on tax revenues in the District.

The indirect operational impacts of Alternative A-C would be the same as those of Alternative A (see **Section 14.5.2.2**, *Indirect Operational Impacts*) except for impacts associated with the potential development of the Federal air rights, described below.

Potential Federal Air-Rights Development

Relative to the No-Action Alternative, in Alternative A-C, the potential development of the Federal air right as office space would result in a negligible indirect operational impact on demography; no indirect operational impact on local communities; a moderate beneficial

[48] In fiscal year 2016, WUS revenue from the parking garage operations was $8,532,403: *USRC Annual Report* 2016. Accessed from https://www.usrcdc.com/wp-content/uploads/2017/02/usrc_annual_report_2016_final_spreads.pdf. Accessed on July 18, 2017.

indirect operational impact on employment; a beneficial indirect impact on WUS revenue; and a minor beneficial indirect operational impact on District tax revenue.

The assumed development of the remaining Federal air rights as approximately 380,000 square feet of office space would have a beneficial impact on WUS revenue through the lease of the space (or other mechanism through which development would be achieved). This impact cannot be quantified at this time but it would at least partially offset the loss of revenue from the reduction in parking capacity.

The provision of this office space would have an impact on demography in the Local Study Area if some employees move to the area to be closer to their workplace. Given WUS's accessibility by transit and the moderate number of employees at the site (see below), this impact would likely be small and negligible.

Development of the Federal air rights into office space would not cause disruptions to local communities, as it would occur within the footprint of a pre-existing facility. It would bring approximately 1,520 additional new jobs to the Local Study Area, a moderate beneficial impact in the context of the Local and Regional Study Areas.[49] These jobs would generate tax revenue for the District. This beneficial impact would be minor in the context of the District as a whole.

14.5.7.3 Construction Impacts

Demographics

Construction of Alternative A-C would have no impacts on demography.

Like the construction of all Action Alternatives, the construction of Alternative A-C would cause neither an influx nor a displacement of residential populations in the Local or the Regional Study Area**.**

Community Disruption and Other Social Benefits or Impacts

Construction of Alternative A-C would have moderate adverse impacts on local communities.

The adverse impacts of the construction of Alternative A-C on local communities would be the same as those of Alternative A (see **Section 14.5.2.3**, *Construction Impacts, Community Disruption and Other Social Benefits or Impacts*.

Construction Employment

Construction of Alternative A-C would have a minor beneficial impact on employment.

[49] Assumes 1 employee per 250 square feet of office space.

Alternative A-C would generate approximately the same number of jobs as Alternative A (see **Section 14.5.2.3**, *Construction Impacts, Construction Employment*. The total estimated cost of constructing Alternative A-C is slightly higher than that of constructing Alternative A, the difference is so small (approximately 0.15 percent) that both alternatives can be considered equivalent in this respect. The difference in construction job generation would be negligible.

Washington Union Station Revenue

Construction of Alternative A-C would have a major adverse impact on WUS revenue.

The impacts of constructing Alternative A-C on WUS revenue would be the same at those of constructing Alternative A. These impacts are described in **Section 14.5.2.3**, *Construction Impacts, Washington Union Station Revenue*.

Other Economic Benefits or Impacts

Construction of Alternative A-C would have a moderate beneficial impact on the regional economy.

As noted above, Alternative A-C would cost almost the same to construct as Alternative A, with the difference so small as to be negligible. Therefore, the economic benefits and impacts of this alternative would be the same as those of Alternative A, described in **Section 14.5.2.3**, *Construction Impacts, Other Economic Benefits or Impacts.*

14.5.7.4 Comparison to Existing Conditions

The impacts of Alternative A-C on socioeconomic conditions would generally be the same relative to existing conditions as they would be relative to the No-Action Alternative. Because the District's economy would grow between the present and 2040, the impacts of Alternative A-C would be relatively greater when compared to existing conditions than they would be when compared to No-Action Alternative conditions. But given the respective size of the existing economy and the impacts, the difference would be small and would not affect impact intensities

14.6 Comparison of Alternatives

Table 14-17 presents a comparison of the impacts of the No-Action Alternative and five Action Alternatives on social and economic conditions. **Table 4-18** summarizes the impacts in greater details.

Table 14-17. Comparison of Alternatives

<table>
<tr><th>Impact Category</th><th>Type of Impact</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C (Either Option)</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred)</th></tr>
<tr><td rowspan="4">Demographics</td><td>Direct Operational</td><td>Minor impact</td><td colspan="6">No impact</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">Negligible impact</td></tr>
<tr><td>Federal Air-Rights Development</td><td>N/A</td><td>No Impact</td><td colspan="5">Negligible impact</td></tr>
<tr><td>Construction</td><td colspan="7">No Impact</td></tr>
<tr><td rowspan="4">Community Disruption and Other Social Benefits</td><td>Direct Operational</td><td>Moderate beneficial impact</td><td colspan="6">Major beneficial impact</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">No impacts</td></tr>
<tr><td>Federal Air-Rights Development</td><td>N/A</td><td colspan="6">No impact</td></tr>
<tr><td>Construction</td><td>Minor adverse impacts</td><td colspan="6">Moderate adverse impact</td></tr>
<tr><td rowspan="4">Employment</td><td>Direct Operational</td><td>Moderate beneficial impact</td><td colspan="6">Minor beneficial impact</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">Minor beneficial impact</td></tr>
<tr><td>Federal Air-Rights Development</td><td>N/A</td><td>Negligible beneficial impact</td><td colspan="5">Moderate beneficial impact</td></tr>
<tr><td>Construction</td><td colspan="7">Minor beneficial impact</td></tr>
<tr><td>WUS Revenue</td><td>Direct Operational</td><td>No Impact</td><td>Moderate adverse impact</td><td colspan="4">Major adverse impact</td><td>Moderate adverse impact</td></tr>
</table>

Impact Category	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
	Indirect Operational	Negligible beneficial impact	No impact					
	Federal Air-Rights Development	N/A	Beneficial					
	Construction	Minor adverse impacts	Major adverse Impact					
Other Economic Impacts	**Direct Operational**	Minor beneficial impact	Minor beneficial impact					
	Indirect Operational	Minor beneficial impact	Minor beneficial impact					
	Federal Air-Rights Development	N/A	Negligible beneficial impact	Minor beneficial impact				
	Construction	Moderate beneficial impact						

Table 14-18. Summary of Social and Economic Impacts

Alternative	Social Impacts	Employment	WUS Revenue	Construction Social Impacts	Construction Employment[1]	Construction Economic Impacts[1]
No-Action	Moderate benefits to community cohesion, connectivity and station circulation	8,500 new jobs from office, retail, and hotel development	No change	Minor community disruption in and around WUS due to construction.	N/A	N/A
Alternative A	Major benefits to community cohesion, connectivity and station circulation.	1,445 new jobs from retail and Amtrak expansion; no jobs from potential Federal air-rights development.	Partial loss of parking revenue (order of magnitude: $1.79 million based on fiscal year 2016 revenue).	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (3 years 1 month).	An annual average of 6,543 jobs supported for 10 years 5 months.	Total construction cost of $7.24 billion would spur economic output of $586 to $1,405 million annually to the region.
Alternative B	Major benefits to community cohesion, connectivity and station circulation.	1,445 new jobs from retail and Amtrak expansion; 3,670 jobs from potential Federal air-rights development.	Total loss of parking revenue (order of magnitude: $8.5 million based on fiscal year 2016 revenue).	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (4 years 11 months).	An annual average of 6,088 jobs supported for 13 years 4 months.	Total construction cost of $8.63 billion would spur economic output of $382 to $1,139 million annually to the region.

Alternative	Social Impacts	Employment	WUS Revenue	Construction Social Impacts	Construction Employment[1]	Construction Economic Impacts[1]
Alternative C	Major benefits to community cohesion, connectivity and station circulation.	1,445 new jobs from retail and Amtrak expansion; 3,810 jobs from potential Federal air-rights development.	Total loss of parking revenue (order of magnitude: $8.5 million based on fiscal year 2016 revenue)	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (4 years).	An annual average of 6,374 jobs supported for 11 years 3 months.	Total construction cost of $7.55 billion would spur economic output of $305 to $1,236 million annually to the region.
Alternative D	Major benefits to community cohesion, connectivity and station circulation.	1,529 new jobs from retail and Amtrak expansion; 2,752 jobs from potential Federal air-rights development.	Total loss of parking revenue (order of magnitude: $8.5 million based on fiscal year 2016 revenue).	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (4 years).	An annual average of 6,416 jobs supported for 11 years 3 months.	Total construction cost of $7.61 billion would spur economic output of $313 to $1,269 million annually to the region.
Alternative E	Major benefits to community cohesion, connectivity and station circulation	1,529 new jobs from retail and Amtrak expansion; 2,752 jobs from potential Federal air-rights development.	Total loss of parking revenue (order of magnitude: $8.5 million based on fiscal year 2016 revenue).	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (4 years 11 months).	An annual average of 6,132 jobs supported for 13 years 4 months.	Total construction cost of $8.69 billion would spur economic output of $382 to $1,137 million annually to the region.

Alternative	Social Impacts	Employment	WUS Revenue	Construction Social Impacts	Construction Employment[1]	Construction Economic Impacts[1]
Alternative A-C	Major benefits to community cohesion, connectivity and station circulation.	1,445 new jobs from retail and Amtrak expansion; 1,520 jobs from potential Federal air-rights development.	Partial loss of parking revenue (order of magnitude: $2.3 million based on fiscal year 2016 revenue).	Moderate community disruption in and around WUS due to construction. Concentrated in Phases 1 (2 years 5 months) and 4 (3 years 1 month).	An annual average of 6,543 jobs supported for 10 years 5 months.	Total construction cost of $7.24 billion would spur economic output of $586 to $1,405 million annually to the region.

1. Intermediate Phase not included. Note that construction-economic impact modeling was performed on the basis of the rough-order-of magnitude combined construction cost estimates developed by Amtrak, which are the only estimates available at the phase level (see Appendix A.8, Station Expansion Project Action Alternatives Cost Estimates Memorandum; the combined estimates include costs associated with the private air-rights development deck and potential Federal air-rights development deck.).

For all alternatives, operational impacts would be beneficial, with the exception of the impacts of the Action Alternatives on WUS revenue because of the partial (Alternatives A and A-C) or total (other Action Alternatives) loss of revenue from parking. In all Action Alternatives, the potential development of the Federal air rights could offset this loss. In general, with the exception of employment in the Project Area, the beneficial operational impacts of the Action Alternatives would be greater than those of the No-Action Alternative.

Among the Action Alternatives, the primary differentiator would be the employment and economic impacts of constructing the alternatives, which would be a function of the cost and duration of construction. Taking both into account, Alternatives B and E would support the most jobs and Alternatives A and A-C the fewest, with Alternatives C and D in the middle. Similarly, Alternatives B and E would generate the most total economic output, and Alternatives A and A-C the least, with Alternative C and D generating a little more than Alternatives A and A-C.

Construction of all Action Alternatives would cause disruptions to surrounding neighborhoods, but these would remain moderate because of the focus of construction activity on the rail terminal and areas immediately adjacent. Based on duration, Alternative A and A-C would have the smallest impact and Alternatives B and E the greatest one. Column removal work in all Action Alternatives would displace some existing retail at WUS for approximately 2 years and 6 months at least, overlapping with construction Phases 1 and 2.

14.7 Avoidance, Minimization and Mitigation Evaluation

All Action Alternatives would result in a permanent loss of revenue to WUS due to a loss of parking space. All Action Alternatives except Alternatives A and A-C would eliminate all parking revenue because the new parking would be outside WUS's lease area and, therefore, generate no revenue for the station under existing leasing and subleasing agreements. New retail would not contribute to offsetting these impacts in the long-term because it also would be located outside the station's lease area. Additionally, in all Action Alternatives, construction of the Project would displace existing retail outlets during column removal work (approximately 2 years and 6 months overlapping with Phases 1 and 2 of construction) and eliminate parking revenue during Phase 4.

Mitigation for this major impact on revenue being considered by FRA includes extending WUS's lease area to encompass part or all of the new parking and retail area to generate new revenue that would offset the anticipated loss. The scope and financial dimension of the impacts from the column removal work on existing retail, and the need for amending existing lease agreements, would need to be evaluated among FRA, USRC, USI, and the affected businesses.

14.8 Permits and Regulatory Compliance

There are no compliance efforts or permits applicable to this resource.

15 Public Safety and Security

15.1 Overview

This section addresses the potential impacts on public safety and security conditions of the No-Action Alternative and the Action Alternatives. If applicable, it also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies permitting and regulatory compliance requirements.

15.2 Regulatory Context

The Federal Railroad Administration (FRA), the Transportation Security Administration (TSA) and Amtrak oversee safety and security issues for rail stations and rail travel. In addition, at WUS, WMATA and its Metro Transit Police Department maintain jurisdiction at the co-located Metrorail station. At the local level, local code requirements govern safety and security issues. The District of Columbia Fire and Emergency Medical Services Department (DC Fire and EMS), Metropolitan Police Department (MPD), and Homeland Security and Emergency Management Agency are the local agencies responsible for safety and security issues in Washington, DC. The following are safety and security regulations and guidance most relevant to the Project.

Federal policies, regulations, and guidance:

- FRA Safety Standards (49 Code of Federal Regulations [CFR] 200 – 299);
- FRA *High-Speed Passenger Rail Safety Strategy*;[1]
- Rail Safety Improvement Act of 2008 (Public Law 110-432);
- U.S. Code on Railroad Safety (49 United States Code [USC] 20101 et seq);
- Department of Homeland Security/Transportation Security Administration Regulations concerning Rail Transportation Security (49 CFR 1580); and

[1] U.S. Department of Transportation, Federal Railroad Administration. 2009. *High-Speed Passenger Rail Safety Strategy.* Accessed from https://www.fra.dot.gov/eLib/Details/L03624. Accessed on May 8, 2020.

- Transportation Security Administration— Security Directive RAILPAX-04-01 and RAILPAX-04-02.[2]

Other relevant guidance includes:

- Amtrak safety and security procedures;[3]
- District of Columbia Fire Code;[4]
- District of Columbia Construction Codes Supplement;[5] and
- District of Columbia Municipal Regulations, Title 24, *Public Space and Safety*.

15.3 Study Area

The Local Study Area includes the Project Area with a half-mile buffer (**Figure 15-1**). It encompasses WUS's grounds, tracks, and platforms as well as the areas where track modifications would occur. The Regional Study Area includes the relevant service boundaries for fire, law enforcement, and emergency services in the District (**Figure 15-2**). These include Amtrak Police, Metro Transit Police, U.S. Park Police, and U.S. Capitol Police.

15.4 Methodology

Section 15 of the April 2018 *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on public safety and security. A summary is below.

[2] Department of Homeland Security, Office of the Inspector General. 2010. *TSA's Preparedness for Mass Transit and Passenger Rail Emergencies.* https://www.oig.dhs.gov/assets/Mgmt/OIG_10-68_Mar10.pdf. Accessed on May 8, 2020.

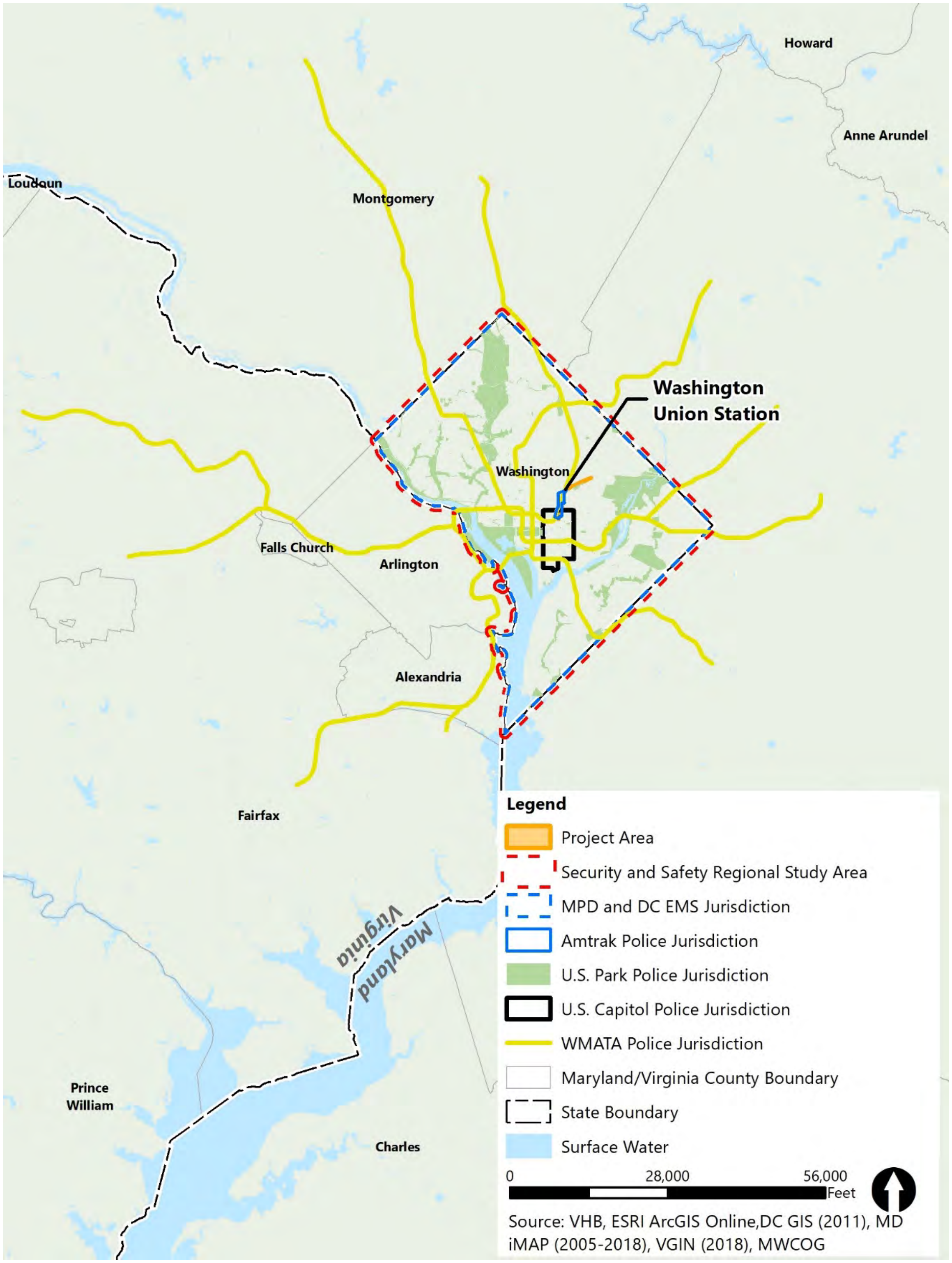
[3] Amtrak is responsible for assessing and implementing safety and security measures for the NEC and its trains in the Study Area and commuter services, in collaboration with Amtrak, are responsible for assessing and implementing safety and security measures for their trains in the Study Area.

[4] Department of Consumer and Regulatory Affairs. District of Columbia Construction Codes. https://dcra.dc.gov/page/dc-construction-codes. Accessed on May 8, 2020.

[5] Same as above.

Figure 15-1. Public Safety and Security Local Study Area

Figure 15-2. Public Safety and Security Regional Study Area



15.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. To assess the impacts of the alternatives on public safety and security, the relevant aspects of each alternative were reviewed to determine how each create new or heightened risks (adverse impact) or reduce or eliminate risks (beneficial impact). Relevant considerations included, among others, changes in the number of persons or vehicles that would be able to gain access to WUS; changes in security procedures; changes in or modification of security and safety features; design considerations; and changes in potential demand for police and emergency services.

15.4.2 Construction Impacts

Construction impacts are those impacts that would result from constructing the Project and would cease when the Project is complete. Assessing potential construction impacts on public safety and security involved reviewing the security and safety risks that conducting construction operations at WUS would create. Factors considered included changes in access opportunities; changes in security procedures; removal or addition of security and safety features (for example, utility access, monitoring systems, safety rails and barriers, and signage); closures of roads and sidewalks; and construction-related traffic.

15.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on public safety and security. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered. The impacts of the No-Action Alternative are assessed relative to existing conditions. The operational impacts of the Action Alternative are assessed relative to the No-Action Alternative. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

15.5.1 No-Action Alternative

15.5.1.1 Direct Operational Impacts

Relative to existing conditions, in the No-Action Alternative, there would be major adverse direct operational impacts on public safety and security.

Existing safety and security practices at WUS would remain in place. **Section 15**, *Public Safety and Security* of the *Washington Union Station Affected Environment Technical Report* (**Appendix C2**) describes these practices. They include Amtrak Police Department (APD) patrols with canines, the use of security cameras, and random screening and searches.

Moderate adverse impacts would result from the increase in the volume of WUS passengers across all modes of transportation. As shown in **Section 1.7.1**, *No-Action Alternative,* **Table 1-2**, average daily passenger numbers would grow from approximately 58,400 to approximately 77,500. This would represent a 33 percent increase over existing conditions. Growth in the number of WUS visitors would also occur, as would activity due to access to and from the private air-rights development above the rail terminal.

Increased passenger and visitor volumes as well as the private air-rights development would generate additional car and truck traffic next to and above the rail terminal. This would increase the risk of vehicle-related crashes and vehicle-based attacks such as the use of vehicle-borne improvised explosive devices (VBIED). Bus and freight movements would also increase but would continue to remain unscreened.

The private air-rights deck would have to comply with Amtrak's vertical clearance requirements. Amtrak would review and approve plans to ensure that applicable clearances are met. Based on this requirement, no adverse impacts are anticipated on the safety of rail operations.

With regard to security, based on currently available concepts, the private air-rights development would include vehicular parking within the overbuild deck structure, above WUS's tracks and platforms.[6] Public access to areas inside the structural deck for parking would create new VBIED risks at a sensitive location. Such risks have been identified and considered in a Threat and Vulnerability Risk Assessment (TVRA).[7] This would be a major adverse impact on security at WUS. It is anticipated that FRA, USRC, and Amtrak would work with the private air-rights developer to address such risks consistent with the recommendations of the TVRA, including consideration of solutions that would not place parking in the deck.

Larger passenger and visitor volumes would result in greater potential demands on security and emergency services at WUS. ADP would likely need to add staff in order to continue effectively policing the station. The local units of MPD and DC Fire and EMS would likely have to respond to a greater number of incidents at and near WUS than currently. The adverse impact would be moderate because there would be enough time for the affected services to evaluate future demand and incorporate it in their staffing and operations plans. Minimization or mitigation of the potential impacts would be the responsibility of the projects' respective owners.

6 Akridge. November 15, 2017. *Burnham Place and Washington Union Station. Concept Level Podium Structural Systems for 30'x55' Column Grid Areas*.

7 The TVRA was developed by FRA and the Project Proponents in collaboration with multiple agencies and stakeholders. It was completed in July 2016.

15.5.1.2 Indirect Operational Impacts

Relative to existing conditions, the No-Action Alternative would result in minor adverse indirect operational impacts on public safety and security.

The increase passenger, visitor, and vehicle volumes described above would require updating emergency operations plans. They would also likely require hiring new emergency responders such as medical personnel. In the context of the District's growth over the new two decades, the specific impacts of the projects included in the No-Action Alternative would be minor.

15.5.1.3 Construction Impacts

Construction activities in the No-Action Alternative would result in moderate adverse impacts on public safety and security.

Construction of the projects included in the No-Action Alternative would take place according to different schedules and using construction methods currently unknown. In general, each project would have adverse impacts on security to the extent that it would require granting access to WUS or the rail terminal to workers and vehicles during the construction period. The extent of these security risks would depend on the size of each construction site as well as the type and duration of construction operations. It would be the responsibility of the respective project owners and their contractors to minimize security risks. Impacts would be moderate based on the size of the projects and because they would not all take place at the same time.

Construction activities would have adverse impacts on public safety because construction inherently poses safety risks on and adjacent to the construction site. Impacts on public safety in the No-Action Alternative would be moderate based on the size and location of the projects. On site, work would have to comply with applicable OSHA requirements and guidelines. Construction activities within the rail terminal would also be subject to Amtrak's requirements and authorization. As noted above, construction occurring within 25 feet of any track or overhead catenary system requires Amtrak approval and the use of track protection personnel.

15.5.2 Alternative A

15.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A would have a major beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

Alternative A could potentially have adverse impacts on security at WUS due to the increase in passenger and visitor volumes. Relative to the No-Action Alternative, combined average daily passenger volumes for Amtrak, MARC, VRE, and intercity buses would increase from

77,500 to 128,200, or a 65 percent growth. Relative to the No-Action Alternative, this would generate more car and truck traffic next to and above the rail terminal, increasing the risk of vehicle-related crashes and vehicle-based attacks.

However, this potential impact would be offset by the security improvements that would result from Alternative A, resulting in a net impact that would be beneficial and major. The Project Proponents and FRA coordinated and would continue to coordinate with the Federal Protective Service (FPS) and Department of Homeland Security when planning concourses, new loading dock, and new bus facility. [8] As noted above, during the early stages of planning for the Project, FRA and the Project Proponents completed TVRA to identify threats to WUS. At a minimum, the design of Alternative A would incorporate recommended safety and security principles, such as clear sightlines, adequate and intuitive access for emergency responders, and spatial flexibility for future security measures. The design of Alternative A would allow for the screening of passengers and their luggage when entering the ticketed area to board trains.

The same security risks associated with the potential use of the deck structure for private air-rights development parking identified for the No-Action Alternative (see **Section 15.5.1.1**, *Direct Operational Impacts* above) would occur in Alternative A. While these risks would not be an impact of Alternative A relative to the No-Action Alternative, coordination between FRA, the Project Proponents, and the private developer would be needed to address them in a manner consistent with the recommendations of the TVRA, including consideration of solutions that do not place parking in the deck.

In contrast to the No-Action Alternative, in which no pre-screening of the goods delivered through the WUS loading docks would occur, FPS would provide screening services at an existing or to-be-constructed screening facility.[9] FPS has confirmed that it could accommodate expected deliveries to WUS via road in 2040. Bus operations would be subject to some level of screening through authentication and passenger screening practices, but not through physical screening of buses at WUS. Bus or train maintenance activities would not be affected, as they take place outside the Project Area at facilities owned by the bus and train operators.

Increased activity at WUS would also result in greater demands on emergency services at WUS, with potential increases in personnel and equipment maintenance costs. ADP would likely need to add staff in order to continue effectively policing the station. Emergency responders would need to allocate additional resources to firehouses and police service

[8] FRA and the Project Proponents have engaged in coordination with FPS over the development of the Project. See **Appendix A5b**, *Washington Union Station Expansion Project Action Alternatives Refinement Report*, Section 1, *Introduction*; Section 2, *Preliminary Alternatives Planning and Design Refinements;* and Appendix A-2, *Compendium of Relevant Studies*.

[9] Loading dock deliveries includes those for the Commissary (food and beverage for Amtrak trains), retail (including restaurants), and Package Express, a service that ships packages via Amtrak trains.

areas to cover the additional passengers. Additionally, medical responders would have to deal with changing traffic patterns and additional entry/exit points. Additional resources would need to be allocated to training personnel in navigating this new geography. While this would adversely affect emergency services, the adverse impact would be moderate because growth would take place over time and the various affected services would have time to plan to avoid personnel shortages or a significant deterioration of response times.

15.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would have minor adverse indirect operational impacts on public safety and security.

Development of the Federal air rights as additional parking space would result in minor adverse impacts because it would encourage more vehicle trips to WUS. This would increase further the risk of vehicle-based crashes and attacks as well as potential demand on emergency services. This indirect impact would be small in the context of the total number of vehicles trips and activities at WUS.

Alternative A may also have a minor adverse indirect operational impact on FPS if, as a result of freight screening, demand exceeded FPS's available capacity. In such a case, FPS would potentially need to establish a new facility for WUS with attendant staffing and operating costs.

15.5.2.3 Construction Impacts

Construction of Alternative A would have major adverse impacts on security and moderate adverse impacts on public safety.

Construction of Alternative A would have major adverse impacts on security because construction operations would require granting access to WUS and the rail terminal to a large number of workers and vehicles for approximately 11 years and 5 months. Entrance and exit points would change depending on the phase but at any time, deliveries and loading of construction materials would use multiple access points.

Physical and non-physical access by workers would pose risks as well. Physical access to the construction site may make it a target for terrorism and criminal activity. Non-physical access to construction information, such as scheduling dates, storage locations, and management activities may also make the site vulnerable to criminality.

Construction would also affect operational station security. Vehicles and workers may have access to internal station areas not normally accessible to them. Construction vehicles and large construction equipment such as cranes may disrupt video monitoring and patrolling of select areas of WUS, leading to diminished security monitoring.

All these security risks would be compounded by the size of the construction site, the sensitivity of WUS as a major transportation hub and potential target, and the duration of the construction, which would involve large numbers of workers on multiple shifts for more than 11 years.

Construction of Alternative A would have adverse impacts on public safety because construction inherently poses safety risks. These risks result from the wide range of simultaneous activities large construction projects involve. Adverse impacts on safety may arise from the physical disturbance associated with construction. Examples include the excavation of open trenches or pits; the movement and operation of large motorized equipment and trucks; or the closure of sidewalks, disruption of well-used pathways, and changes in traffic patterns.

The impacts on public safety would be moderate because most construction-related activities would take place within the Project Area, members of the public would not have access to the construction zone, and appropriate measures, as described in **Section 15.7**, *Avoidance, Minimization and Mitigation Evaluation*, would be implemented.

On site, work would comply with applicable OSHA requirements and guidelines for general and construction industries. Construction activities within the rail terminal would also be subject to Amtrak's requirements and authorization. As noted above, construction occurring within 25 feet of any rail track or overhead catenary system requires Amtrak approval and the use of track protection personnel. Specific clearances to active track and catenary must be maintained during construction. Construction work in the vicinity of the DC Streetcar would require contractors to comply with the safety training requirements of the DC Streetcar Track Allocation Program. Crane operations are subject to strict policies when operating over live tracks. Emergency egress in accordance with the standards defined in National Fire Protection Association (NFPA) 130 routes would be maintained at all times.[10]

Within WUS, the First Street Tunnel column removal work would potentially involve the demolition of existing flooring and structural elements within parts of the Retail and Ticketing Concourse. As explained in **Section 15.7**, *Avoidance, Minimization and Mitigation Evaluation*, physical risks to persons (for instance trip and fall accidents) would be avoided by closing off the area and ensuring it is only accessible to authorized personnel.

Outside the construction site, construction of Alternative A would require operating and moving equipment and other materials on public streets throughout each phase of construction over most of the entire construction period of approximately 11 years and 5 months, although activities during the 12-month Intermediate Phase would mostly be limited to the interior of the station. The movement of heavy trucks and heavy material would pose safety risks. Trucks traveling on public streets could cause conflicts and accidents with other vehicles, pedestrians, and bicyclists. Sidewalk, bike lane, and road closures as well as the creation of temporary drop-off and pick-up areas may cause confusion for drivers, bicyclists

[10] NFPA 130 (available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=130) specifies fire protection and life safety requirements for underground, surface, and elevated fixed guideways transit and passenger rail systems.

and pedestrians in a changing environment, increasing the risk of conflicts. Construction may diminish lines of sight. These risks would be minimized and mitigated as described in **Section15.7**, *Avoidance, Minimization and Mitigation Evaluation.*

Construction would affect emergency response services when road closures are in effect. Lane closures with various timing plans may take place throughout the construction period. Construction activities would not affect nearby schools or other public facilities from a public safety perspective, as they would take place at least one block away from these facilities.

There would likely be hazardous materials (such as fuel, lubricants, or solvents among others) and hazardous waste stored on the construction site. These must be contained securely, and in accordance with all applicable occupational health and safety regulations. Spills or leaching of these materials can cause danger to people and property in the vicinity (see **Section 4.5.2.3**, *Construction Impacts* of this report). Emergency and security personnel would need to be prepared to encounter potentially hazardous materials if they respond to an emergency at WUS during construction.

15.5.2.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A would have a major beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS in Alternative A would be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions as would be the case relative to the No-Action Alternative. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate, as affected services would have ample time to plan for the increase.

15.5.3 Alternative B

15.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative B would have a major beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

Alternative B would have the same beneficial and adverse direct operational impacts as described for Alternative A. These impacts are described in **Section 15.5.2.1**, *Direct Operational Impacts*. Additionally, Alternative B would have the following adverse impacts. The provision of two levels of below-ground parking under the rail terminal would create a new security risk by making WUS and parts of the private air-rights development potentially susceptible to a VBIED attack from underneath the rail terminal. This would be taken into account when planning and designing security measures. Net impacts on security would be beneficial and major.

15.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would have moderate adverse indirect operational impacts on public safety and security.

Development of the Federal air rights as approximately 917,420 square feet of office space would result in moderate adverse impacts because it would bring additional population to WUS and place a large development over WUS's tracks and platforms. The development would be equivalent to a large downtown office building, with an estimated 3,670 employees (see **Section 14.5.3.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*). This additional population, and associated vehicular activity, would increase the risk of vehicle-based crashes and attacks. The development's working population would also generate potential additional demand on emergency services. This indirect impact would be moderate in the context of the expanded station and the adjacent private air-rights development.

Like Alternative A and the other Action Alternatives, Alternative B would potentially result in a minor adverse indirect operational impact on FPS if, as a result of vehicle screening, demand exceeded FPS's available capacity. In such a case, FPS would potentially need to establish a new facility for WUS with attendant staffing and operating costs.

15.5.3.3 Construction Impacts

Construction of Alternative B would have major adverse impacts on security and moderate adverse impacts on public safety.

The construction impacts of Alternative B on public safety and security would be similar to those of Alternative A because the means and methods of construction would be the same: see **Section 15.5.2.3,** *Construction Impacts*. Adverse impacts would be major in both alternatives, with the difference being they would last longer in Alternative B, which would take approximately 14 years and 4 months to complete.

15.5.3.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative B would have a major beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS in Alternative B be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions as would be the case relative to the No-Action Alternative. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate as affected services would have ample time to plan for the increase.

15.5.4 Alternative C

15.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have a moderate beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

Alternative C would have the same beneficial and adverse direct operational impacts as described for Alternative B. See **Section 15.5.3.1**, *Direct Operational Impacts*.[11] Additionally, it would have the following adverse impacts.

Alternative C would create an additional risk to WUS by placing a bus pick-up and drop-off area between the historic station building and the train hall. A VBIED or vehicle ramming attack at this location could cause damage to the adjacent Retail and Ticketing Concourse. Alternative C would also adversely affect the private air-rights development because it would place the bus facility and above-ground parking facility north of H Street NE, within the private air rights. The air-rights owner may develop the unused air rights above the facilities. The presence of buses and parking below this development would create safety risks for persons accessing the development and security risks from VBIED for the structure above the parking facility. Although the security features that would be incorporated in Alternative C would result in net beneficial impacts, these two security issues would keep these impacts moderate.

15.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have moderate adverse indirect operational impacts on public safety and security.

The indirect operational impacts of Alternative C would be the same as those of Alternative B, described in **Section 15.5.3.2**, *Indirect Operational Impacts*. In Alternative C, the Federal air-rights development would be a little larger than in Alternative B: it would consist of approximately 952,600 square feet of office space, with an estimated 3,810 employees (See **Section 14.5.4.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*).

[11] Unlike Alternative B, Alternative C would have only one level of below-ground parking. This does not make a measurable difference with regard to impacts on public safety and security.

With regard to public safety and security impacts, this would not make a measurable difference.

15.5.4.3 Construction Impacts

Construction of Alternative C (either option) would have major adverse impacts on security and moderate adverse impacts on public safety.

The construction impacts of Alternative C on public safety and security would be similar to those of Alternative A because the means and methods of construction would be the same. These impacts are described in **Section 15.5.2.3**, *Construction Impacts*. Adverse impacts would be major in both alternatives, but they would last longer in Alternative C, which would take approximately 12 years and 3 months to complete.

15.5.4.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative C would have a moderate beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS in Alternative C be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions, as would be the case relative to the No-Action Alternative, and to the same degree. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate as affected services would have ample time to plan for the increase.

15.5.5 Alternative D

15.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative D would have a moderate beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

The direct operational impacts of Alternative D on public safety and security would be the same as those of Alternative C, described in **Section 15.5.4.1**, *Direct Operational Impacts*. In this alternative, the parking facility would be within the private air rights north of H Street NE, just south of K Street NE. This would create the same risk to the private air-right development above the facility as in Alternative C. The bus facility integrated with the train hall would create the same risk for WUS as Alternative C's bus pick-up and drop-off area.

15.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would have moderate adverse indirect operational impacts on public safety and security.

The indirect operational impacts of Alternative D would be the same as those of Alternative B (see **Section 15.5.3.2**, *Indirect Operational Impacts*). In Alternative D, the Federal air-rights development would be smaller than in Alternative B: it would consist of approximately 688,050 square feet of office space, with an estimated 2,752 employees (See **Section 14.5.5.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*). With regard to public safety and security impacts, this would not make a measurable difference.

15.5.5.3 Construction Impacts

Construction of Alternative D would have major adverse impacts on security and moderate adverse impacts on public safety.

The construction impacts of Alternative D on public safety and security would be the same as those of Alternative A because the means and methods of construction would be the same: see **Section 15.5.2.3**, *Construction Impacts*. Adverse impacts would be major in both alternatives, but they would last longer in Alternative D, which would take approximately 12 years and 3 months to complete.

15.5.5.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative D would have a moderate beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS in Alternative D be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions, as would be the case relative to the No-Action Alternative, and to the same degree. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate as affected services would have ample time to plan for the increase.

15.5.6 Alternative E

15.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative E would have a moderate beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

The direct operational impacts of Alternative E on security and public safety would be the same as those of Alternative B, described in **Section 15.5.3.1**, *Direct Operational Impacts*. In addition, the integrated bus facility-train hall would create a VBIED risk for the station historic building similar to what would occur in Alternative C with the bus pick-up and drop-off area (see **Section 15.5.4.1**, *Direct Operational Impacts*). Although the security features that would be incorporated in Alternative E would result in net beneficial impacts, this security issue would keep these impacts moderate.

15.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would have moderate adverse indirect operational impacts on public safety and security.

The adverse indirect impacts of Alternative E on public safety and security would be the same as those of Alternative D, described in **Section 15.5.5.2**, *Indirect Operational Impacts*. The potential Federal air-rights development would be the same in both alternatives.

15.5.6.3 Construction Impacts

Construction of Alternative E would have major adverse impacts on security and moderate adverse impacts on public safety.

The construction impacts of Alternative E on public safety and security would be the same as those of Alternative A because the means and methods of construction would be the same (see **Section 15.5.2.3**, *Construction Impacts)*. Adverse impacts would be major in both alternatives, but they would last longer in Alternative E, which would take approximately 14 years and 4 months to complete.

15.5.6.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative E would have a moderate beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS in Alternative E be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions, as would be the case relative to the No-Action Alternative, and to the same degree. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate as affected services would have ample time to plan for the increase.

15.5.7 Alternative A-C (Preferred Alternative)

15.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have a major beneficial direct operational impact on public security and a moderate adverse direct operational impact on public safety.

Alternative A-C would have the same beneficial and adverse direct operational impacts as Alternative A. These impacts are described in **Section 15.5.2.1**, *Direct Operational Impacts*.

15.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have moderate adverse indirect operational impacts on public safety and security.

Potential development of the Federal air rights as approximately 380,000 square feet of office space would result in moderate adverse impacts because it would bring additional population to WUS and place a large development over WUS's tracks and platforms. The development would be equivalent to a large downtown office building, with an estimated 1,520 employees (see **Section 14.5.7.2**, *Indirect Operational Impacts, Potential Federal Air-Rights Development*). This additional population, and associated vehicular activity, would increase the risk of vehicle-based crashes and attacks. The development's working population would also generate potential additional demand on emergency services. This indirect impact would be moderate in the context of the expanded station and the adjacent private air-rights development.

Like the other Action Alternatives, Alternative A-C would potentially result in a minor adverse indirect operational impact on FPS if, as a result of vehicle screening, demand exceeded FPS's available capacity. In such a case, FPS would potentially need to establish a new facility for WUS with attendant staffing and operating costs.

15.5.7.3 Construction Impacts

Construction of Alternative A-C would have major adverse impacts on security and moderate adverse impacts on public safety.

The construction impacts of Alternative A-C on public safety and security would be the same as those of Alternative A because the means and methods, as well as the duration, of construction, would be the same: see **Section 15.5.2.3,** *Construction Impacts*.

15.5.7.4 Comparison to Existing Conditions

Relative to existing conditions, Alternative A-C would have a major beneficial direct operational impact on security and moderate adverse direct operational impacts on public safety. Although the increase in passenger and visitor volumes at WUS be greater when compared to existing conditions than when compared to the No-Action Alternative (from 58,400 to 128,200, or a 120 percent growth instead of 65 percent), the security features included in the alternative would offset this increase and improve conditions as would be the case relative to the No-Action Alternative. The potential increase in demand on police and emergency services would also be proportionately greater when compared to existing conditions than when compared to the No-Action Alternative, since existing conditions do not include the private air-rights development and its residential and working population. The adverse impact would be moderate as affected services would have ample time to plan for the increase.

15.6 Comparison of Alternatives

Table 15-1 summarizes the impacts of the alternatives. The main differences among the Action Alternatives concern security impacts. Because all Action Alternatives would incorporate enhanced security features, all would result in net beneficial impacts on security in spite of the risks born of greater activity at the station. However, because Alternatives C through E include bus access between the train hall and the historic station building, their net beneficial impacts would be moderate rather than major. Alternatives C and D would also create more security risks than the other Action Alternatives because they would mix station elements (bus facility and/or parking facility) with private air-rights development buildings north of H Street. Conversely, Alternative A and Alternative A-C would be the only Action Alternatives without below-ground parking and, therefore, without an associated risk of VBIED attack from below. In the No-Action Alternative, impacts on security would be adverse, as risks from increased activity and passenger volumes would not be offset by security enhancements.

With regard to public safety, all alternatives would have similar impacts, as these impacts would be the result of increased activity at WUS over time, which emergency services would have time to plan for.

Table 15-1. Comparison of Alternatives

Resource Category	Type of Impact	No-Action Alternative	Alternative A	Alternative B	Alternative C (Either Option)	Alternative D	Alternative E	Alternative A-C (Preferred)
Security	Direct Operational	Major adverse impacts	Major beneficial impacts		Moderate beneficial impacts			Major beneficial impacts
	Indirect Operational	Minor adverse impacts	Minor adverse impacts	Moderate adverse impacts				
	Construction	Moderate adverse impacts	Major adverse impact					
Safety	Direct Operational	Moderate adverse impacts						
	Indirect Operational	Minor adverse impacts						
	Construction	Moderate adverse impacts						

15.7 Avoidance, Minimization and Mitigation Evaluation

Based on the determination of impacts relative to the No-Action Alternative, FRA is considering the following minimization and mitigation measures:

- **Safety and Security Staffing Levels due to Increased Passenger Volumes (All Action Alternatives) –** The growth in use of WUS would have a major impact on the safety and security of the traveling public. Additionally, while the Action Alternatives allow for the potential screening of railroad passengers, the specific manner of screening or the impacts of such screening on the rail service desirability are not known at this time. To address the increased risks due to increased passenger volumes, FRA and the Project Proponents, in coordination with relevant Federal agencies, would develop a *Safety and Security Operations Plan***.** The plan would identify procedures appropriate to the level of passenger activity; evaluate appropriate passenger screening practices; and identify funding for these purposes.
- **Increased Safety risks and security threats due to Increased Vehicular Volumes (All Action Alternatives) –** The planned growth in the use of WUS would likely result in a proportional growth of vehicular travel in and around WUS. This anticipated growth would increase the risk of vehicle-based attacks, including VBIEDs; traffic accidents; and vehicle-pedestrian accidents. To address this risk, FRA and the Project Proponents, in coordination with relevant Federal law enforcement and security

agencies, would identify security features, such as for example bollards, that the Project design would incorporate, including measures recommended in the TVRA, as appropriate.

- **Public Safety and Security Threats impacts from Construction (All Action Alternatives) –** Construction activities in all Action Alternatives would pose risks to public safety due to both the general nature of construction and WUS's specific operational constraints. Security threats would arise from the movement of goods, equipment, and people in and out of the Project Area. FRA and the Project Proponents would develop a construction safety and security plan for the Project to include procedures for screening people, equipment, and goods, and for reducing risk of injury. This plan would include procedures to screen people, equipment, and goods, and to reduce the risk of injury to workers, passengers, and passers-by from construction activities. It may also include background checks for contractors and their employees.
- **Public Safety Risks from Construction Traffic (All Action Alternatives):** Risks to the public would be minimized by requiring the construction contractor to ensure that the movement of heavy motorized equipment and trucks in and out of the construction site is through designated access points and designated truck routes only. The construction contractor would also be required to use flaggers as needed to prevent conflicts between trucks and street traffic. The construction contractor would ensure that construction-related traffic proceeds in compliance with applicable speed limitations and other District traffic laws.
- **Public Safety Risks from Column Removal Work (All Action Alternatives)** – The construction contractor would put in place temporary walls and partitions to close off the portions of the historic station building where the column removal work would be conducted from the areas remaining accessible to the public or to station or Amtrak employees. These walls and partitions would be sufficient to provide fire protection at least equal to that provided by the existing floor and walls. Only authorized personnel would have access to the closed off area.
- **Potential Risks to WUS from Private Air-rights Development Parking within the Deck Structure**: FRA and the Project Proponents would work with the private air-rights developer to address such risks consistent with the recommendations of the TVRA, including consideration of solutions that would not place parking in the deck.
- **Potential Risks to Private Air-rights Development (Alternatives C and D) –** The construction of the bus facility and parking facility would pose security risks if the private air-rights owner develops the remaining air rights above the parking facility. In that case, FRA and the Project Proponents would refine the facilities' design to reduce risks to the private development.
- **Indirect Impacts of Federal Air-Rights Development on Safety and Security (All Action Alternatives) –** To mitigate the impacts of the potential Federal air-rights

development, FRA would require that any sale, transfer, or lease of the air rights include requirements that the new owner, transferee, or lessee develop a safety and security plan that Amtrak and FRA would review and approve.

15.8 Permits and Regulatory Compliance

Table 15-2 below details the regulatory requirements and processes that the Project would follow.

Table 15-2. Permits and Regulatory Compliance for Safety and Security

Permitting Entity	Description and Laws/Regulations	Potential Permits and Processes
FRA	Is responsible for the safety of the railroad system. - FRA Safety Standards (49 Code of Federal Regulations [CFR] 200 – 299) - US Code on Railroad Safety (49 United States Code [USC] 20101 et seq);	Compliance with safety standards and railroad safety statute. FRA may inspect the Project for adherence to these regulations.
Amtrak	Is responsible for assessing and implementing safety and security measures for the NEC and its trains in the Study Area and commuter services, in collaboration with Amtrak, are responsible for assessing and implementing safety and security measures for their trains in the Study Area.	Meeting Amtrak Safety and Security Regulations. Amtrak would have approval authority over measures taken to address the safety of the railroad operations and Station activity as identified.
TSA	Oversees the security of the transportation system. - Department of Homeland Security/Transportation Security Administration Regulations concerning Rail Transportation Security (49 CFR 1580)	TSA may perform inspections of WUS for compliance with Federal law

16 Public Health, Elderly and Persons with Disabilities

16.1 Overview

This section addresses the impacts of the No-Action Alternative and the Action Alternatives on public health and the welfare of the elderly and persons with disabilities. In accordance with the Federal Railroad Administration (FRA)'s *Procedures for Considering Environmental Impacts*, it also considers the impacts of the alternatives on the transportation and general mobility of the elderly and persons with disabilities.[1] If applicable, this section also recommends measures to avoid, minimize, or mitigate potential adverse impacts and identifies permitting and regulatory compliance requirements.

16.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to public health, the elderly, and persons with disabilities that are relevant to the Project include:

- *National Ambient Air Quality Standards* (NAAQS) (40 Code of Federal Regulations [CFR] 50);[2]
- Occupational Safety and Health Administration (OSHA) *Safety and Health Regulations for Construction* (29 CFR 1926);
- *National Emission Standards for Hazardous Air Pollutants* (NESHAP) Regulations (40 CFR 61);[3]

[1] Federal Railroad Administration. 1999. *Procedures for Considering Environmental Impacts*. 64 Federal Register (FR) 28545, Section 12, May 26, 1999 as updated by 78 FR 2713, January 14, 2013.

[2] Code of Federal Regulations Title 40 Protection of Environment Part 50 National Primary and Secondary Ambient Air Quality Standards. Accessed from https://www.govinfo.gov/content/pkg/CFR-2019-title40-vol2/xml/CFR-2019-title40-vol2-part50.xml. Accessed on May 9, 2020.

[3] U.S. Department of Labor. *Regulations (Standards- 29 CFR)*. Accessed from https://www.osha.gov/laws-regs/regulations/standardnumber/1926. Accessed on May 10, 2020.

- *Americans with Disabilities Act* (ADA) (42 USC 1210); [4]
- *Transportation Services for Individuals with Disabilities* (49 CFR 37);[5]
- Federal Transit Administration (FTA) *Americans with Disabilities Act Guidance* (FTA Circular 4710.1);[6] and
- U.S. Environmental Protection Agency (EPA) Memorandum, *Promoting the Use of Health Impact Assessment to Address Human Health in Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act*;[7]

District of Columbia (District) policies, regulations, and guidance that pertain to public health, elderly, and persons with disabilities include:

- District Municipal Regulations (DCMR), Title 22-B, *Public Health and Medicine*;[8]
- The District of Columbia Building Code,[9] Chapter 11, *Accessibility*; and
- The District of Columbia Green Construction Code,[10] Chapter 8, *Indoor Environmental Quality and Comfort*.

16.3 Study Area

The Local Study Area for impacts on public health, the elderly, and persons with disabilities includes the Project Area and a half-mile buffer (**Figure 16-1**). There is no Regional Study Area because impacts on a regional level are not anticipated. Potential impacts to public health, the elderly, and persons with disabilities would be local.

4 Americans With Disabilities Act of 1990, as Amended. Accessed from https://www.ada.gov/pubs/adastatute08.htm. Accessed on May 10, 2020.

5 Federal Transit Administration. *Part 37 – Transportation Services for Individuals with Disabilities*. Accessed from https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/part-37-transportation-services-individuals-disabilities. Accessed on May 9, 2020.

6 Federal Transit Administration. 2015. FTA Circular 4710.1 *Americans with Disabilities Act: Guidance*. Accessed from https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/Final_FTA_ADA_Circular_C_4710.1.pdf. Accessed on January 21, 2019.

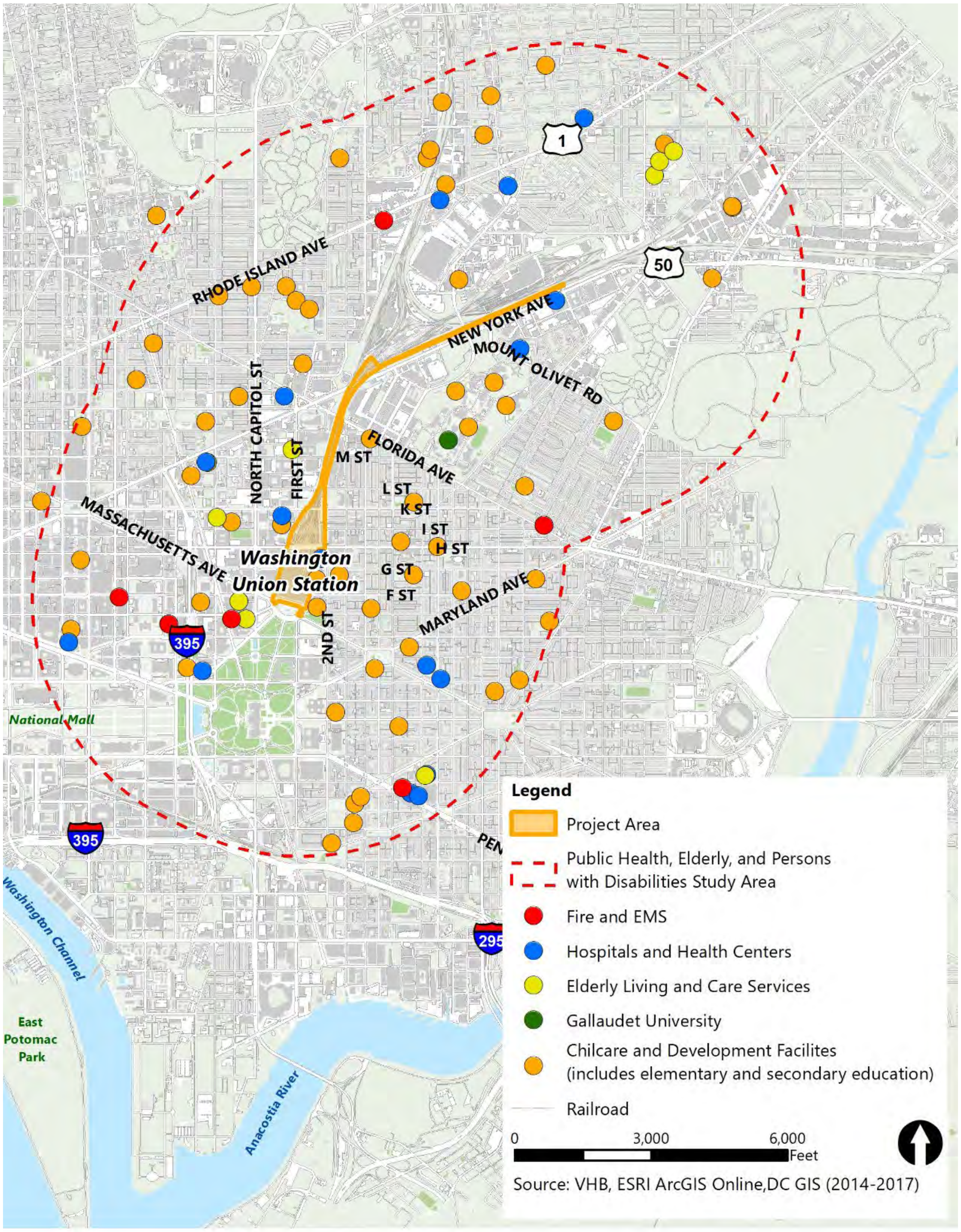
7 U.S. Environmental Protection Agency. 2015. *Promoting the Use of Health Impact Assessment to Address Human Health in Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act*. Accessed from https://www.epa.gov/sites/production/files/2016-03/documents/hia_memo_from_bromm.pdf. Accessed on July 27, 2017.

8 District of Columbia Municipal Regulations. 2018. Title 22-B *Public Health and Medicine*. Accessed from https://dcregs.dc.gov/Common/DCMR/ChapterList.aspx?subtitleNum=22-B. Accessed on June 1, 2017.

9 District of Columbia. 2014. *District of Columbia Building Code – Chapter 11, Accessibility.* Accessed from https://codes.iccsafe.org/public/chapter/content/9182/. Accessed on March 20, 2018.

10 District of Columbia. 2013. *District of Columbia Green Construction Code, Chapter 8, Indoor Environmental Quality and Comfort.* Accessed from https://codes.iccsafe.org/public/document/details/toc/920. Accessed on May 9, 2018.

Figure 16-1. Public Health, Elderly, and Persons with Disabilities Local Study Area



16.4 Methodology

Section 16 of the *Environmental Impact Statement Methodology Report* (**Appendix C1**) describes the approach used to assess the impacts of the No-Action and Action Alternatives on public health, the elderly, and persons with disabilities. A summary is below.

16.4.1 Operational Impacts

Operational impacts are long-term or permanent impacts that would result from the operation of the Project after construction is complete in the planning horizon year of 2040. Potential operational impacts on public health were assessed qualitatively. The assessment drew on a review of other operational impacts analyzed in this report to determine whether they may affect public health or the health of sensitive populations. Impacts may occur via exposure to potentially harmful substances such as, ingestion (swallowing), inhalation (breathing), and absorption (penetration through a barrier such as the skin).

The operational impacts analysis also considered potential impacts on the transportation and general mobility of the elderly and persons with disabilities. These were assessed through a review of the changes in the transportation infrastructure (including WUS) that would result from the Project and how they would affect these persons' movements within and near WUS.

16.4.2 Construction Impacts

Construction impacts from the Project and would cease when the Project is complete. Construction activities may have impacts on public health and the transportation and mobility of the elderly and persons with disabilities. The analysis of construction impacts was conducted using a similar approach to that used for the operational impacts. It included a review of construction impacts on resources such as air quality and noise presented in other sections of this report, and an analysis of how they would affect public health. The analysis also considered how construction activities would affect the way elderly persons and persons with disabilities could access WUS and move in and around the station.

16.5 Impact Analysis

This section presents the impacts of the No-Action Alternative and the Action Alternatives on public health and the transportation and mobility of the elderly and persons with disabilities. Impacts are first summarized in bold lettering, followed by a supporting description and analysis. For each alternative, direct and indirect operational as well as construction impacts are considered relative to the No-Action Alternative. The impacts of the No-Action Alternative are assessed relative to existing conditions. For the Action Alternatives, each section also provides a brief assessment of the impacts relative to existing conditions.

16.5.1 No-Action Alternative

16.5.1.1 Direct Operational Impacts

Relative to existing conditions, in the No-Action Alternative, there would be no direct operational impacts on public health. There would be moderate beneficial direct operational impacts on the transportation and mobility of the elderly and persons with disabilities.

In the No-Action Alternative, the Project would not be constructed and there would be no construction impacts. Several other public and private projects would be implemented in the Project Area, as described in **Section 1.7.1**, *No-Action Alternative*. They include multiple station and track improvements at WUS; private air-rights development; the replacement of the H Street Bridge; the relocation of Substation 25A; and the Virginia Railway Express (VRE) Midday Storage Replacement Facility. None of these projects would create conditions that would measurably adversely affect public health. They would support activities and functions typical of a multimodal transportation facility and dense urban environment. Such land uses are already present in the Study Area and none would introduce public health risks into it.

Increases in localized air pollutant concentrations due to increased train, bus, and car traffic would not result in adverse public health impacts. As documented in **Section 6.5.1.1**, *Direct Operational Impacts*, growth in train and vehicular traffic would generate local increases (hotspots) in carbon monoxide (CO) and particulate matter sized 2.5 micrometers or less ($PM_{2.5}$) concentration. The hotspot analysis documented in **Section 6.5.1.1***, Direct Operational Impacts*, showed that in the No-Action Alternative, emissions of CO and $PM_{2.5}$ would not exceed the NAAQS applicable to those pollutants, even in places where they would be most concentrated (such as near the WUS parking garage). The purpose of the NAAQS is in part to provide public health protection and protect the health of sensitive populations such as asthmatics, children, and the elderly. Increases in pollutant concentrations that do not exceed the NAAQS would not result in adverse health impacts, even on the most sensitive populations.

There would be beneficial impacts on the transportation and mobility of the elderly and persons with disabilities in the No-Action Alternative. These beneficial impacts would be moderate because, while they would make noticeable improvements, they would still leave some known deficiencies unaddressed. As explained in the *Washington Union Station Affected Environment Technical Report* (**Appendix C2**), **Section 16.6.1**, *Elderly and Persons with Disabilities in the Project Area*, WUS currently has a number of accessibility issues and some station elements do not meet the latest standards. This is the case of the existing train platforms, which are not compliant with current ADA or emergency egress standards. The platforms do not allow for level boarding. There are excessive gaps between the platforms and the trains. This would remain the case in the No-Action Alternative. While the number of accessible parking spaces in the WUS garage currently exceeds requirements under the *2010*

ADA Standards for Accessible Design, the facility does not meet the standard for van-accessible parking spaces.[11] This would remain the case under the No-Action Alternative.

However, some of the station improvement projects included in the No-Action Alternative would help remedy a few of these known issues. Examples of such projects include the installation of new ADA-compliant elevators to Track 27-28 and the raising of Platform 15-16 to 48 inches above track to meet level-boarding ADA requirements. Other projects, such as the Concourse Modernization Project, would improve access for all passengers. The elderly are more likely to trip and fall than other passengers or visitors when crowded conditions occur. Reducing congested conditions and facilitating circulation within the station would be especially beneficial to these passengers.

Within the Project Area outside of WUS, projects such as the private air-rights development and the replacement of the H Street Bridge would be needed to comply with requirements pertaining to accessibility by persons with disabilities. These include ADA regulations,[12] Chapter 11 of the District of Columbia Building Code,[13] and the *Supplementary Accessibility Requirements* of the International Building Code. [14]

16.5.1.2 Indirect Operational Impacts

Relative to existing conditions, in the No-Action Alternative, there would be no indirect operational impacts on public health and negligible adverse indirect operational impacts on the transportation and mobility of the elderly and persons with disabilities outside WUS.

As explained in **Section 6.5.1.2**, *Indirect Operational Impacts*, emissions of several criteria pollutants would decrease over the coming decades. This reduction would likely have a global beneficial impact on public health in the long-term, though it is not likely to be noticeable in the Study Area by 2040. Emissions of one criteria pollutant, particulate matter 10 micrometers or less (PM_{10}), would increase. However, emissions of PM_{10} would remain below the *de minimis* threshold for this pollutant.

There would be no noise and vibration impact on public health in the No-Action Alternative. The primary public health concern associated with noise is noise-induced hearing loss (NIHL) from long-term exposure to elevated noise levels. Risk of hearing loss becomes a

11 Americans with Disabilities Act National Network. 2017. *Accessible Parking*. Accessed from https://adata.org/factsheet/parking. Accessed on May 9, 2018.

12 U.S. Department of Justice. 2010. *The Americans with Disabilities Act of 1990 and Revised Regulations Implementing Titles II and III.* Accessed from https://www.ada.gov/2010_regs.htm. Accessed on March 20, 2018.

13 District of Columbia. 2014. *District of Columbia Building Code – Chapter 11, Accessibility.* Accessed from https://codes.iccsafe.org/public/chapter/content/9182/. Accessed on March 20, 2018.

14 International Building Code Council. 2012. *Appendix E: Supplementary Accessibility Requirements*. Accessed from https://up.codes/viewer/south_holland/ibc-2012/chapter/E/supplementary-accessibility-requirements#E. Accessed on March 20, 2018.

consideration with long and repeated exposure to noise levels of 85 decibels (dBA) and higher.[15] There would be no risk of such exposure in the No-Action Alternative. Noise impact analysis (see **Section 10.5.1.1**, *Direct Operational Impacts, Operational Noise*) shows that anticipated noise levels near WUS would not exceed 60 to 75 dBA. In areas nearer the station, noise levels would decrease relative to existing conditions following the construction of the private air-rights development. This is because the development would cover the rail terminal and absorb the noise from train operations that currently occur in the open. The change would be particularly noticeable at the Kaiser Permanente Medical building (700 2nd Street NE), where noise would decrease by more than 10 A-weighted decibels (dBA). The human ear generally perceives such a reduction as a halving of the noise level.

The noise and vibration analysis showed that no noticeable changes in vibration from train operations would occur in the No-Action Alternative. Vibration from railroad operations would exceed FTA standards only at two modeled receptors (see **Section 10.5.1.1**, *Direct Operational Impacts, Operational Vibration*) near the planned Kettler mixed-use development at 300 Morse Street NE. Elsewhere in the Study Area, no changes or only small increases in vibration levels would occur. This would not create any public health concerns. Vibrations would remain below applicable FTA thresholds at the facilities serving sensitive populations located near WUS, including the Federal Energy Regulatory Commission (FERC) Child Development Center, Inc. (888 First Street NE); Harbor at Station Place daycare (100 F Street NE); Thurgood Marshall Child Development Center (1 Columbus Circle Northeast); and Kaiser Medical Center.

Adverse impacts on transportation and mobility of the elderly and persons with disabilities outside WUS would be negligible. Increased roadway traffic may create a perceived barrier to circulation because of the greater potential for conflict between pedestrians and vehicles. Most intersections near WUS have high visibility sidewalks across major approaches, with wheelchair ramps and detectable warning surfaces to aid visually impaired individuals. Most intersections also have accessible pedestrian signal (APS) equipment. Those that do not currently have such equipment are expected to be rebuilt or retrofitted in the next few years.

16.5.1.3 Construction Impacts

In the No-Action Alternative, there would be minor adverse construction impacts on public health and moderate adverse construction impacts on the transportation and mobility of the elderly and persons with disabilities.

Under the No Action Alternative, the Project would not be built. Construction of the various projects included in the No-Action Alternative, such as the private air-rights development, would inherently generate public-health-related risks. Direct impacts may arise from the physical disturbance associated with construction and associated emissions of air pollutants

[15] National Institute on Deafness and Other Communication Disorders, *Noise-Induced Hearing Loss.* https://www.nidcd.nih.gov/health/noise-induced-hearing-loss, accessed on September 28, 2018.

and dust. Examples include the excavation of open trenches or pits; the movement and operation of large motorized equipment and trucks; or the closure of sidewalks, disruption of well-used pathways, and changes in traffic patterns.

Potential adverse impacts on public health from these activities would be minor because best management practices that minimize risks from physical disturbance are a standard feature of all large construction sites. These include, for instance, fencing, clear separation of storage and staging area from the public way; warning signs and alternative pathways during sidewalk closures; and dust control measures such as wetting or seeding of exposed soils.

Public health impacts may also arise from accidental spills of fuel or hazardous material. As explained in **Section 4.5.1.3**, *Construction Impacts*, of this report, compliance with the Emergency Planning and Community Right-to-Know Act (EPCRA), Oil Pollution Act (OPA), and Resource Conservation and Recovery Act (RCRA) requirements would minimize the risk of spilled materials adversely affecting the public.

Construction activities would have moderate adverse impacts on the transportation and mobility of elderly persons and persons with disabilities. During the replacement of the H Street Bridge, walking across the bridge would not be possible or it would be challenging because of sidewalk closures and the proximity of construction activities. Construction of the various WUS improvement projects included in the No-Action Alternative would close parts of the station or make it challenging to navigate. Installation of the columns supporting the private air-rights deck in the rail terminal may reduce platform space and make the platforms narrower and more crowded. These adverse impacts would be moderate because they would occur in different locations and on different schedules. Majority of WUS would remain accessible most of the time.

16.5.2 Alternative A

16.5.2.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A would have no adverse direct operational impact on public health. It would have a major beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

Alternative A would not introduce in the Study Area functions or activities that could adversely affect public health. Alternative A would include an air conditioning strategy that would isolate areas within which fumes, heat, and noise associated with operating diesel trains occur from areas where passengers and visitors would wait or remain for any significant amount of time. The tracks and platform areas would ventilate to the outside of the station.

Emissions from increased railroad operations, combined with emissions from greater vehicular traffic on the adjacent roadways, would result in higher localized concentrations of

CO and $PM_{2.5}$. These impacts were assessed through a microscale (hotspot) air quality analysis (see **Section 6.5.2.1**, *Direct Operational Impacts*). The analysis showed that concentrations of these two pollutants would not exceed the applicable NAAQS. Because EPA specifically established the NAAQS for public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly, the anticipated increases would not result in health-related impacts, even on the most sensitive populations.

Alternative A would have a major beneficial impact on the transportation and mobility of the elderly and persons with disabilities by making it easier to access and navigate WUS. Alternative A would bring WUS into full compliance with applicable accessibility codes and regulations. These include the *2010 ADA Standards for Accessible Design* and provisions of Chapter 11 of the *2013 District of Columbia Building Code.* The latter incorporates Appendix E of the *International Building Code* as they relate to design and construction of facilities for accessibility by persons with physical disabilities. This would remedy shortcomings that the No-Action Alternative would not address. Elevators and wheelchair ramps would be provided as required. The new parking facility would contain sufficient handicapped and van spaces (at least 28 accessible parking spaces, five of which are van-accessible). [16] The new platforms would be wider and would allow for level boarding, addressing a significant existing short-coming.

Several other features would benefit the elderly and persons with disabilities as well as the general public. New entrances to WUS on First, 2nd, and H Streets NE would reduce the distance many persons have to travel within WUS to reach their trains or buses. Improved private pick-up and drop-off areas in front of WUS and new ones on First and 2nd Streets NE and next to the train hall would also facilitate access.

The new concourses and train hall would provide climate-controlled, more spacious transitional spaces than the existing Claytor Concourse, which would remain in the No-Action Alternative. The new bus facility would provide upgraded waiting spaces and other amenities relative to the existing ones, which the No-Action Alternative would keep in their current condition. Because the bus facility and parking facility would be at the same approximate location as they currently are and would remain in the No-Action Alternative, the improvements would be a net benefit: the distance to the other elements of the station would not significantly change.

By making boarding and alighting from trains or buses easier and reducing congestion in transitional spaces such as concourses, Alternative A would reduce trip and fall risks, which are a consideration in an environment where people are often moving hurriedly and encumbered with luggage. While this would benefit all passengers and visitors, it would

[16] Americans with Disabilities Act National Network. 2017. *Accessible Parking*. Accessed from https://adata.org/factsheet/parking. Accessed on May 9, 2018.

particularly benefit the elderly and persons with disabilities, making it easier for them to navigate the station and move between multimodal elements.

Increased accessibility at WUS would also provide direct access to the Kaiser Permanente Capitol Hill Medical Center on 700 2nd Street, NE at the corner of 2nd Street NE and H Street NE. The new H Street entrance to the station would provide the public, the elderly, and persons with disabilities using public transportation a new access to the medical center.

16.5.2.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A would have no indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly and persons with disabilities outside WUS.

No indirect impacts on public health would result from mesoscale air quality emissions. The air quality mesoscale analysis conducted for Alternative A (see **Section 6.5.2.2**, *Indirect Operational Impacts, Mesoscale Analysis*) indicates that Alternative A would cause additional emissions of all criteria pollutants relative to the No-Action Alternative. However, these emissions would remain below the applicable *de minimis* levels. Also, reduction in region-wide traffic would sufficiently reduce emissions of mobile source air toxics (MSAT) to offset any increases due to Alternative A. Therefore, there would be no public health impacts.

Relative to the No-Action Alternative, ambient noise levels would increase at several locations under Alternative A, as explained in **Section 10.5.2.1**, *Direct Operational Impacts, Operational Noise*. However, increases would not exceed three dBA and, as such, would be barely perceptible and negligible. Nowhere would noise levels reach levels that could cause NIHL.[17] At 14 modeled locations, the resulting noise levels would exceed the FTA threshold for a moderate noise impact. A moderate impact is generally not sufficient to generate strong, adverse reactions and has no potential to cause public health issues. Similarly, vibration impacts from Alternative A would be minor, with no potential to affect public health.

There would be minor adverse indirect impacts on the transportation and mobility of the elderly and persons with disabilities. Increased roadway traffic may create a perceived barrier to the transportation and mobility of such persons near WUS because of the greater potential for conflict between pedestrians and vehicles. This would occur in the No-Action Alternative as well, but Alternative A would generate more traffic than the No-Action Alternative, especially along H Street NE, 2nd Street NE, North Capitol Street, and the north side of Columbus Circle (traffic impacts are presented in detail in **Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Traffic*, of this report).

[17] As previously noted, risk of hearing loss becomes a consideration only with long and repeated exposure to noise levels of 85dB and higher (National Institute on Deafness and Other Communication Disorders, *Noise-Induced Hearing Loss* (https://www.nidcd.nih.gov/health/noise-induced-hearing-loss, accessed on September 28, 2018).

As in the No-Action Alternative, existing and likely future accessibility features (See **Section 16.5.1.2**, *Indirect Operational Impacts*) would reduce this risk. Additionally, Alternative A has several features that would contribute to offsetting the risk. They include additional access points (on First, 2nd, and H Streets NE), which would reduce the distance some persons would have to walk on public streets to reach the station. Also, the reconfiguration of the multiple pick-up and drop-off lanes in front of WUS and the realignment of First Street NE as a one-way street would facilitate access to WUS, with fewer roadways to cross. The removal of hop-on hop-off and tour bus traffic from that area would also make access to the front of WUS easier.

Currently, Gallaudet University runs a shuttle for students between WUS and the campus. In Alternative A, this shuttle would be discontinued because the new bus facility would not be able to accommodate it. This would represent an adverse impact on the transportation of persons with disabilities. This impact would be minor because it would not preclude Gallaudet University from finding another pick-up and drop-off location near WUS for its shuttle. Also, the Gallaudet campus shuttle is a standard service many universities offer rather than a special accommodation required to meet the specific needs of Gallaudet's hearing-impaired students.

16.5.2.3 Construction Impacts

Construction of Alternative A would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

Construction of Alternative A would take approximately 11 years and 5 months to complete. Construction would take place in four phases moving from east to west plus an Intermediate Phase between Phases 1 and 2 when only First Street Tunnel column removal work would be conducted. Construction activities, especially on the scale of the Project, inherently generate public-health-related risks. Direct impacts may arise from the physical disturbance associated with construction. Examples include the excavation of open trenches or pits; the movement and operation of large motorized equipment and trucks; or the closure of sidewalks, disruption of well-used pathways, and changes in traffic patterns.

Potential adverse impacts on public health from these activities would be minor because best management practices that are standard for all large construction sites would minimize risks from physical disturbance. All areas under construction would be fenced, screened, and inaccessible to the public either from the surrounding neighborhoods or from within WUS.

Public health impacts may arise from the air pollution and noise caused by construction work or if a large spill of fuel or hazardous material occurred. For the reasons described in the following paragraphs, these impacts would be minor.

During construction, fuel and hazardous materials would be stored and used on site. Accidental spills may occur, which could pose a risk to public health. As explained in **Section 4.5.2.3**, *Construction Impacts*, compliance with EPCRA, OPA, and RCRA requirements would minimize the risk of spilled materials migrating outside the Project Area and coming into contact with the public.

Construction activities would cause air pollutant emissions from the operation of motorized equipment and movement of construction trucks to and from the site. The amount of emissions would vary with each construction phase, and within each phase, with the type of activity. Quantitative estimates of construction-related emissions of criteria pollutants in Alternative A are presented in **Section 6.5.2.3**, *Construction Impacts*. The estimates are for each phase's most emissions-intensive activities, conservatively assumed to take place within a year.[18] This analysis showed that there would be no year during which emissions of criteria pollutants would exceed the applicable *de minimis* levels. Therefore, these emissions would not adversely affect public health.

During column removal work, when part of the Retail and Ticketing Concourse would be demolished and the tunnel underneath exposed, there is potential for fumes from train engines to enter the station – both public areas and back of house areas – because several tracks would remain active at all times to minimize impacts on train service. These impacts would be avoided by closing off the construction area as described in **Section 16.7**, *Avoidance, Minimization and Mitigation Evaluation*.

Construction of Alternative A would also cause noise impacts (see **Section 10.5.2.3**, *Construction Impacts*). Construction workers who are exposed to noise as part of their occupation have an increased risk of NIHL when there is a time-weighted average (TWA) noise exposure of 85 dBA or greater over 8-hours according to the United States Occupational Safety and Health Administration (OSHA). For a 12-hour work shift, the risk of NIHL occurs at a TWA level of 83 dBA. For routine exposure to noise over a 20-hour period, the threshold for NIHL is approximately 81 dBA. Above these noise thresholds, OSHA requires an employer to implement a hearing conservation program, including annually testing employees, monitor sound, and require hearing protection or other engineering noise controls.

These requirements would ensure that workers are protected from NIHL if they are exposed to noise above the relevant thresholds. Members of the general public or WUS workers would not be at risk of exposure to noise levels capable of causing NIHL. Non-authorized persons would not be allowed within the construction site or near noisy equipment. The partitions used to close off the part of the station where the column removal work would

[18] As explained in **Section 6.4.3**, *Construction Impacts*, the Intermediate Phase was not included in the air quality analysis. However, construction activities during that phase would be limited to those associated with column removal in the First Street Tunnel and the resulting emissions would be negligible compared to the emissions from the four main construction phases considered in the analysis.

take place from the rest of the building would be designed to provide an adequate level of noise shielding. Passers-by or neighbors would be exposed to noise for periods of time short enough for exposure to remain well below the OSHA thresholds for NIHL. There would be no impacts on public health from noise.

Construction of Alternative A would have major adverse impacts on the transportation and mobility of elderly persons and persons with disabilities. WUS would continue to operate throughout the construction period of approximately 11 years and 5 months. During that time, depending on the phase of construction, parts of WUS would be closed to the public. This would result in congested conditions during periods of peak passenger activity. Areas that would remain open to the public may have to be temporarily reconfigured. Access to and from train platforms, bus facility, and parking facility would be relocated as construction proceeds. The disruption of usual pathways within WUS may be confusing to everyday riders and may make WUS more challenging to navigate for occasional users. Combined with increased congestion, it would create a heightened risk of trip and fall accidents or make access by elderly persons or persons with disabilities more difficult. During Phase 4 of construction, the unavailability of parking and intercity bus service at WUS would restrict options for access to WUS. It may be more difficult or costly for the elderly and persons with disabilities to switch to alternative modes of access such as transit or for-hire vehicles. Phase 4 would last approximately 3 years and 1 month in Alternative A.

Outside of WUS, temporary sidewalk and lane closures would occur at various times during construction. Temporary relocation of bus stops and rerouting may be necessary. During Phase 1 of construction (lasting approximately 2 years and 5 months), sidewalk or lane closures may make access to the Kaiser Permanente Medical Building (700 2nd Street NE) more challenging, although ADA-compliant access would be maintained at all time.

Although much of the main public spaces in the station, including those in the historic station building, would remain open and unencumbered, access to and from WUS during construction, as well as internal circulation, would unavoidably remain more challenging than normal for the elderly and persons with disabilities. Because of the length of construction (approximately 11 years and 5 months), this would be a major adverse impact. **Section 16.7**, *Avoidance, Minimization, and Mitigation Evaluation* identifies measures to mitigate this impact.

16.5.2.4 Comparison to Existing Conditions

The operational impacts of Alternative A relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative A would have no adverse direct operational impact on public health and a major beneficial direct operational impact on the transportation and mobility of the elderly and persons with disabilities at WUS. However, Alternative A would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative.

Relative to existing conditions, Alternative A would also have no adverse indirect operational impacts on public health and minor adverse indirect operational impacts on transportation and mobility of the elderly or persons with disabilities outside WUS. Indirect impacts on the transportation and mobility of the elderly and persons with disabilities would be the same because differences between the No-Action Alternative and existing conditions are not meaningful.

The intensity of impacts from air pollutant emissions and noise depends on the absolute level of impacts rather than on the relative change from a given baseline. Alternative A emissions would be below the *de minimis criteria* and would have negligible impacts on public health. Noise levels would have no potential to cause NIHL.

16.5.3 Alternative B

16.5.3.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative B would have no adverse direct operational impact on public health. It would have a moderate direct beneficial operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

Alternative B would have no adverse direct operational impact on public health for the same reasons as described for Alternative A in **Section 16.5.2.1**, *Direct Operational Impacts*.

Alternative B would have moderate beneficial direct operational impacts on the transportation and mobility of the elderly or persons with disabilities. The impacts would generally be the same as those described for Alternative A (see **Section 16.5.2.1**, *Direct Operational Impacts*), with one notable difference. In Alternative B, parking would be in two below-ground levels along the west side of the rail terminal, between K Street NE and the back of the historic station building. This would increase the walking distance from the farthest parking spaces to the other parts of WUS relative to the No-Action Alternative (increase of up to approximately 1,000 feet to reach the back of the historic station building, for instance). Navigating the large parking facility to the nearest WUS access point could be more challenging to persons with reduced mobility than in the No-Action Alternative, which would keep the existing garage. Alternative B would generally improve conditions at WUS for the elderly and persons with disabilities, resulting in a net beneficial impact, but the location of the parking facility would offset some of the benefits, making the impact moderate.

16.5.3.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative B would have no adverse indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly or persons with disabilities outside WUS.

The indirect operational impacts of Alternative B would be the same as those of Alternative A. They are described in **Section 16.5.2.2***, Indirect Operational Impacts*.

16.5.3.3 Construction Impacts

Construction of Alternative B would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

The construction impacts of Alternative B on public health would be similar to those of Alternative A described in **Section 16.5.2.3***, Construction Impacts*. The same measures that would minimize risks from physical disturbances, traffic, and hazardous materials that would apply in Alternative A would apply in Alternative B. Although Alternative B would cause higher noise levels during the early phase of construction due to the type of cut-off wall used, the potential for members of the public to be exposed to levels that could cause NIHL would be as limited as in Alternative A. Similarly, construction-related air pollutant emissions in Alternative B would remain below *de minimis* levels.

The adverse impacts of constructing Alternative B on the transportation and mobility of the elderly and persons with disabilities would be the same as those of Alternative A (see **Section 16.5.2.3**, *Construction Impacts*) and would be major. They would last for a longer period of time, as construction of Alternative B would take an estimated 14 years and 4 months. Phase 4, during which parking and intercity bus service would be unavailable at WUS would last for approximately 4 years and 11 months in Alternative B.

16.5.3.4 Comparison to Existing Conditions

The operational impacts of Alternative B relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative B would have no adverse direct operational impact on public health and a moderate beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities. Alternative B would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative but the beneficial impact would remain moderate because of the relocation of parking to a two-level, below-ground facility. Indirect impacts relative to existing conditions would be as described for Alternative A in **Section 16.5.2.4**, *Comparison to Existing Conditions*.

16.5.4 Alternative C

16.5.4.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have no adverse direct operational impact on public health. It would have a moderate beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

Alternative C (either option) would have no adverse direct operational impact on public health for the same reasons as described for Alternative A (**Section 16.5.2.1**, *Direct Operational Impacts*). Alternative C would have moderate beneficial direct operational impacts on the transportation and mobility of the elderly or persons with disabilities. The impacts would generally be the same as those described for Alternative A (see **Section 16.5.2.1**, *Direct Operational Impacts*), with two notable differences. In Alternative C, the bus facility and above-ground parking facility would be located north of H Street NE, either on the west side (West Option) or the east side (East Option) of the rail terminal. More than half the total number of parking spaces would be on one below-ground level along the west side of the rail terminal between K Street and the back of the historic station building.

This layout would increase the maximum walking distance from the bus facility and a majority of the parking spaces to other parts of WUS relative to the No-Action Alternative. Bus passengers would have to walk approximately an additional 1,100 feet in the East Option and an additional 250 feet in the West Option to reach the back of the historic station building. In both cases, the connection would be mostly through the new concourses, which would provide an ADA-compliant and inviting environment. The additional distance could still represent a challenge for persons with reduced mobility. Similarly, persons parking in the below-ground parking facility could have to walk up to an additional 1,000 feet or so to reach the back of the historic station building. As described for Alternative B, navigating the large parking facility to the nearest WUS access point could be challenging for persons with reduced mobility.

Alternative C with either option would generally improve conditions at WUS with regard to the transportation and mobility of the elderly and persons with disabilities, resulting in a net beneficial impact. The location of the bus facility and parking facility would offset some of the benefits, making the beneficial impact moderate.

16.5.4.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative C (either option) would have no adverse indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly or persons with disabilities outside WUS.

The indirect operational impacts of Alternative C would be the same as those of Alternative A. They are described in **Section 16.5.2.2**, *Indirect Operational Impacts*.

16.5.4.3 Construction Impacts

Construction of Alternative C (either option) would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

The construction impacts of Alternative C on public health would be similar to those of Alternative A described in **Section 16.5.2.3**, *Construction Impacts*. The same measures that would minimize risks from physical disturbances, traffic, and hazardous materials that would apply in Alternative A would apply in Alternative C. Although Alternative C would cause higher noise levels during the early phase of construction due to the type of cut-off wall used, the potential for members of the public to be exposed to levels that could cause NIHL would be as limited as in Alternative A. Similarly, construction-related air pollutant emissions in Alternative C would remain below *de minimis* levels.

The adverse impacts of constructing Alternative C on the transportation and mobility of the elderly and persons with disabilities would be the same as those of Alternative A, described in **Section 16.5.2.3**, *Construction Impacts*, and would be major. They would last for a longer period, as construction of Alternative C would take an estimated 12 years and 3 months. Phase 4, during which parking and bus service would be unavailable at WUS would last for approximately 4 years in Alternative C with the West Option. In Alternative C with the East Option, because of the availability of the new bus facility and above-ground parking during Phase 4 of construction, the reduction in accessibility for the elderly and persons with disabilities would not be as great. However, as explained in **Section 16.5.4.1**, *Direct Operational Impacts*, the distance to the front of the station would increase relative to existing conditions.

16.5.4.4 Comparison to Existing Conditions

The operational impacts of Alternative C (either option) relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative C would have no direct adverse operational impact on public health and a moderate direct beneficial operational impact on the transportation and mobility of the elderly or persons with disabilities. Alternative C would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative but the beneficial impact would remain moderate because of the relocation of bus facility to a location north of H Street NE and the relocation of all parking in a facility above the bus facility or to a below-ground, one-level parking facility. Indirect impacts relative to existing conditions would be as described for Alternative A in **Section 16.5.2.4**, *Comparison to Existing Conditions*.

16.5.5 Alternative D

16.5.5.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative D would have no adverse direct operational impact on public health. It would have a moderate beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

Alternative D would have no adverse direct operational impact on public health for the same reasons as described for Alternative A in **Section 16.5.2.1**, *Direct Operational Impacts*. Alternative D would have moderate beneficial direct operational impacts on the transportation and mobility of the elderly or persons with disabilities. The impacts would generally be the same as those described for Alternative A in **Section 16.5.2.1**, *Direct Operational Impacts*, with two notable differences. First, in Alternative D, the above-ground parking facility would be located at the north end of the rail terminal, just south of K Street NE. Persons parking in the above-ground parking facility would need to use surface streets to reach the nearest access point to WUS on H Street NE, approximately 600 feet away. This would require people to be outside and exposed to weather conditions. This may present a challenge to persons with reduced mobility. Once within WUS, they would need to walk another 900 feet or so to reach the back of the historic station building, though this would be in air-conditioned concourses. Also, more than half the total number of parking spaces would be on one below-ground level along the west side of the rail terminal between K Street NE and the back of the historic station building. This would increase the distance some parkers would need to walk to reach the historic station building by up to approximately 1,000 feet.

The second difference would be the lack of private pick-up and drop-off area adjacent to the train hall. The integration of the bus facility with the train hall would not permit it. However, by placing the bus facility next to the train hall and the historic station building, Alternative D would also make moving between buses and other modes of transportation easier than in the No-Action Alternative.

Overall, like the other Action Alternatives, Alternative D would generally improve conditions at WUS with regard to the transportation and mobility of the elderly and persons with disabilities, resulting in a net beneficial impact. The remote location of the parking facility and lack of private pick-up and drop-off area next to the train hall would offset some of the benefits, making the beneficial impact moderate.

16.5.5.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative D would have no adverse indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly or persons with disabilities outside WUS.

The indirect operational impacts of Alternative D would be the same as those of Alternative A. They are described in **Section 16.5.2.2**, *Indirect Operational Impacts*.

16.5.5.3 Construction Impacts

Construction of Alternative D would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

The construction impacts of Alternative D on public health would be similar to those of Alternative A, described in **Section 16.5.2.3**, *Construction Impacts*. Impacts on the transportation and mobility of the elderly and persons with disabilities would be the same as those of Alternative C, described in **Section 16.5.4.3**, *Construction Impacts*.

16.5.5.4 Comparison to Existing Conditions

The operational impacts of Alternative D relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative D would have no adverse direct operational impact on public health and a moderate beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities. Alternative D would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative but the beneficial impact would remain moderate because of the relocation of parking just south of K Street NE or to a below-ground, one-level parking facility. Indirect impacts relative to existing conditions would be as described for Alternative A in **Section 16.5.2.4**, *Comparison to Existing Conditions.*

16.5.6 Alternative E

16.5.6.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative E would have no adverse direct operational impact on public health. It would have a moderate beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

Alternative E would have no adverse direct operational impact on public health for the same reasons as described for Alternative A (**Section 16.5.2.1**, *Direct Operational Impacts*).

It would generally have the same moderate beneficial operational impact on the transportation and mobility of the elderly or persons with disabilities as Alternative B (see **Section 16.5.3.1**, *Direct Operational Impacts*) with two differences. The integration of the new bus facility with the train hall would facilitate the movement of people, including the elderly and persons with disabilities, between the various transportation modes at WUS. There would be no room for a private pick-up and drop-off area next to the train hall. This, and the location and layout of the parking facility would offset some of the benefits (see **Section 16.5.2.1**, *Direct Operational Impacts)*, resulting in a moderate beneficial impact.

16.5.6.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative E would have no adverse indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly or persons with disabilities outside WUS.

The indirect operational impacts of Alternative E would be the same as those of Alternative A, described in **Section 16.5.2.2**, *Indirect Operational Impacts*.

16.5.6.3 Construction Impacts

Construction of Alternative E would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

The construction impacts of Alternative E on public health would be similar to those of Alternative A, described in **Section 16.5.2.3***, Construction Impacts*.

Alternative E's impacts on the transportation and mobility of the elderly and persons with disabilities would be the same as those of Alternative B (**Section 16.5.3.3**, *Construction Impacts*).

16.5.6.4 Comparison to Existing Conditions

The operational impacts of Alternative E relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative E would have no adverse direct operational impact on public health and a moderate beneficial direct operational impact on the transportation and mobility of elderly or persons with disabilities. Alternative E would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative but the beneficial impact would remain moderate because of the relocation of all parking to a two-level, below-ground facility. Indirect impacts relative to existing conditions would be as described for Alternative A in **Section 16.5.2.4**, *Comparison to Existing Conditions.*

16.5.7 Alternative A-C (Preferred Alternative)

16.5.7.1 Direct Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have no adverse direct operational impact on public health. It would have a major beneficial direct operational impact on the transportation and mobility of the elderly or persons with disabilities within WUS.

The direct operational impacts of Alternative A-C would be the same as those of Alternative A, described in **Section 16.5.2.1**, *Direct Operational Impacts*.

16.5.7.2 Indirect Operational Impacts

Relative to the No-Action Alternative, Alternative A-C would have no indirect operational impacts on public health and minor adverse indirect operational impacts on the transportation and mobility of the elderly and persons with disabilities outside WUS.

The indirect operational impacts of Alternative A-C would be the same as those of Alternative A, described in **Section 16.5.2.2**, *Indirect Operational Impacts*.

16.5.7.3 Construction Impacts

Construction of Alternative A-C would result in minor adverse impacts on public health and major adverse impacts on the transportation and mobility of the elderly and persons with disabilities.

The construction impacts of Alternative A-C on public health would be the same as those of Alternative A, described in **Section 16.5.2.3***, Construction Impacts*.

16.5.7.4 Comparison to Existing Conditions

The operational impacts of Alternative A-C relative to existing conditions would generally be similar to its impacts relative to the No-Action Alternative. Alternative A-C would have no adverse direct operational impact on public health and a major beneficial direct operational impact on the transportation and mobility of elderly or persons with disabilities. Alternative A-C would represent a greater improvement relative to existing conditions than relative to the No-Action Alternative. Indirect impacts relative to existing conditions would be as described for Alternative A in **Section 16.5.2.4**, *Comparison to Existing Conditions.*

16.6 Comparison of Alternatives

With regard to public health and the transportation and mobility of elderly and persons with disabilities, all Action Alternatives would have similar impacts, as shown in **Table 16-1**.

Table 16-1. Comparison of Alternatives

<table>
<tr><th>Impact Category</th><th>Type of Impact</th><th>No-Action Alternative</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C (Either Option)</th><th>Alternative D</th><th>Alternative E</th><th>Alternative A-C (Preferred)</th></tr>
<tr><td rowspan="3">Public Health</td><td>Direct Operational</td><td colspan="7">No impact</td></tr>
<tr><td>Indirect Operational</td><td colspan="7">No impact</td></tr>
<tr><td>Construction</td><td colspan="7">Minor adverse impact</td></tr>
<tr><td rowspan="3">Transportation and Mobility of Elderly and Persons with Disabilities</td><td>Direct Operational</td><td>Moderate beneficial impact</td><td>Major beneficial impact</td><td colspan="4">Moderate beneficial impact</td><td>Major beneficial impact</td></tr>
<tr><td>Indirect Operational</td><td>Negligible adverse impact</td><td colspan="6">Minor adverse impact</td></tr>
<tr><td>Construction</td><td>Moderate adverse impact</td><td colspan="6">Major adverse impact</td></tr>
</table>

The Action Alternatives would have no adverse operational impacts and minor adverse construction impacts on public health. All would include the same air conditioning strategy to maintain temperature and air quality within WUS. Outside WUS, increases in air pollutant emissions from increased railroad operations and vehicular traffic would remain below the applicable NAAQS.

All Action Alternatives also would have beneficial impacts on the transportation and mobility of the elderly and persons with disabilities relative to the No-Action Alternative, as they would all fully bring WUS to the applicable ADA standards and facilitate access to the station for all. These beneficial impacts would vary slightly depending on the Action Alternative because of the new parking and bus facilities location, and the different new private pick-up and drop-off areas. **Table 16-2** shows how the No-Action and the Action Alternatives compare with regard to these differentiating factors.

Table 16-2. Comparison of Impacts of Transportation and Mobility of to the Elderly and Persons with Disabilities

Alternative	ADA-Compliance	Parking Location	Bus Facility Location and Distance	Pick-up/Drop-off next to Train Hall?
No-Action	Partial	No change	No change	N/A
A	Full	All above ground at existing location. No change in distance	No change	Yes
B	Full	All below ground between K Street NE and historic station building. Increased distance (by up to approximately 1,000 feet).	No change	Yes
C	Full	Part below-ground between K Street NE and historic station building and part above ground just north of H Street NE. Increased distance (below-ground: by up to approximately 1,000 feet; above-ground: by up to approximately 1,100 feet [East Option] or 250 feet [West Option]).	Just north of H Street NE. Increased distance (by up to approximately 1,100 feet [East Option] or 250 feet [West Option]).	Yes
D	Full	Part below-ground between K Street NE and historic station building and part above ground just south of K Street NE. Increased distance (below-ground: by up to approximately 1,000 feet; above-ground: by up to approximately 1,500 feet).	Integrated with train hall.	No
E	Full	All below ground between K Street NE and historic station building. Increased distance (by up to approximately 1,000 feet).	Integrated with train hall.	No
A-C	Full	All above ground at existing location. No change in distance	No change	Yes

In all Action Alternatives except Alternative A and Alternative A-C, average walking distances from and to the bus facility, parking facility, or both would increase relative to the No-Action Alternative, which may adversely affect users with reduced mobility. Alternative C would place the bus facility north of H Street NE, a short distance from the new WUS entrance on the H Street Bridge, but farther from the historic station building than in the other Action Alternatives. Alternatives D and E would integrate the bus facility with the train hall, facilitating movements between the various transportation modes. Alternatives A, A-C, and B would keep the bus facility approximately at the same location as in the No-Action Alternative, also facilitating movements among modes.

With regard to parking, Alternative D would increase walking distances most, requiring users of the above-ground parking facility to walk outside for approximately 600 feet before reaching the closest WUS access point at H Street NE. Alternatives A and A-C would keep all parking closest to the concourse and historic station building. Alternatives B and C would be in-between.

With regard to pick-up and drop off areas, Alternatives D and E, unlike the other Action Alternatives, would have no room next to the train hall. This is because of the integrated bus facility, which would wrap around the train hall.

16.7 Avoidance, Minimization, and Mitigation Evaluation

To avoid or minimize operational impacts on the transportation and mobility of the elderly or persons with disabilities, FRA is considering the following measures:

- In Alternatives B, C, D, and E, USRC would ensure parking reserved for persons with disabilities is located near the southern end of the below-ground parking facility to minimize the distance between parking spaces and Concourse A.
- In Alternatives B and E, reserved parking would further be located on the first level of the parking facility.
- In all Action Alternatives, the Project Proponents would ensure that the most direct path from the parking facility or bus facility to the nearest WUS entrance is clearly identified. Adequate signage, lighting, and safety features would be provided. Everywhere, access to elevators, escalators, and emergency exits would be clearly marked. Signs and maps would be clear and concise, with large, high-contrast, and raised lettering for those who rely on tactile capabilities for information. Where possible, audible directions would be incorporated. Joints in walkways and transitions from ramps to walks would be closed and flush to prevent tripping and reduce the risks of canes or small wheels getting trapped in gaps or spaces. Walkways would have a continuous detectable edge to help users navigate paths safely.
- Amtrak would ensure that its Red Cap service remains available and is adequately staffed to assist elderly passengers and passengers with physical, visual, and auditory disabilities in navigating and traversing the station, including moving between the platforms and the bus or parking facilities.

To avoid, minimize, or mitigate major adverse impacts on public health and on transportation and mobility of the elderly or persons with disabilities during construction, the following measures are being considered by FRA:

- Within WUS, the Project Proponents would require the construction contractor to install temporary walls and partitions to close off the portions of the Retail and

Ticketing Concourse where the column removal work would be conducted from the areas remaining accessible to the public or to station or Amtrak employees. Only authorized personnel would have access to the area. These walls and partitions would be sufficient to prevent the fumes from train operations in the tunnel, as well as dust from the demolition or construction work and emissions from construction equipment, from entering these areas. They would also provide adequate shielding from noise.

- The Project Proponents would ensure that within WUS, accessibility is maintained during construction in compliance with ADA requirements and the District Department of Transportation (DDOT) *Pedestrian Safety and Work Zone Standards*.[19] Pathways within and outside WUS would be planned to avoid creating narrow passages, bottlenecks, or areas otherwise difficult for persons with disabilities or elderly persons with reduced mobility to navigate.
- Outside WUS, where construction would require work within the public right-of-way and the closing of sidewalks, alternative, the construction contractor would be required to provide alternative protected pedestrian passages, along with appropriate signage. Signs would be clear and concise and designed to communicate information to visually impaired persons. Where possible, audible directions would be incorporated. Pedestrian pathways would be kept clear of debris and obstructions, adequately drained, and with adequate passing spaces. Pedestrian pathways would also have detectable edges or channelizing equipment. Crash-worthy barriers would be used to protect pedestrians from vehicular traffic. Barriers would be equipped with reflective material on the side exposed to traffic.
- The construction contractor would be required to ensure that lane closures, detours, alternative parking access, or use of metal plates to cover temporary trenches across roadways are appropriately advertised.
- The construction contractor would be required to notify the owners and occupants of the Kaiser Permanente Medical Building of any planned road or sidewalk closures sufficiently in advance to allow them to publicize these disruptions to their patients and customers as appropriate. Temporary entrances or pathways would be clearly marked and advertised. ADA-compliant access to the building would be maintained at all times.

[19] District Department of Transportation. 2010. *Pedestrian Safety and Work Zone Standards: Covered and Open Walkways*. Accessed from https://ddot.dc.gov/page/pedestrian-safety-and-work-zone-standards-covered-and-open-walkways. Accessed on April 3, 2020.

16.8 Permits and Regulatory Compliance

In terms of accessibility and mobility for the elderly and persons with disabilities, the Project must comply with ADA regulations, as well as meet standards set forth by the Transportation Services for Individuals with Disabilities (49 CFR 37) and the U.S. Access Board's ADA Accessibility Guidelines (ADAAG) adopted by the U.S. Department of Transportation in 2006. The Project must also meet the District of Columbia Building Code, which includes requirements for accessibility and indoor environmental quality, and is enforced through the building permitting process administered by the District Department of Consumer and Regulatory Affairs.

17 Environmental Justice

17.1 Overview

This section evaluates the potential of the No-Action Alternative and the Action Alternatives to cause disproportionately high and adverse impacts on environmental justice (EJ) populations in accordance with Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. EO 12898 requires that Federal agencies identify and address disproportionately high and adverse impacts resulting from Federal projects on minority and low-income communities.

As stated in Federal Transit Administration (FTA) Circular 4703.1, *Environmental Justice Policy Guidance for Federal Transit Administration Recipients*, the United States Department of Transportation (U.S. DOT) must make EJ part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority populations or low-income populations. Consistent with this directive, the Federal Railroad Administration (FRA) is committed to the EJ principles, which include:

- Avoiding, minimizing, or mitigating disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- Ensuring the full and fair participation by all potentially affected communities in the transportation decision-making process; and
- Preventing the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

If applicable, this section also describes measures to avoid, minimize, or mitigate potential disproportionately high and adverse impacts and identifies permitting and regulatory compliance requirements.

17.2 Regulatory Context

Federal policies, regulations, and guidance that pertain to EJ include:

- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*;
- U.S. Civil Rights Act Title VI (42 USC 2000d);

- *Memorandum of Understanding on Environmental Justice and EO 12898* (August 4, 2011);[1]
- Council on Environmental Quality, *Environmental Justice: Guidance Under the National Environmental Policy Act (NEPA)*;[2]
- U.S. DOT Order 5610.2(a), *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*;[3]
- U.S. DOT, *Environmental Justice Strategy*;[4]
- *Promising Practices for EJ Methodologies in NEPA Reviews: Report of the Federal Interagency Working Group on Environmental Justice and NEPA Committee*;[5]
- FTA Transit Laws, 49 USC 53; and
- FTA Circulars:
    - 4702.1B *Title VI Requirements and Guidelines for Federal Transit Administration Recipients*;[6] and
    - 4703.1 *Environmental Justice Policy Guidance for Federal Transit Administration Recipients*.[7]

[1] Memorandum of Understanding on Environmental Justice and Executive Order 12898. Accessed from https://www.epa.gov/sites/production/files/2015-02/documents/ej-mou-2011-08.pdf. Accessed on August 6, 2018.

[2] Council on Environmental Quality. 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Accessed from https://www.epa.gov/sites/production/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf. Accessed on August 17, 2017.

[3] U.S. Department of Transportation. *Final DOT Environmental Justice Order 5610.2(a).* Accessed from https://www.fhwa.dot.gov/environment/environmental_justice/ej_at_dot/orders/order_56102a/. Accessed on January 21, 2019.

[4] U.S. Department of Transportation. November 15, 2016. *Environmental Justice Strategy*. Accessed from https://www.transportation.gov/policy/transportation-policy/environmental-justice-strategy. Accessed on August 17, 2017.

[5] Federal Interagency Working Group on Environmental Justice & NEPA Committee. 2016. *Promising Practices for EJ Methodologies in NEPA Reviews: Report of the Federal Interagency Working Group on Environmental Justice & NEPA Committee*. Accessed from https://www.epa.gov/sites/production/files/2016-08/documents/nepa_promising_practices_document_2016.pdf. Accessed on August 17, 2017.

[6] U.S. Department of Transportation. *Title VI Requirements and Guidelines for Federal Transit Administration Recipients*. Accessed from https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Title_VI_FINAL.pdf. Accessed on January 21, 2019.

[7] U.S. Department of Transportation. 2012. *Environmental Justice Policy Guidance for Federal Transit Administration Recipients*. Accessed from https://www.transit.dot.gov/regulations-and-guidance/fta-circulars/environmental-justice-policy-guidance-federal-transit. Accessed on January 21, 2019.

17.3 Study Area

EJ communities exist at the local level and are generally identified in Census block groups and not at a regional level. Therefore, only a Local Study Area was defined for EJ. The Local Study Area includes Census block groups that are wholly or partially within one-half mile of the Project Area. **Figure 17-1** and **Figure 17-2** show the distribution of minority and low-income populations in the Local Study Area. Census block groups with at least 50 percent minority residents or 27 percent of the population below 150 percent of the poverty line were considered areas of EJ concern.

Table 17-1 and **Table 17-2** list facilities and resources in the Local Study Area that specifically serve or support these populations (ID numbers refer to the figures). The *Washington Union Station Affected Environment Technical Report* (**Appendix C2**) identified these facilities.

Table 17-1. Places of Worship with Predominantly African American Congregations

ID	Congregation	Address	Neighborhood
1	Faith Tabernacle United Holy Church	300 A Street NE	Capitol Hill
2	Mount Carmel Baptist	901 3rd Street NW	Mount Vernon Square
3	Second Baptist	816 3rd Street NW	Mount Vernon Square
4	Enon Baptist	505 L Street NE	Near Northeast
5	Pilgrim Baptist	700 I Street NE	Near Northeast
6	Calvary Episcopal Church	820 6th Street NE	Near Northeast
7	Crusaders Baptist	800 I Street NE	Near Northeast
8	Greater Pleasant Grove Baptist	1101 4th Street NE	Near Northeast
9	Upon This Rock Tabernacle	513 M Street NE	Near Northeast
10	Community Holiness	305 K Street NE	Near Northeast
11	Mount Olive Baptist	1140 6th Street NE	Near Northeast
12	Mount Airy Baptist	1100 North Capitol Street NW	NoMa
13	Northeast Holy Trinity Church	709 4th Street NE	Stanton Park
14	Imani Temple	609 Maryland Avenue NE	Stanton Park

Figure 17-1. Minority Populations in the Local Study Area

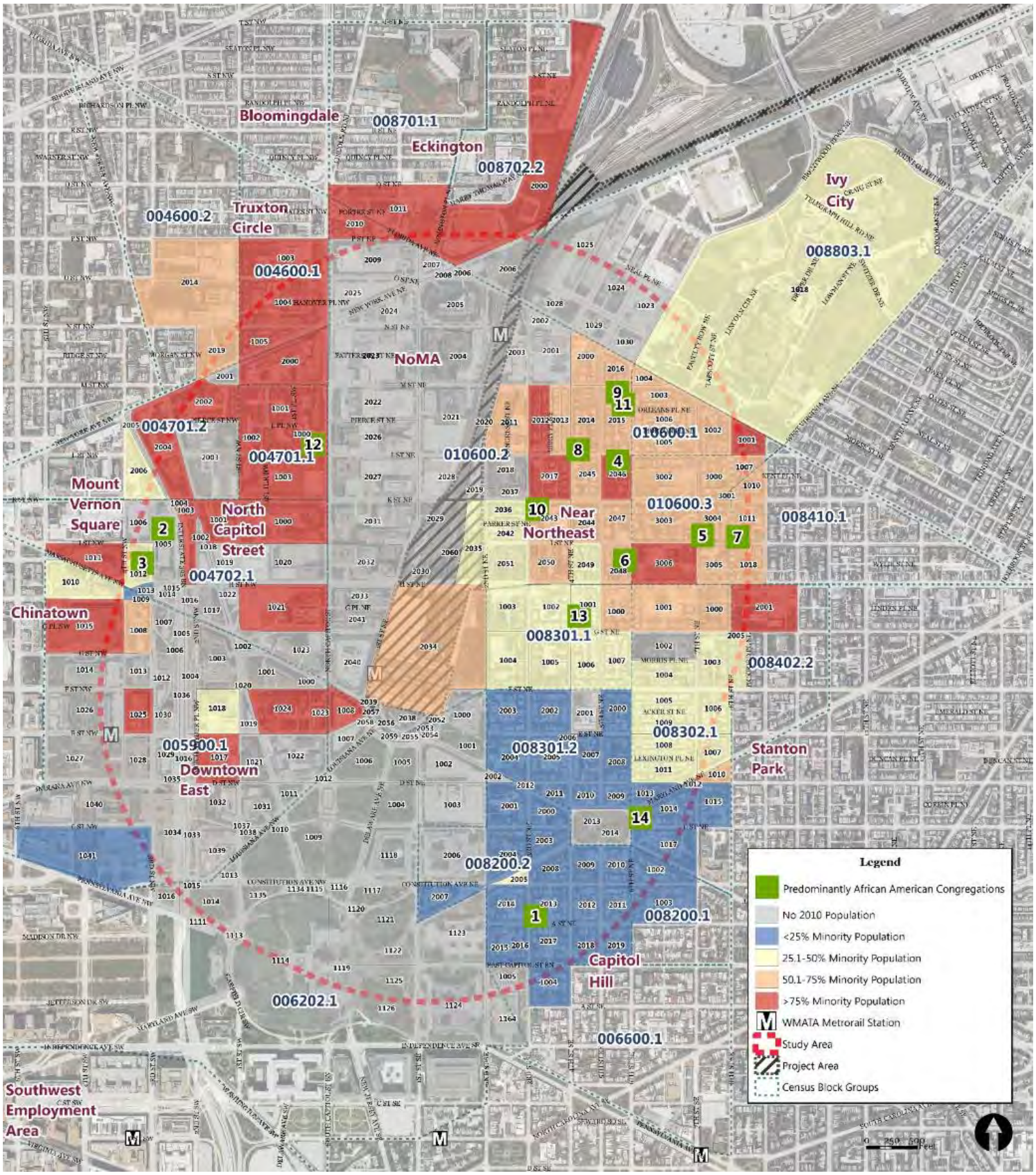


Figure 17-2. Low-income Populations in the Local Study Area

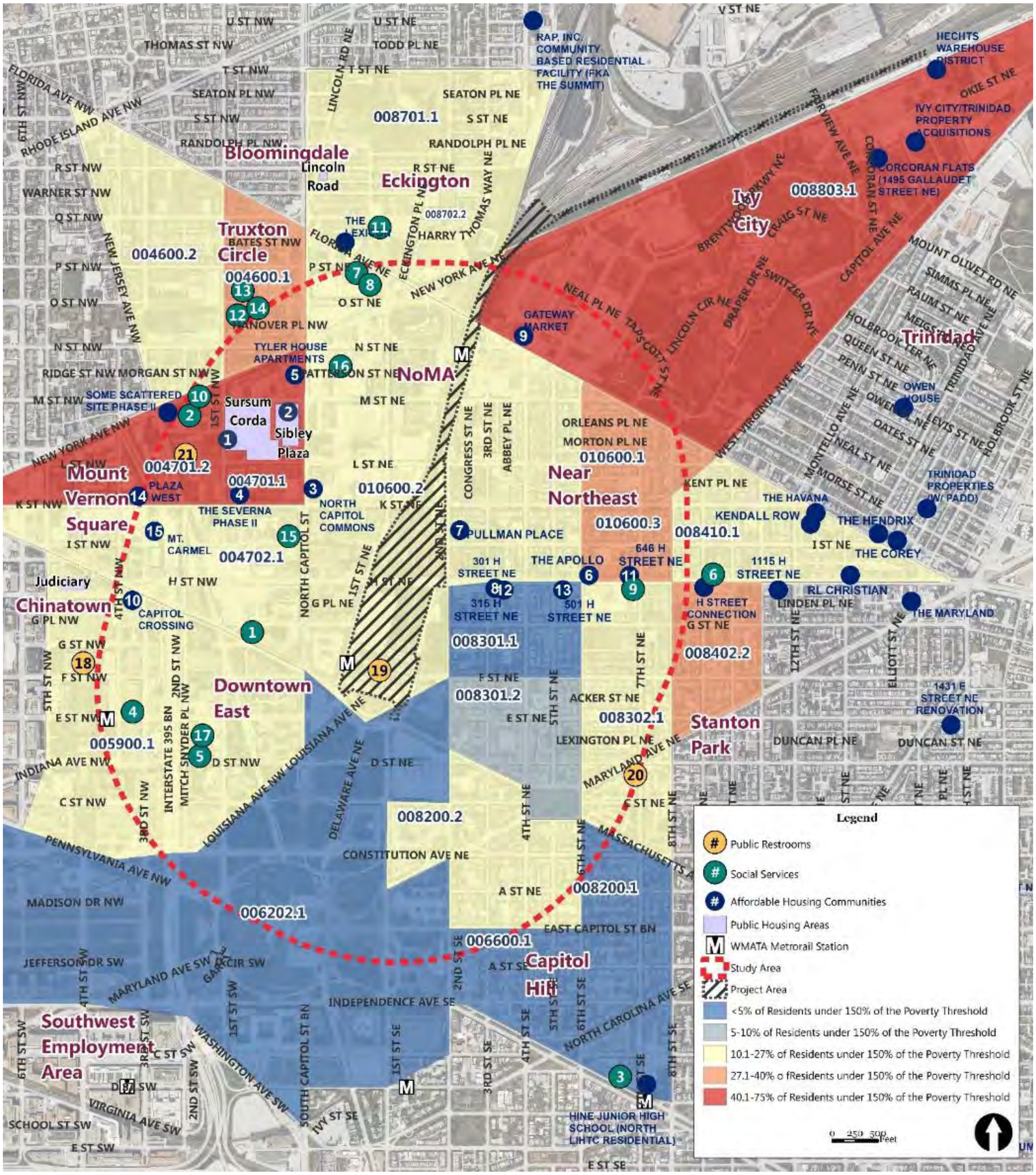


Table 17-2. Affordable Housing Units in the Local Study Area

ID	Name	Address	Affordable Units	Neighborhood
		Public Housing		
1	Sursum Corda	97 K Street NW	28	North Capitol Street
2	Sibley Plaza	1140 North Capitol Street NW	246	North Capitol Street
		Completed Units		
3	North Capitol Commons	1005 North Capitol Street NE	123	NoMa
4	The Severna Phase II (Severna on K)	43 K Street NW	133	North Capitol Street
5	Tyler House Apartments	1200 North Capitol Street NW	284	North Capitol Street
6	The Apollo	600 H Street NE	35	Near Northeast
7	Pullman Place	911 2nd Street NE	3	Near Northeast
8	301 H Street NE	301 H Street NE	3	Near Northeast
9	Gateway Market (The Edison)	340 Florida Avenue NE	38	Union Market
		Units Under Construction		
10	Capitol Crossing	300 Massachusetts Avenue NW	50	Downtown East
11	646 H St NE	646 H Street NE	2	Near Northeast
12	315 H St NE	315 H Street NE	8	Near Northeast
13	501 H St NE	501 H Street NE	3	Near Northeast
14	Plaza West	307 K Street NW	223	Mount Vernon Square
		Planned Units		
15	Mt. Carmel	901 3rd Street NW	66	Mount Vernon Square

Table 17-3. Homeless Resources in the Local Study Area

ID	Organization	Program	Address
1	Central Union Mission	Ministry Resource Center & Shelter	65 Massachusetts Avenue NW
2	Bright Beginnings	Early Child Care Program	128 M Street NW
3	Community Connections	The Center for Families and Children	650 Pennsylvania Ave SE
4	Community Family Life Services	Emergency Services Program	305 E Street NW
5	Community for Creative Non-Violence	The Mitch Snyder Center for Arts and Education	425 2nd Street NW
6	HIPS	Drop-In Center	906 H Street NE
7	Department of Behavioral Health	Assessment and Referral Center)	75 P Street NE
8	Department of Human Services	Family Services Administration	64 New York Ave NE
9	Department of Human Services	H Street Service Center	645 H Street NE

ID	Organization	Program	Address
10	Samaritan Ministry of Greater Washington	The Next Step Program (Perry School Center)	128 M Street NW
11	Pathways to Housing	Administrative Office & Health Clinic	101 Q Street NE, Suite G
12	So Others Might Eat (S.O.M.E.)	Isaiah House Day Program	75 Hanover Place NW
13	S.O.M.E.	Dining, Shower, and Clothing Programs	71 O Street NW
14	S.O.M.E.	Medical & Behavioral Health Clinic	60 O Street NW
15	The Father McKenna Center	Day Shelter Program	900 North Capitol Street NW
16	Unity Health	Walker Jones Health Center (Ward 6)	40 Patterson Street NE
17	Jobs Have Priority	Employment Assistance Center	425 2nd Street NW
Facilities with Public Restrooms			
18	National Building Museum	Public Restrooms	401 F Street NW
19	Union Station	Public Restrooms	50 Massachusetts Avenue NE
20	DC Public Library	Northeast Library	330 7th Street NE
21	DC Public Library	Northwest One Library	155 L Street NW

17.4 Methodology

The EJ analysis evaluated whether the No-Action and Action Alternatives would result in disproportionately high and adverse impacts to minority and low-income populations. Based on FTA guidance, this evaluation involved the following steps:

- Determining whether adverse impacts, if any, would be predominantly borne by minority or low-income populations. Determining whether adverse impacts, if any, would be concentrated on minority or low-income communities.
- Determining if any adverse impacts to minority or low-income populations would be more appreciably more severe or greater in magnitude than those on non-minority or low-income populations.
- Identifying if the alternatives would affect resources especially important to an environmental justice population (such as social, religious, or cultural functions).

- Analyzing whether any benefits would be accompanied by impacts to environmental justice populations.
- Determining mitigation measures, enhancements, and betterments, if needed, and their effects.

All resource categories considered in this report were reviewed to identify those with the potential to result in disproportionately high and adverse effects on EJ populations. Resource categories with no impacts or negligible adverse impacts were dismissed from the analysis as, by definition, they would not disproportionately adversely affect minority or low-income populations. Resources categories that would result in more than negligible impacts were then screened to determine whether these impacts had potential to disproportionately and adversely affect EJ populations. Based on the findings of this screening, presented in **Table 17-4** below, the following resource categories were determined to have at least some potential to result in disproportionately high and adverse impacts and therefore to require further analysis: Transportation (Metrorail, Intercity Buses, City and Commuter Buses, and Vehicular Traffic); Noise and Vibration; and Social and Economic Conditions (Community Disruption). These are the areas the following sections focus on in more details.

As applicable, and based on available data, the EJ analysis was conducted by considering the geographical distribution of the anticipated adverse impacts or whether they would affect activities of special economic or cultural importance to EJ populations. This approach was used to review direct and indirect impacts from the operation of WUS after the completion of the Project and impacts from the construction of the Project, as presented below.

17.5 Impact Analysis

This section considers whether the adverse impacts of the No-Action Alternative and Action Alternative would disproportionately affect EJ communities and whether their beneficial impacts would be denied to such communities. Because the focus is on the distribution of impacts, its organization is different from that of the other sections of this report. There is no distinction between direct and indirect operational impacts because the character of the impacts does not affect whether they would affect some populations more than others. For both the No-Action Alternative and the Action Alternatives, EJ determinations (bolded) are made based on existing demographic and economic conditions (based on 2010 Census data) only. It is not possible to predict the demographic and economic make-up of the Study Area in 2040.

Table 17-4. EJ Screening

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Natural Ecological Systems	None.	Minor adverse from the loss of a few street trees during construction on First and 2nd Streets NE along the sides of the WUS rail terminal.	**No**. The trees that would be removed are not located in areas of EJ concern and they would be replaced in accordance with District requirements. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.
Water Resources and Water Quality			
Surface Waters	Negligible adverse.	None	**No**. Impacts would be on infrastructure and system capacity. They would not bear directly on individuals or affect EJ communities in an appreciably different manner than non-EJ populations. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.
Groundwater	Negligible to moderate adverse from long-term withdrawal.	Negligible to moderate adverse from short-term withdrawal.	
Stormwater	Minor adverse from changes to infrastructure.	Minor adverse on runoff from erosion and sedimentation.	
Wastewater	Minor adverse from increased generation.	Negligible to minor adverse from increased generation.	
Drinking Water	Minor adverse from increased demand.	Negligible adverse.	
Solid Waste Disposal and Hazardous Materials and Waste			
Municipal Solid Waste	Minor adverse from increase in municipal solid waste needing disposal.	Minor adverse from construction spoil and debris needing disposal.	**No**. Impacts would be on the waste collection and disposal system and would not directly affect individuals, including members of EJ communities. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Hazardous Materials and Waste	Negligible adverse.	Minor adverse from use and storage. Minor beneficial from removal of potential soil contamination.	**No**. Adverse impacts would be negligible or minor and concentrated within the Project Area. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations. Beneficial impacts would benefit all District residents and EJ populations would not be excluded.
Transportation			
Commuter and Intercity Rail	Major adverse (No-Action Alternative) from constrained rail service to major beneficial (Action Alternatives) from increased rail service.	Moderate adverse from limited train delays and cancelations.	**No**. Adverse impacts would be borne by all rail passengers across lines and destination. There is no available data suggesting that train riders at WUS are disproportionately minority of low-income. Similarly, beneficial impacts would benefit all rail and bus passengers and would not exclude EJ populations. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations.
WMATA Metrorail	Moderate adverse from capacity exceedances and platform congestion.	Moderate adverse from intermittent stoppages or single tracking.	**Yes**, depending on the racial and socio-economic make-up of WUS Metrorail Station users. Further analysis required.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
DC Streetcar	Minor beneficial from increased ridership.	Moderate adverse from temporary disruption of direct access from WUS.	**No**. Adverse impacts would be borne by all Streetcar station users equally and no available data suggest that minority or low-income populations are disproportionately represented among these users. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations. Nor would EJ populations be excluded from the benefits of the Project.
Intercity, Tour/Charter, and Sightseeing Buses	Major (No-Action Alternative) to moderate (Action Alternatives) adverse.	Major adverse from displacement of intercity bus service in Phase 4 (except Alternative C, East Option)	**Yes**, for intercity buses, depending on the racial and socio-economic make-up of riders. Further analysis required. No available data suggest that EJ populations account for a disproportionate number of charter or sightseeing buses, which are predominantly tourist accommodations.
Loading	None.	Major adverse from unavailability of West Dock.	**No**. Use of WUS loading docks is not an EJ concern.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Pedestrians	Major adverse (No-Action Alternative) from congestion to major beneficial (Action Alternatives) from enhanced space (in WUS). Minor adverse from greater congestion (outside WUS).	Moderate adverse from disruptions due to construction activities.	**No**. Adverse impacts would be borne by all pedestrians walking in, to, or from WUS equally and no available data suggest that minority or low-income populations are disproportionately represented among these pedestrians. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations. Nor would EJ populations be excluded from the benefits of the Project.
Bicycle Activities	Moderate adverse (No-Action Alternative) from volumes increase without new accommodations to minor beneficial (Action Alternatives) from increased storage and minor adverse from increased congestion.	Major adverse from disruptions due to construction activities.	**No**. Adverse impacts would be borne by all bicyclists riding to, from, or near WUS and no available data suggest that minority or low-income populations are disproportionately represented among these bicyclists. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for these populations than for non-EJ populations. Nor would EJ populations be excluded from the benefits of the Project.
City and Commuter Buses	Moderate (No-Action Alternative) to minor (Action Alternatives) adverse from increased ridership and traffic.	Negligible to minor adverse from traffic disruptions.	**Yes**, depending on the racial and socio-economic make-up of WUS city bus riders. Further analysis required.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Vehicular Parking	Minor to moderate adverse from loss of parking capacity.	Major from unavailability of parking in Phase 4 (except Alternative C, East Option).	**No**. Adverse impacts would be borne by all drivers. There are no available data suggesting that minority or low-income populations are disproportionately represented among WUS parking users. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations.
For-Hire Vehicles	Moderate beneficial (Facilities) and major to moderate adverse (congestion).	Major adverse from extended queuing.	**No**. Adverse impacts would be borne by all for-hire vehicles and their passengers. There are no available data suggesting that minority or low-income populations are disproportionately represented persons using for-hire vehicles to or from WUS. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations. Nor would EJ populations be excluded from the benefits of the Project.
Private pick-up and Drop-off	Moderate beneficial (Facilities) and major to moderate adverse (congestion).	Major adverse from extended queuing.	**No**. Adverse impacts would be borne by all WUS users being picked-up or dropped off at WUS by a private vehicles. There are no available data suggesting that minority or low-income populations are disproportionately represented among such WUS users. Impacts would not be disproportionately borne by EJ populations or appreciably more severe or greater in magnitude for them than for non-EJ populations. Nor would EJ populations be excluded from the benefits of the Project.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Vehicular Traffic	Major adverse from increases delays and queuing at multiple intersections.	Major adverse from construction traffic.	**Yes**, depending on the location of the affected intersections. Further analysis required.
Air Quality	Negligible to moderate adverse from increased pollutant emissions.	Negligible to moderate adverse from increased pollutant emissions.	**No**. Both microscale (local) and mesoscale (regional) analysis show that anticipated emissions would be below the National Ambient Air Quality Standards and applicable *de minimis* levels. These standards are designed to protect human health with an adequate margin of safety, including sensitive populations. No adverse impacts would be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population.
Greenhouse Gas Emissions and Resilience			
Greenhouse Gas Emissions	Negligible adverse from increased emissions.	Negligible adverse from increased emissions	**No**. Impacts would negligible.
Resilience	Beneficial from opportunities to increase resilience.	None.	**No**. EJ populations would not be excluded from the benefits of the Project.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Energy Resources	Minor adverse from increased energy consumption.	Minor adverse from increased energy consumption.	**No**. Impacts would be on regional energy consumption and production and would not directly affect individuals or communities, including EJ communities. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population.
Land Use, Planning, and Property			
Land Use and Development	Major to moderate beneficial from enhanced multimodal use at WUS.	Moderate adverse from delay in private air-rights development and loss of parking and intercity bus service in Phase 4.	**No.** EJ populations would not be excluded from the benefits of the Project. Delays in the private air-rights development are not an EJ concern. Impacts on parking and bus service are addressed under *Transportation*.
Property	Moderate to major adverse from acquisition of private air rights.	None.	**No**. The private air-rights development is not an EJ concern.
Local and Regional Plan	Major to minor beneficial depending on plan	None	**No**. EJ populations would not be excluded from the benefits of the Project.
Noise and Vibration	Moderate adverse at several locations.	Major to minor adverse at multiple locations.	**Yes**, depending on the location of the impacts. Further analysis required.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Aesthetics and Visual Quality	Negligible to major adverse from changes in multiple views from the south, east, and west of WUS.	Negligible to moderate adverse from changes in multiple views from the south, east, and west of WUS.	**No**. The affected views are not disproportionately within areas of EJ concern or have special significance for EJ populations. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population.
Cultural Resources	Major adverse impacts on three cultural resources (WUS, REA Building, WUS Historic Site). Negligible to moderate adverse impacts on multiple other cultural resources.	Major adverse impacts on two cultural resources (WUS, REA Building). Negligible to moderate adverse impacts on multiple other cultural resources.	**No**. The affected resources are not disproportionately within areas of EJ concern or of special significance to EJ populations. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population.
Parks and Recreation Areas	Minor adverse impacts from increased wear and tear from visitors.	Moderate adverse on Columbus Plaza and Metropolitan Branch Trail.	**No**. There is no available data suggesting that the affected parks are of special significance to EJ populations or predominately used by them. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population.
Social and Economic Conditions			
Demographics	Negligible impact.	None.	**No**.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Community Disruption and Other Social Benefits	Major beneficial from enhanced connectivity.	Moderate adverse from construction disruption.	**Yes**, depending on the location of the adverse impacts and who they would affect. Further analysis required.
Employment	Minor beneficial from new employment.	Minor beneficial from direct and indirect construction jobs.	**No**. EJ populations would have access to jobs generated by the Project. They would not be excluded from the benefits of the Project.
WUS Revenue	Moderate to major adverse from lost revenue.	Moderate to major adverse from lost revenue.	**No**. WUS revenue is not an EJ concern.
Other Economic Impacts	Minor beneficial on regional economy.	Moderate beneficial on regional economy	**No**. EJ populations would not be excluded from the benefits of the Project.
Public Safety and Security			
Security	Beneficial from security enhancements at WUS. Minor to moderate adverse on WUS from increased risks associated with the potential Federal air-rights development.	Major adverse from risks associated with construction operations.	**No**. Adverse impacts would be localized and would not extend past the Project Area and immediate vicinity. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population. EJ populations would not be excluded from the beneficial impacts.

Resource Category	Summary of Key Operational Impacts	Summary of Key Construction Impacts	Potential for Disproportionately High and Adverse Effects on EJ Populations?
Safety	Minor to moderate adverse from increased demand on emergency services.	Moderate from risks associated with construction operations.	**No**. Operational adverse impacts would be system-wide and be addressed through planning. Construction impacts would be localized (Project Area) and within areas not accessible to the public. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population
Public Health, Elderly and Persons with Disabilities			
Public Health	None. Moderate to major beneficial from accessibility improvements at WUS. Minor adverse from increased activity at and near WUS.	Minor adverse from construction risks.	**No**. Adverse impacts would be localized (Project Area and immediate surroundings) and would be borne by all WUS users and visitors. Impacts would not be predominantly suffered by EJ population or appreciably more severe or greater in magnitude than the effect that would be suffered in the non-EJ population. EJ populations would not be excluded from the benefits of the Project.
Transportation and Mobility of Elderly and Persons with Disabilities	Major to Moderate beneficial from multimodal enhancements at WUS. Minor adverse from greater activity at and near WUS.	Major adverse from disruptions associated with construction.	

17.5.1 No-Action Alternative

17.5.1.1 Operational Impacts

Relative to existing conditions, in the No-Action Alternative, not expanding WUS would have a disproportionately high and adverse operational impacts on EJ communities because of increase in bus facility operations with no improvements to the facility and overcrowding on some city buses

Transportation

WMATA Metrorail

In the No-Action Alternative, there would be an increase in Metrorail ridership at WUS, resulting in capacity exceedances and a moderate adverse operational impact (see **Section 5.5.1.1**, *Direct Operational Impacts, WMATA Metrorail*). This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations. It would affect all Metrorail riders equally and available data indicates that members of EJ communities do not account for a disproportionate numbers of riders. Based on a 2012 Metrorail passenger survey, minorities (non-white or Hispanic) made up approximately 43 percent of Metrorail riders. Persons with household incomes less than S30,000 a year accounted for 11 percent of passengers.[8]

Intercity Buses

The No-Action Alternative would result in a major adverse operational impact on WUS's bus passenger facilities' ability to accommodate projected increases in users (see **Section 5.5.1.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*). Based on a *Northeast Corridor Intercity Travel Study* published in 2015, 55 percent of intercity bus passengers in the Northeast Corridor were white and their median household income was in the $50,000-$75,000 range.[9] A 2015 study of curbside bus operations in the northeast found that, depending on the bus company, the percentage of white passengers ranged from 60 percent (for what the study defines as "corporate curbside buses," which include Boltbus and Megabus) to 37 percent (for what the study defined as "Chinatown buses."). Forty percent of

[8] Washington Metropolitan Area Transit Authority (WMATA). January 25, 2013. *2012 Metrorail Passenger Survey*. Accessed from http://www.mwcog.org/asset.aspx?id=committee-documents/ZF1cV1Zb20130125141114.pdf. Accessed on April 23, 2020.

[9] Northeast Corridor Infrastructure and Operations Advisory Commission. 2015. *Northeast Corridor Intercity Travel Study*. Accessed from https://nec-commission.com/app/uploads/2018/04/2015-09-14_NEC-Intercity-Travel-Summary-Report_Website.pdf. Accessed on April 15, 2020.

Corporate curbside bus passengers reported an annual household income of less than $40,000, with a similar proportion for Chinatown buses.[10] Costumer profile data received from Megabus in 2015 indicates that 40 percent of their passengers has an income under $60,000. Based on these data, while minority or low-income persons would be affected by the adverse impact on intercity bus operations at WUS, this impact would likely not be predominantly borne by them.

However, some data presented in the 2015 *Northeast Corridor Intercity Travel Study* suggests that minorities and low-income persons rely on the bus for intercity travel much more than other demographics. Thus, the 2015 study finds that while racial minorities make up only 4 percent of intercity travelers by car, they make up 45 percent of bus passengers, indicating an appreciably greater reliance on bus travel by EJ than non-EJ populations. Similarly, people with household incomes less than $25,000 represent 2 percent of drivers but 22 percent of bus passengers. On this basis, the major adverse operational impact on intercity bus operations would represent a disproportionately high and adverse impact on EJ populations, as it would be appreciably greater in magnitude for these populations than for the non-EJ population.

City and Commuter Buses

In the No-Action Alternative, anticipated increases in ridership and traffic volumes would cause a moderate adverse direct operational impact on city buses due to overcrowding of some buses and likely decreases in bus speeds and reliability. According to a 2014 Metrobus passenger survey, minorities represent 81.5 percent of Metrobus users and low-income persons 52 percent.[11] On this basis, the moderate adverse operational impact on city bus operations would be a disproportionately high and adverse impact on EJ populations, as it would be borne predominantly by members of EJ populations.

Vehicular Traffic

Roadway traffic in the Local Study Area would increase in the No-Action Alternative because of greater activity at WUS, local developments, and district-wide population and economic growth. As shown by the traffic impact analysis (**Section 5.5.1.1**, *Direct Operational Impacts, Vehicular Traffic*), this would cause a degradation of operational conditions at multiple intersections. These adverse traffic impacts would not be predominantly borne by EJ

[10] Nicolas J. Klein. 2015. "Get on the (Curbside) Bus: The New Intercity Bus" in *The Journal of Transport and Land Use*, Vol. 8, No.1, pp, 155-169. Accessed from https://www.researchgate.net/publication/276474451_Get_on_the_Curbside_bus_The_new_intercity_bus. Accessed on April 25, 2020.

[11] WMATA. March 22, 2018. *G9 Title VI Evaluation*. *Table One. Metrobus Ridership Bus Demographic Profile*. Accessed from https://www.wmata.com/about/board/meetings/board-pdfs/upload/9A-201959-G9-Title-VI-Evaluation.pdf. Accessed on April 23, 2020.

populations or be appreciably more severe for these populations than for non-EJ communities.

Of the 35 study intersections for the No-Action Alternative, 13 (37 percent) are adjacent to Census blocks or block groups with more than 50 percent minority population or more than 27 percent low-income residents. These 13 intersections are listed in **Table 17-5**. The table also shows which of the 13 intersections would experience a major impact under one of three indicators used to assess traffic impacts.

Table 17-5. Traffic Impacts on EJ Communities, no-Action Alternative

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	North Capitol Street / K Street		X	X
5	North Capitol Street / H Street	X	X	X
9	3rd Street / H Street NE	X	X	X
10	North Capitol Street / G Street			
13	North Capitol Street / Massachusetts Avenue		X	X
19	North Capitol Street / E Street		X	
25	4th Street / H Street NE		X	X
28	1st Street / D Street NW			
29	2nd Street / D Street NW		X	
31	3rd Street / E Street NW		X	X
32	3rd Street / Massachusetts Ave / H St NW	X	X	X
33	North Capitol Street (SB Ramp) / New York Avenue		X	
34	North Capitol Street (NB Ramp) / New York Avenue			

Out of the 13 intersections of EJ concern, ten (77 percent) would experience a major impact. However, these ten intersections would be half or less of all the intersections that would experience major impacts for each of the three factors (3 out of 6 for degradation to Level of Service [LOS] F; 10 out of 21 for increase in queue length of more than 150 feet; and 7 out of 18 for delay increases of more than 5 seconds). Additionally, none of the ten intersections is located entirely within an EJ community or is of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of commuter traffic.

Noise and Vibration

As explained in **Section 10.5.1.1**, *Direct Operational Impacts*, ambient noise near WUS and the rail terminal would decrease in the No-Action Alternative because the private air-rights development would cover the rail terminal and mask the noise from train operations. Farther away, small increases in noise would occur because of greater traffic. The noise impact analysis presented in **Section 10.5.1.1** showed that increases would be in the range of 1 decibel (dBA), which is below the general threshold of perception.[12] Slightly greater increases in noise levels would occur near New York Avenue because of the new Virginia Railway Express Midday Storage Replacement Facility but they would not exceed 3 dBA, still below the threshold of perception. Such changes in noise levels have no potential to result in disproportionately high and adverse impacts on EJ communities.

Social and Economic Conditions

Among the several No-Action Alternative projects at and near WUS, the development of the private air rights above the rail terminal is the project with the most potential to disproportionately affect the social and economic condition of EJ communities. This development would potentially bring approximately 2,150 new residents to the area. New development and an influx of new residents may raise concerns related to gentrification. The US Department of Housing and Urban Development defines gentrification as "the process by which a neighborhood occupied by lower-income households undergoes revitalization or reinvestment through the arrival of upper-income households."[13] The result can be the involuntary displacement of long-standing minority or low-income residents through rent increases or induced redevelopment. As explained in **Section 14.5.1.2**, *Indirect Operational Impacts*, *Community Disruption and Other Social Benefits or Impacts,* the Census tracks around WUS do not currently meet key social and demographic criteria commonly used to define areas liable to gentrification.

At the Census block group and block levels at which the EJ analysis is conducted, the following observations can be made. The private air-rights development would not replace or eliminate any existing housing or other land uses since it would be in what is now open space above the rail terminal. There are two blocks immediately adjacent to the Project Area that showed a minority population of over 50 percent in the 2010 Census. Of these, one (1008) is a parking lot and one (2034) includes WUS itself as well as office buildings to the east. It is likely that the minority population reported in 2010 consisted of transient (homeless) individuals rather than a stable population that gentrification could drive away. Farther from WUS, on the western side of North Capitol Street between E Street and P Street NW, there are numerous block groups that reported more than 50-percent minority populations in 2010 or had more than 27 percent low-income residents. To the east, there are mixed-income developments in the Near Northeast neighborhood along H Street NE with similar characteristics. These areas are parts of neighborhoods to the northwest and northeast of WUS that are rapidly redeveloping, with much of the redevelopment as multi-family

[12] A change of less than 3 dBA is generally imperceptible: Federal Highway Administration, *Traffic Noise: Analysis and Abatement Guidance* [June 2010] in District Department of Transportation, *Noise Policy* [January 10, 2011], p. 9, Table 4.

[13] Freeman, L. "Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods." *Urban Affairs Review*, 463-491. 2005.

residential buildings (see **Appendix C2**, *Washington Union Station Expansion Affected Environment Technical Report,* **Section 17.5.2**, *Low-Income Populations*). The private air-rights development would fit in and contribute to this general trend.

17.5.1.2 Construction Impacts

In the No-Action Alternative, not constructing the Project has no potential to cause disproportionately high and adverse impacts on EJ communities. Construction of the other projects included in this alternative may displace homeless persons.

In the No-Action Alternative, the Project would not take place, which has no potential to generate disproportionately high and adverse impacts on EJ communities. Construction of the various projects included in the No-Action Alternative would generate transportation and noise impacts and cause some community disturbance. While it is not possible to assess the intensity and duration of these impacts, they would generally be most noticeable immediately adjacent to the respective project sites.

The projects with the potential to cause the greatest construction-related impacts are the private air-rights development and the replacement of the H Street Bridge. As noted above, these would take place in Census blocks with no permanent EJ populations. However, as reported in the 2010 Census and confirmed by field visits and news reports, these blocks have a substantial homeless population.[14]

For safety and security reasons, it may be necessary to remove encampments and to displace homeless persons during the construction of some of the No-Action projects, or they may leave because of construction-related disturbances. Displaced homeless persons may relocate to nearby areas, but it is not possible to predict where they would go and how many of them there would be. Nearby homeless assistance resources (see **Table 17-3**) would remain available to help the area's homeless and project owners would have the option to work with these resources if and when it is necessary to remove homeless encampments.

[14] Hughes, Sarah Anne, "DC Removes Homeless Campers from Near Union Station," *Washington City Paper*, March 11, 2016. Accessed from http://www.washingtoncitypaper.com/news/city-desk/blog/13070584/d-c-removes-homeless-campers-from-near-union-station. Accessed on September 27, 2017; Austermuhle, Martin, "Why DC's Shutdown of a NoMa Homeless Encampment Won't Work," *WAMU Washington*, June 20, 2017. Accessed from http://wamu.org/story/17/06/20/cat-mouse-game-d-c-shuts-one-homeless-encampment-another-quickly-pops/. Accessed on September 27, 2017. During various field visits for the preparation of this report, encampments were observed along First Street NE near the Metrorail station entrance and under the K Street overpass.

In January 2020, the District enacted and implemented a policy to permanently remove all homeless encampments from the K Street NE underpass. The removal policy did not apply to L Street encampments. Heim, Joe and Moyer, Justin Wm., "No Room on the Street: D.C. Orders Homeless out of Underpass in Fast-Developing Neighborhood," *Washington Post*, January 10, 2020. Accessed from https://www.washingtonpost.com/local/no-room-on-the-street-dc-orders-homeless-out-of-underpass-in-fast-developing-neighborhood/2020/01/10/1704d604-319c-11ea-9313-6cba89b1b9fb_story.html. Accessed on April 24, 2020.

17.5.2 Alternative A

17.5.2.1 Operational Impacts

Alternative A would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative.

Transportation

WMATA Metrorail

In Alternative A, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative A would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. This would result in more trips in and out of the bus facility and may create additional delays for bus operators; buses may also need to lay over at other locations in the District or the region. Although, as explained above for the No-Action Alternative, available data suggest that EJ populations rely on the bus for intercity travel appreciably more than non-EJ populations do (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above), the adverse impacts in Alternative A would predominantly be borne by bus operators rather than bus passengers. Passengers would benefit from a new facility with enhanced accommodations and connectivity. Therefore, the moderate adverse operational impact on intercity bus operations would not be a disproportionately high and adverse impact on EJ populations.

City and Commuter Buses

As explained in **Section 5.5.2.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative A would have a minor adverse direct operational impact on city and commuter buses, as increases in WUS-generated ridership would incrementally contribute to the overcrowding of some city buses and increases in traffic congestion would incrementally contribute to delays experienced by all city and commuter buses. This would not amount to a disproportionately high and adverse impact on EJ communities. While the impacts would affect members of EJ populations, who make up a large proportion of bus passengers as noted in **Section 17.5.1.1**, *Operational Impacts, Transportation* above, the increase attributable to the Project in Alternative A would be small relative to No-Action Alternative conditions and the same bus lines would be affected.

Vehicular Traffic

In Alternative A, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis (**Section 5.5.2.1**, *Direct Operational Impacts, Vehicular Traffic*), this would cause a degradation of operational conditions at multiple intersections relative to the No-Action Alternative. Of the 35 study intersections for Alternative A, 13 (37 percent) are adjacent to Census blocks or block groups with more than 50 percent minority population or more than 27 percent low-income residents. These 13 intersections are listed in **Table 17-6**. **Table 17-6** also shows which of the 13 intersections would experience a major impact under one of three indicators used to assess traffic impacts.

Table 17-6. Traffic Impacts on EJ Communities, Alternative A

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	North Capitol Street / K Street	X	X	X
5	North Capitol Street / H Street		X	X
9	3rd Street / H Street NE		X	X
10	North Capitol Street / G Street		X	X
13	North Capitol Street / Massachusetts Avenue	X	X	X
19	North Capitol Street / E Street		X	X
25	4th Street / H Street NE			
28	1st Street / D Street NW			
29	2nd Street / D Street NW			X
31	3rd Street / E Street NW		X	
32	3rd Street / Massachusetts Ave / H St NW			X
33	North Capitol Street (SB Ramp) / New York Avenue			
34	North Capitol Street (NB Ramp) / New York Avenue			

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. Out of the 13 intersections of EJ concern, nine (70 percent) would experience a major impact. These nine intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (2 out of 7 for degradation to LOS F; 7 out of 16 for increase in queue length of more than 150 feet; and 8 out of 20 for delay increases of more than 5 seconds). Additionally, none of the nine intersections is located entirely within an EJ community or is of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of commuter traffic and would continue to do so under the No-Action Alternative.

Noise and Vibration

Increased traffic in Alternative A would also cause increases in operational noise throughout the Study Area. Adverse noise impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. As shown in in **Section 10.5.1.1**, *Direct Operational Impacts*, everywhere, including along North Capitol Street and H Street, noise levels would not change by more than 3 dBA, which is below what is generally perceptible. The operational noise analysis also showed that these small increases would bring noise level up to the FTA threshold for moderate noise impacts at 14 modeled receptor locations. Noise levels would also increase at 10 planned development locations. Of those receptors, none are within majority minority Census blocks or are of special significance to EJ communities. Only two receptors are located within a Census block with more than 27 percent of the residents under 150 percent of the poverty threshold and four of the planned developments would be within that same block.

Operational vibration impacts would be negligible with no potential to disproportionately affect EJ populations

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative A would have a major beneficial impact on local communities by improving community cohesion and providing new pedestrian connections between WUS and the surrounding neighborhoods. Alternative A would result in more and improved bus and train service at WUS. It would provide enhanced connections between the neighborhoods to the east and west of WUS as well as make the station more accessible to pedestrians, bicycles, and persons with reduced mobility. Alternative A also would have positive economic impacts through the addition of new retail space at WUS and the intensification of train operations (see **Section 14.5.2.1**, *Direct Operational Impacts, Community Disruption and Other Social Benefits or Impacts*). Together, this would support an estimated 1,445 jobs over the No-Action Alternative. Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.2.2 Construction Impacts

Construction of Alternative A would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Transportation

WMATA Metrorail

Like operational impacts and for the same reason, construction impacts on WMATA Metrorail in Alternative A would not be predominantly borne by EJ communities or be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.

Intercity Buses

As explained in **Section 5.5.2.3**, *Construction Impacts, Intercity, Tour/Charter, and Sightseeing Buses*, in Alternative A, intercity bus service would not be available at WUS during Phase 4 of construction. As explained in **Section 17.5.1.1**, *Operational Impacts, Transportation* above, data indicate that EJ populations rely on the bus for intercity travel appreciably more than non-EJ populations. Therefore, the displacement of intercity bus service in Phase 4 of construction would be a disproportionately high and adverse impact on EJ populations, as it would be appreciably greater in magnitude for these populations than for the non-EJ population.

In Alternative A, Phase 4 would last for approximately 3 years and 1 month. Measures to avoid, minimize, and mitigate this impact are identified in **Section 17.7**, *Avoidance, Minimization, and Mitigation Evaluation*.

City and Commuter Buses

Construction of Alternative A would have negligible adverse impacts on city and commuter bus operations, as there would only be intermittent disruptions (see **Section 5.5.2.3**, *Construction Impacts, City and Commuter Buses*). There would be no potential for disproportionately high and adverse impacts on EJ communities.

Vehicular Traffic

As explained in **Section 5.5.2.3**, *Construction Impacts, Vehicular Traffic,* construction activities at WUS would generate traffic to and from the Project Area throughout the day during the entire construction period, although the volume and nature of this traffic would vary depending on the construction phase and type of activities being conducted. It would be greatest during excavations activities, when up to 120 trucks per 20-hour day could be traveling to and from the site. This is a maximum, conservative estimate that assumes that no work trains would be used to haul spoils away. Trucks would only travel along designated truck routes, with the exception of short stretches of First and 2nd Streets NE to reach the nearest designated route. Trucks would not travel through neighborhoods in a manner that could result in disproportionately high and adverse impacts on EJ communities.

Noise and Vibration

Construction of Alternative A would cause noise and vibrations. Construction noise levels in EJ communities would not be consistently higher in EJ communities than in non-EJ communities. The construction noise impact analysis (**Section 10.5.2.3**, *Construction Impacts*) for Alternative A shows that there would be major stationary- and mobile-source construction noise impacts at up to 33 receptors, including residential and commercial uses, where noise levels would exceed the FTA criteria for moderate or severe (major) impacts during support of excavation (SOE) construction or at the beginning of excavation, which would be the noisiest activities. Most of these receptors are located close to the edge of the rail terminal, within which the work would take place, along First and 2nd Streets NE south of L Street and west of 3rd Street NE. Three out of the 33 of the receptors are in a Census block with more than 50 percent minority population: 1111-1139 3rd Street NE (severe impact) and 300 L Street NE (moderate impact) in Block 2017; and 907-913 3rd Street NE in Block 2043 (severe impact). All three receptors are residential uses. Outside those two blocks, two receptors that would experience moderate adverse noise impacts during excavation activities are Station House Apartments (701 2nd Street NE), an affordable housing complex; and 301-319 K Street NE, close to a predominantly African-American place of worship (Community Holiness, 305 K Street NE). Thus, some minority or low-income persons and locations of significance to EJ populations would experience severe or moderate noise impacts. However, these impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. Measures that would be implemented to avoid, minimize, or mitigate noise impacts (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*) would reduce impacts at EJ as well as non-EJ locations.

Construction would also generate vibration. Modeling indicated that the greatest levels of stationary-source vibrations would be along the eastern side of the Project Area (affecting the Railway Express Agency Building and the Kaiser Permanente Medical Center). Vibration from truck traffic is expected to generate annoyance at 12 locations close to New York Avenue, North Capitol Street and 2nd Street NE. These locations are not in Census blocks or block groups with more than 50 percent minority or more than 27 percent low-income populations.

Social and Economic Conditions

There is currently a substantial homeless population near WUS and along First Street and such a population may still be present when construction of Alternative A begins. Construction of Alternative A would displace any homeless persons present then. Because of the anticipated duration of construction, areas currently used by the homeless may become inhospitable for a long time. Due to the transient, mobile, and changing character of the homeless population, as well as evolving District policies, [15] it is not possible to estimate how many people this would affect and whether it would amount to a disproportionately high and adverse impact on EJ communities. Some homeless persons may relocate to nearby areas while other may travel further. Nearby homeless assistance resources (see **Table 17-3**) would remain available to help the area's homeless. The steps described in **Section 17.7**, *Avoidance, Minimization, and Mitigation Evaluation*, would minimize impacts on this population.

17.5.3 Alternative B

17.5.3.1 Operational Impacts

Alternative B would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative.

Transportation

WMATA Metrorail

In Alternative B, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.3.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative B, like Alternative A, would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.3.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. As explained above for Alternative A (**Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would be predominantly borne by bus operators and would not amount to a disproportionately high and adverse impact on EJ populations.

[15] As noted above, in January 2020, the District enacted and implemented a policy to permanently remove all homeless encampments from the K Street NE underpass. However, the removal policy did not apply to L Street encampments. Heim, Joe and Moyer, Justin Wm., "No Room on the Street: D.C. Orders Homeless out of Underpass in Fast-Developing Neighborhood," *Washington Post*, January 10, 2020. Accessed from https://www.washingtonpost.com/local/no-room-on-the-street-dc-orders-homeless-out-of-underpass-in-fast-developing-neighborhood/2020/01/10/1704d604-319c-11ea-9313-6cba89b1b9fb_story.html. Accessed on April 24, 2020.

<u>**City and Commuter Buses**</u>

As explained in **Section 5.5.3.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative B, like Alternative A, would have a minor adverse direct operational impact on city and commuter buses. For the same reason as explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would not amount to a disproportionately high and adverse impact on EJ populations.

<u>**Vehicular Traffic**</u>

In Alternative B, as in all Action Alternatives, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis for Alternative B (**Section 5.5.3.1**, *Direct Operational Impacts, Vehicular Traffic*), this would cause a degradation of operations at multiple intersections around WUS relative to the No-Action Alternative. **Table 17-7** shows which of the 13 study intersections adjacent to areas of EJ concern (36 percent of the 36 intersections considered in Alternative B) would experience major impacts from increased traffic under one of three indicators used to assess traffic impacts.

Table 17-7. Traffic Impacts on EJ Communities, Alternative B

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	North Capitol Street / K Street	X	X	X
5	North Capitol Street / H Street		X	X
9	3rd Street / H Street NE		X	X
10	North Capitol Street / G Street		X	X
13	North Capitol Street / Massachusetts Avenue		X	X
19	North Capitol Street / E Street		X	X
25	4th Street / H Street NE			
28	1st Street / D Street NW			
29	2nd Street / D Street NW			
31	3rd Street / E Street NW		X	X
32	3rd Street / Massachusetts Ave / H St NW			
33	North Capitol Street (SB Ramp) / New York Avenue			
34	North Capitol Street (NB Ramp) / New York Avenue			

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. Out of the 13 intersections of EJ concern, seven (54 percent) would experience a major impact. These seven intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (1 out of 4 for degradation to LOS F; 7 out of 15 for increase in queue length of more than 150 feet; and 7 out of 21 for delay increases of more than 5 seconds). None of the intersections is located entirely within an EJ community or of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of traffic and would continue to do so in the No-Action Alternative.

Noise and Vibration

The adverse operational impacts of Alternative B on noise and vibration (**Section 10.5.3.1**, *Direct Operational Impacts*) would vary slightly from those of Alternative A but not in a manner that would change their distribution across the Study Area or their potential to affect EJ communities. Such communities would not experience disproportionately high and adverse impacts for the same reasons as explained in **Section 17.5.2.1**, *Operational Impacts, Noise and Vibration*.

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative B would have the same major beneficial impact on local communities as described for Alternative A in **Section 17.5.2.1**, *Operational Impacts, Social and Economic Conditions.* Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.3.2 Construction Impacts

Construction of Alternative B would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Transportation

<u>WMATA Metrorail</u>

Like operational impacts and for the same reason, construction impacts on WMATA Metrorail in Alternative B would not be predominantly borne by members of EJ communities or be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.

<u>Intercity Buses</u>

As explained in **Section 5.5.3.3**, *Construction Impacts*, *Intercity, Tour/Charter, and Sightseeing Buses,* the impact of constructing Alternative B on intercity bus service at WUS would be similar to those of Alternative A: bus service would not be available at WUS during Phase 4 of construction. For the same reasons as explained for Alternative A in **Section 17.5.2.2**, *Construction Impacts, Transportation* above, this would be a disproportionately high and adverse impact on EJ populations, as it would be appreciably greater in magnitude for these populations than for the non-EJ population. In Alternative B, Phase 4 would last for approximately 4 years and 11 months.

City and Commuter Buses

Construction of Alternative B would have minor adverse impacts on city and commuter bus operations from lane closures on K Street NE (see **Section 5.5.3.3**, *Construction Impacts, City and Commuter Buses*). This would not amount to a disproportionately high and adverse impact on EJ communities. While the impacts would affect members of EJ populations, who make up a large proportion of city bus passengers (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above), only one Metrobus line (D4) out of 13 that serve WUS and its surrounding, would be affected and one lane of traffic would remain open in each direction during the day.

Vehicular Traffic

Construction traffic impact in Alternative B (described in **Section 5.5.3.3**, *Construction Impacts, Vehicular Traffic*) would not amount to disproportionately high and adverse impacts on EJ communities for the same reason as explained for Alternative A (**Section 17.5.2.2**, *Construction Impacts, Transportation*).

Noise and Vibration

Construction of Alternative B would cause noise and vibrations. Construction noise levels in EJ communities would not be consistently higher in EJ communities than in non-EJ communities. The construction noise impact analysis (**Section 10.5.3.3**, *Construction Impacts*) for Alternative B showed that there would be major stationary- and mobile-source construction noise impacts at up to 38 receptors, including residential and commercial uses, where noise levels would exceed the FTA criteria for moderate or severe (major) impacts during SOE construction or at the beginning of excavation, which would be the noisiest activities. This would be five more receptors than in Alternative A (see **Section 17.5.2.2**, *Construction Impacts, Noise and Vibration*) but none of these five would be in areas of EJ concern. As in Alternative A, while some minority or low-income persons and locations of significance to EJ populations would experience severe or moderate noise impacts, such impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. Measures that would be implemented to avoid, minimize, or mitigate noise impacts (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*) would reduce impacts at EJ as well as non-EJ locations. Construction vibration impacts would generally be the same as those of Alternative A and would not affect EJ communities.

Social and Economic Conditions

The impacts of constructing Alternative B on homeless populations would be as described for Alternative A in **Section 17.5.2.2**, *Construction Impacts*, *Social and Economic Conditions*).

17.5.4 Alternative C

17.5.4.1 Operational Impacts

Alternative C (either option) would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative.

Transportation

WMATA Metrorail

In Alternative C, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.4.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative C, like the other Action Alternatives, would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.4.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. As explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would be predominantly borne by bus operators and would not amount to a disproportionately high and adverse impact on EJ populations.

City and Commuter Buses

As explained in **Section 5.5.4.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative C, like Alternative B, would have a minor adverse direct operational impact on city and commuter buses. For the same reason as explained above for Alternative A ***(*Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would not amount to a disproportionately high and adverse impact on EJ populations.

Vehicular Traffic

In Alternative C, as in all Action Alternatives, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis for Alternative C (**Section 5.5.4.1**, *Direct Operational Impacts, Vehicular Traffic*), there would be a degradation of operations at multiple intersections around WUS under either option. **Table 17-8** and **Table 17-9** show which of the 13 study intersections adjacent to areas of EJ concern (36 percent of the 36 intersections considered in Alternative C) would experience major impacts from increased traffic under both options, respectively.

Table 17-8. Traffic Impacts on EJ Communities, Alternative C East Option

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	**North Capitol Street / K Street**	X	X	X
5	**North Capitol Street / H Street**		X	X
9	**3rd Street / H Street NE**	X	X	X
10	**North Capitol Street / G Street**		X	X
13	**North Capitol Street / Massachusetts Avenue**		X	X
19	**North Capitol Street / E Street**		X	X
25	**4th Street / H Street NE**			
28	**1st Street / D Street NW**			
29	**2nd Street / D Street NW**		X	X
31	**3rd Street / E Street NW**			X
32	**3rd Street / Massachusetts Ave / H St NW**		X	X
33	**North Capitol Street (SB Ramp) / New York Avenue**		X	
34	**North Capitol Street (NB Ramp) / New York Avenue**		X	

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. In Alternative C with the East Option, out of the 13 intersections of EJ concern, ten (77 percent) would experience a major impact. These ten intersections would be a minority of all the intersections that would experience major impacts for two of the factors (2 out of 5 for degradation to LOS F and 9 out of 21 for delay increases of more than 5 seconds) and just over half the intersections that would experience an impact for the third factor (10 out of 19 for increase in queue length of more than 150 feet).

Table 17-9. Traffic Impacts on EJ Communities, Alternative C West Option

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	North Capitol Street / K Street	X	X	X
5	North Capitol Street / H Street		X	X
9	3rd Street / H Street NE			
10	North Capitol Street / G Street		X	X
13	North Capitol Street / Massachusetts Avenue		X	X
19	North Capitol Street / E Street		X	X
25	4th Street / H Street NE			
28	1st Street / D Street NW			
29	2nd Street / D Street NW			
31	3rd Street / E Street NW		X	X
32	3rd Street / Massachusetts Ave / H St NW			
33	North Capitol Street (SB Ramp) / New York Avenue			
34	North Capitol Street (NB Ramp) / New York Avenue			

In Alternative C with the West Option, out of the 13 intersections of EJ concern, six (46 percent) would experience a major impact. These six intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (1 out of 4 for degradation to LOS F; 6 out of 19 for increase in queue length of more than 150 feet; and 6 out of 20 for delay increases of more than 5 seconds).

Additionally, regardless of the option, none of the affected intersections is located entirely within an EJ community or of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of traffic and would continue to do so in the No-Action Alternative.

Noise and Vibration

The adverse operational impacts of Alternative C (either option) on noise and vibration (**Section 10.5.4.1**, *Direct Operational Impacts*) would vary slightly from those of Alternative A but not in a manner that would change their distribution across the Study Area or their potential to affect EJ communities. Such communities would not experience disproportionately high and adverse impacts for the same reasons as explained in **Section 17.5.2.1**, *Operational Impacts, Noise and Vibration*.

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative C (either option) would have the same major beneficial impact on local communities as described for Alternative A in **Section 17.5.2.1**, *Operational Impacts, Social and Economic Conditions.* Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.4.2 Construction Impacts

Construction of Alternative C with the East Option would not have disproportionately high and adverse impacts on EJ communities. Construction of Alternative C with the West Option would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Transportation

WMATA Metrorail

Like operational impacts and for the same reason, construction impacts on WMATA Metrorail in Alternative C would not be predominantly borne by members of EJ communities or be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations.

Intercity Buses

As explained in **Section 5.5.3.3**, *Construction Impacts*, *Intercity, Tour/Charter, and Sightseeing Buses*, the impacts of constructing Alternative C with the West Option on intercity bus service at WUS would be similar to those of Alternative A: bus service would not be available at WUS during Phase 4 of construction. For the same reasons as explained for Alternative A in **Section 17.5.2.2**, *Construction Impacts, Transportation* above, this would be a disproportionately high and adverse impact on EJ populations, as it would be appreciably greater in magnitude for these populations than for the non-EJ population. In Alternative C, Phase 4 would last for approximately 4 years.

In Alternative C with the East Option, however, this displacement would not occur because the new bus facility (on the east side of the Project Area) would be operational by the time the existing one is demolished.

City and Commuter Buses

Construction of Alternative C (either option) would have the same minor adverse impacts on city and commuter bus operations as Alternative B (see **Section 5.5.3.3**, *Construction Impacts, City and Commuter Buses*). This would not amount to a disproportionately high and adverse impact on EJ communities for the same reason as explained for Alternative B in **Section 17.5.3.2**, *Construction Impacts, Transportation* above.

<u>**Vehicular Traffic**</u>

Construction traffic impact in Alternative C with either option (described in **Section 5.5.4.3**, *Construction Impacts, Vehicular Traffic*) would not amount to disproportionately high and adverse impacts on EJ communities for the same reason as explained for Alternative A (**Section 17.5.2.2**, *Construction Impacts, Transportation*).

Noise and Vibration

Construction of Alternative C (either option) would cause noise and vibrations. Construction noise levels in EJ communities would not be consistently higher in EJ communities than in non-EJ communities. The construction noise impact analysis (**Section 10.5.4.3**, *Construction Impacts*) for Alternative C showed that there would be major stationary- and mobile-source construction noise impacts at 32 receptors, including residential and commercial uses, where noise levels would exceed the FTA criteria for moderate or severe (major) impacts during SOE construction or at the beginning of excavation, which would be the noisiest activities. The affected receptors located in areas of EJ concern would be the same as in Alternative A. Therefore, as in Alternative A, while some minority or low-income persons and locations of significance to EJ populations would experience severe or moderate noise impacts, such impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. Measures that would be implemented to avoid, minimize, or mitigate noise impacts (see **Section 10.7**, *Avoidance, Minimization, and Mitigation Evaluation*) would reduce impacts at EJ as well as non-EJ locations. Construction vibration impacts would generally be the same as those of Alternative A and would not affect EJ communities.

Social and Economic Conditions

The impacts of constructing Alternative C (either option) on homeless populations would be as described for Alternative A in **Section 17.5.2.2**, *Construction Impacts*, *Social and Economic Conditions*).

17.5.5 Alternative D

17.5.5.1 Operational Impacts

Alternative D would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative.

Transportation

<u>**WMATA Metrorail**</u>

In Alternative D, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.5.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative D, like the other Action Alternatives, would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.5.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. As explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would be predominantly borne by bus operators and would not amount to a disproportionately high and adverse impact on EJ populations.

City and Commuter Buses

As explained in **Section 5.5.5.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative D, like Alternative B, would have a minor adverse direct operational impact on city and commuter buses. For the same reason as explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would not amount to a disproportionately high and adverse impact on EJ populations.

Vehicular Traffic

In Alternative D, as in all Action Alternatives, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis for Alternative D (**Section 5.5.5.1**, *Direct Operational Impacts, Vehicular Traffic*), there would be a degradation of operations at multiple intersections around WUS. **Table 17-10** shows which of the 13 study intersections adjacent to areas of EJ concern (36 percent of the 36 intersections considered in Alternative D) would experience major impacts from increased traffic.

Table 17-10. Traffic Impacts on EJ Communities, Alternative D

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	**North Capitol Street / K Street**	X	X	X
5	**North Capitol Street / H Street**		X	X
9	**3rd Street / H Street NE**			
10	**North Capitol Street / G Street**		X	X
13	**North Capitol Street / Massachusetts Avenue**		X	X
19	**North Capitol Street / E Street**		X	X
25	**4th Street / H Street NE**			
28	**1st Street / D Street NW**			
29	**2nd Street / D Street NW**			
31	**3rd Street / E Street NW**		X	X
32	**3rd Street / Massachusetts Ave / H St NW**			
33	**North Capitol Street (SB Ramp) / New York Avenue**			
34	**North Capitol Street (NB Ramp) / New York Avenue**			

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. In Alternative D, out of the 13 intersections of EJ concern, six (46 percent) would experience a major impact. These six intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (1 out of 4 for degradation to LOS F; 6 out of 14 for increase in queue length of more than 150 feet; and 6 out of 20 for delay increases of more than 5 seconds).

Additionally, regardless of the option, none of the affected intersections is located entirely within an EJ community or of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of traffic and would continue to do so in the No-Action Alternative.

Noise and Vibration

The adverse operational impacts of Alternative D on noise and vibration (**Section 10.5.5.1**, *Direct Operational Impacts*) would vary slightly from those of Alternative A but not in a manner that would change their distribution across the Study Area or their potential to affect EJ communities. Such communities would not experience disproportionately high and adverse impacts for the same reasons as explained in **Section 17.5.2.1**, *Operational Impacts, Noise and Vibration*.

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative D would have the same major beneficial impact on local communities as described for Alternative A in **Section 17.5.2.1**, *Operational Impacts, Social and Economic Conditions.* Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.5.2 Construction Impacts

Construction of Alternative D would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Alternative D would use the same SOE method and involve the same amount of excavation as Alternative C. Construction duration would be the same. Because the bus facility would not be operational before the end of Phase 4, the construction impacts of Alternative D would be the same as those of Alternative C with the West Option, addressed in **Section 17.5.4.2**, *Construction Impacts*.

17.5.6 Alternative E

17.5.6.1 Operational Impacts

Alternative E would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative.

Transportation

WMATA Metrorail

In Alternative E, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.6.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative E, like the other Action Alternatives, would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.6.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. As explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would be predominantly borne by bus operators and would not amount to a disproportionately high and adverse impact on EJ populations.

City and Commuter Buses

As explained in **Section 5.5.6.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative E, like Alternative B, would have a minor adverse direct operational impact on city and commuter buses. For the same reason as explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would not amount to a disproportionately high and adverse impact on EJ populations.

Vehicular Traffic

In Alternative E, as in all Action Alternatives, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis for Alternative E (**Section 5.5.6.1**, *Direct Operational Impacts, Vehicular Traffic*), there would be a degradation of operations at multiple intersections around WUS under this alternative. **Table 17-11** shows which of the 13 study intersections adjacent to areas of EJ concern (36 percent of the 36 intersections considered in Alternative E) would experience major impacts from increased traffic.

Table 17-11. Traffic Impacts on EJ Communities, Alternative E

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	North Capitol Street / K Street	X	X	X
5	North Capitol Street / H Street		X	X
9	3rd Street / H Street NE		X	X
10	North Capitol Street / G Street		X	X
13	North Capitol Street / Massachusetts Avenue		X	X
19	North Capitol Street / E Street		X	
25	4th Street / H Street NE			
28	1st Street / D Street NW			
29	2nd Street / D Street NW			
31	3rd Street / E Street NW		X	X
32	3rd Street / Massachusetts Ave / H St NW			X
33	North Capitol Street (SB Ramp) / New York Avenue			
34	North Capitol Street (NB Ramp) / New York Avenue			

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. In Alternative E, out of the 13 intersections of EJ concern, seven (54 percent) would experience a major impact. These intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (1 out of 4 for degradation to LOS F; 7 out of 16 for increase in queue length of more than 150 feet; and 7 out of 20 for delay increases of more than 5 seconds).

Additionally, regardless of the option, none of the affected intersections is located entirely within an EJ community or of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of traffic and would continue to do so in the No-Action Alternative.

Noise and Vibration

The adverse operational impacts of Alternative E on noise and vibration (**Section 10.5.6.1**, *Direct Operational Impacts*) would vary slightly from those of Alternative A but not in a manner that would change their distribution across the Study Area or their potential to affect EJ communities. Such communities would not experience disproportionately high and adverse impacts for the same reasons as explained in **Section 17.5.2.1**, *Operational Impacts, Noise and Vibration*.

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative E would have the same major beneficial impact on local communities as described for Alternative A in **Section 17.5.2.1**, *Operational Impacts, Social and Economic Conditions.* Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.6.2 Construction Impacts

Construction of Alternative E would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Alternative E would use the same SOE method and involve the same amount of excavation as Alternative B. Construction duration would be the same. Because the bus facility would not be operational before the end of Phase 4, the construction impacts of Alternative E would be the same as those of Alternative B, addressed in **Section 17.5.3.2**, *Construction Impacts*.

17.5.7 Alternative A-C (Preferred Alternative)

17.5.7.1 Operational Impacts

Alternative A-C would not have disproportionately high and adverse impacts on EJ communities relative to the No-Action Alternative. Nor would EJ communities be denied any benefits from Alternative A-C.

Transportation

WMATA Metrorail

In Alternative A-C, there would be an increase in Metrorail ridership at WUS due to capacity exceedances (see **Section 5.5.7.1**, *Direct Operational Impacts, WMATA Metrorail*), resulting in a moderate adverse operational impact. This adverse impact is not anticipated to be predominantly borne by EJ communities or to be appreciably more severe or greater in magnitude for EJ populations than for non-EJ populations for the same reason as explained for the No-Action Alternative (see **Section 17.5.1.1**, *Operational Impacts, Transportation* above).

Intercity Buses

Alternative A-C, like the other Action Alternatives, would have a moderate adverse direct operational impact on intercity bus operations because of the new 30-minute time limit for buses at WUS, as explained in **Section 5.5.7.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*. As explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would be predominantly borne by bus operators and would not amount to a disproportionately high and adverse impact on EJ populations.

City and Commuter Buses

As explained in **Section 5.5.7.1**, *Direct Operational Impacts, City and Commuter Buses,* Alternative A-C, like Alternative A, would have a minor adverse direct operational impact on city and commuter buses. For the same reason as explained above for Alternative A **(Section 17.5.2.1**, *Operational Impacts, Transportation*), this impact would not amount to a disproportionately high and adverse impact on EJ populations.

Vehicular Traffic

In Alternative A-C, as in all Action Alternatives, roadway traffic in the Local Study Area would increase due to increased activity at WUS as well as general development and population growth. As shown by the traffic impact analysis for Alternative A-C (**Section 5.5.7.1**, *Direct Operational Impacts, Vehicular Traffic*), there would be a degradation of operations at multiple intersections around WUS under this alternative. **Table 17-12** shows which of the 13 study intersections adjacent to areas of EJ concern (37 percent of the 35 intersections considered in Alternative A-C) would experience major impacts from increased traffic.

Table 17-12. Traffic Impacts on EJ Communities, Alternative A-C

Int. No.	Intersection Adjacent to EJ Population	Degradation to LOS F	Queue Increase Greater than 150 Feet	Delay Increase >5 seconds
1	**North Capitol Street / K Street**	X	X	X
5	**North Capitol Street / H Street**		X	X
9	**3rd Street / H Street NE**		X	X
10	**North Capitol Street / G Street**		X	X
13	**North Capitol Street / Massachusetts Avenue**	X	X	X
19	**North Capitol Street / E Street**		X	X
25	**4th Street / H Street NE**			
28	**1st Street / D Street NW**			
29	**2nd Street / D Street NW**			
31	**3rd Street / E Street NW**		X	X
32	**3rd Street / Massachusetts Ave / H St NW**			
33	**North Capitol Street (SB Ramp) / New York Avenue**			
34	**North Capitol Street (NB Ramp) / New York Avenue**			

Adverse traffic impacts would not be predominantly borne by EJ populations or be appreciably more severe for these populations than for non-EJ communities. In Alternative A-C, out of the 13 intersections of EJ concern, seven (54 percent) would experience a major impact. These intersections would be a minority of all the intersections that would experience major impacts for each of the three factors (2 out of 5 for degradation to LOS F; 7 out of 19 for increase in queue length of more than 150 feet; and 7 out of 22 for delay increases of more than 5 seconds).

Additionally, regardless of the option, none of the affected intersections is located entirely within an EJ community or of special significance to the well-being of any such community. All border major thoroughfares (such as North Capitol Street and H Street) that already carry large amounts of traffic and would continue to do so in the No-Action Alternative.

Noise and Vibration

The adverse operational impacts of Alternative A-C on noise and vibration (**Section 10.5.7.1**, *Direct Operational Impacts*) would be the same as those of Alternative A. EJ communities would not experience disproportionately high and adverse impacts for the same reasons as explained in **Section 17.5.2.1**, *Operational Impacts, Noise and Vibration*.

Social and Economic Conditions

Relative to the No-Action Alternative, Alternative A-C would have the same major beneficial impact on local communities as described for Alternative A in **Section 17.5.2.1**, *Operational Impacts, Social and Economic Conditions.* Minority and low-income persons would enjoy these benefits as much as the general population.

17.5.7.2 Construction Impacts

Construction of Alternative A-C would have a disproportionately high and adverse impact on EJ communities from the unavailability of intercity bus service at WUS during Phase 4 of Construction.

Alternative A-C would use the same SOE method and involve the same amount of excavation as Alternative A. Construction duration would be the same. Because the bus facility would not be operational before the end of Phase 4, the construction impacts of Alternative A-C would be the same as those of Alternative A, addressed in **Section 17.5.2.2**, *Construction Impacts*.

17.6 Comparison of Alternatives

In all Action Alternatives, except Alternative C with the East Option, the unavailability of intercity bus service at WUS during Phase 4 of construction would constitute a disproportionately high and adverse effect on EJ communities. Phase 4 would last for approximately 3 years and 1 month in Alternatives A and A-C; 4 years in Alternatives C and D; and approximately 4 years and 1 months in Alternatives B and E.

Additionally, all alternatives would likely require the displacement of any homeless persons who would be using the area around WUS when construction begins.

17.7 Avoidance, Minimization, and Mitigation Evaluation

In all Action Alternatives except Alternative C with the East Option, to mitigate the disproportionately high and adverse impact on EJ communities during Phase 4 of construction due to the displacement of intercity bus service, FRA is considering the following measure:

- In coordination with the District, USRC would identify a location for an adequately-sized interim bus facility or bus loading zones as close to WUS as possible for use during Phase 4 of construction.

To minimize potential adverse impacts on the homeless population. FRA is considering the following measure:

- If and when construction contractors encounter homeless persons when staging construction activities and need to relocate these persons, they would be required to contact and coordinate with the appropriate authorities and organizations to ensure the displaced persons are given access to available public and private assistance services, including opportunities for shelter as well as health and mental health care; that they are not deprived of their belongings or otherwise mistreated; and that neither they nor the workers interacting with them are put at risk of harm.

17.8 Permits and Regulatory Compliance

There are no formal permits required to demonstrate regulatory compliance with regard to EJ. Compliance with local noise and construction ordinances would occur through the construction permitting process, which would minimize noise impacts. Per DOT Order 5610.2(a), it must be determined whether transportation activities would have an adverse effect on minority and low-income populations and whether that adverse effect would be disproportionately high.

Activities that have a disproportionately high and adverse impact on minority and low-income populations may only be implemented if further mitigation measures or alternatives to avoid or reduce these impacts are not practicable. Effective, meaningful involvement of low-income and minority populations must be undertaken in project planning and development and EJ populations must have fair and equal access to information.

17.9 Outreach to Environmental Justice Populations

One of the guiding principles of environmental justice is ensuring full and fair access to meaningful involvement by minority and low-income populations in project planning and development. Therefore, a robust, sustained, and transparent engagement process is essential through the life of the Project.

The public participation process for the WUS Project and DEIS focused on engaging potentially affected residents through public meetings and materials, social media, and a Community Communications Committee (CCC). The purpose of the CCC was to improve community engagement during the NEPA process. The CCC includes representatives of the communities potentially affected by the Project. Members were selected based on:

- Recognized leadership for their constituency;
- Service in an official capacity; and
- Demonstrated capacity to support communication with, and engagement of, the constituency around this Project.

CCC meetings have convened at logical points throughout the NEPA process such as prior to public meetings.

Per FTA Circular 4703.1, *Environmental Justice Policy Guidance for Federal Transit Administration Recipients*, public outreach has occurred and will continue to occur through interactive public meetings that communicate information about the Project in a manner that is user-friendly, clear, and concise. To date, four public meetings have been held:

- Public Meeting #1 - Public Scoping (during the Public Scoping Period)
- Public Meeting #2 - Informational Forum
- Public Meeting #3 – Presentation of range of concepts
- Public Meeting #4 – Presentation of range of reasonable alternatives)

There will be a public hearing after the Draft EIS is released to present the findings of the impact analysis and solicit public comments.

Translation services and handouts in multiple languages were offered at the past public meetings and will be offered at the public hearing. The public was notified of the public meetings through online and traditional means, including advertisement in the *Washington Informer*, which serves the African-American community. Similar means will be used to advertise the public hearing. The public engagement included comment periods and the Project website continues to accept public comments. All public outreach materials were made available in multiple languages and were Section 508 compliant. The same will be done for the public hearing materials.

In addition to Public Meetings, outreach included dissemination of detailed Project information through emails sent to an extensive database of elected officials including Advisory Neighborhood Commissions (ANCs) and councilmembers, community organizations, media contacts, listservs, key community stakeholders, and businesses. To build stakeholder understanding of Project plans and solutions, educational outreach materials and advertising to communicate key project messages were developed. Communication tools included flyers, press releases, and electronic newsletters

In the Fall of 2018, FRA and the Project Proponents participated in a series of public events during which they distributed a fact sheet with information on the Project and the NEPA process and were available to answer questions or take comments. These events included but were not limited to:

- Presence at Eastern Market, the Barracks Row Festival, and the H Street Main Street Festival.
- Participation in WUS events such as History of Union Station Tour and Union Station Christmas Tree Lighting.

Participation in community events such as NoMA Business Improvement District (BID) Pumpkin Palooza, Hill-o-ween at Easter market, Downtown BID Fall Festival, Wunder Garten Winterfest Holiday Market, and Winter Wonder in NoMA.

18 Cumulative Impacts

18.1 Overview

The Washington Union Station Expansion (WUS) Project (Project) would result in direct and indirect adverse or beneficial impacts to a range of resources, as described in prior impact sections. Under the National Environmental Policy Act of 1969 (NEPA) (40 Code of Federal Regulations 1508.7), a cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

18.2 Regulatory Context

This section assesses the incremental impacts of the Project when considered in conjunction with past, present, and reasonably foreseeable future actions consistent with the Council on Environmental Quality (CEQ) and other agency guidance documents:

- *Considering Cumulative Effects Under the National Environmental Policy Act*;[1]
- *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*;[2]
- *Secondary and Cumulative Impact Assessment in the Highway Project Development Process*;[3]

[1] Council on Environmental Quality Executive Office of the President. 1997. *Considering Cumulative Effects Under the National Environmental Policy Act.* Accessed from https://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf. Accessed on May 10, 2020.

[2] Council on Environmental Quality Executive Office of the President. 2005. *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*. Accessed fromhttps://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-PastActsCumulEffects.pdf. Accessed on May 10, 2020.

[3] Federal Highway Administration. 1992. *Secondary and Cumulative Impact Assessment in the Highway Project Development Process*. Position Paper. Accessed from https://www.environment.fhwa.dot.gov/guidebook/content/Secondary_Cumulative_Impact_Assessmt.asp. Accessed on May 10, 2020.

- *Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process*;[4]
- National Cooperative Highway Research Program (NCHRP) 25-25 Task 11: *Indirect and Cumulative Impact Analysis*;[5] and
- NCHRP Report 423A: *Land Use Impacts of Transportation: A Guidebook*.[6]

18.3 Study Area

As explained in Chapter 2, *Scoping for Cumulative Effects*, of CEQ's *Considering Cumulative Effects Under the National Environmental Policy Act*, geographic areas within which cumulative impact analysis is conducted generally vary depending on the resource considered. For instance, air quality regions as defined by the U.S. Environmental Protection Agency (EPA) may be the appropriate geographic area for cumulative impacts on air quality and a river basins or sub-basin the appropriate area for cumulative impacts on water quality. The appropriate boundary also depends on the characteristics of the impacts being considered and management or regulatory interests.

For the Project, the cumulative impact geographic area for each resource considered is shown in **Table 18-1**. In most cases, the area is either the District as a whole or the Local and Regional Study Areas defined for the resource in the corresponding section of this report.

4 Federal Highway Administration. 2003. *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*. Accessed from https://www.environment.fhwa.dot.gov/guidebook/qaimpact.asp. Accessed on May 10, 2020.

5 Transportation Research Board. 2006. *National Cooperative Highway Research Program (NCHRP) 25-25 Task 11: Indirect and Cumulative Impact Analysis*. Accessed fromhttp://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(11)_FR.pdf. Accessed on May 10, 2020.

6 Transportation Research Board. 1999. *NCHRP Report 423A: Land Use Impacts of Transportation: A Guidebook.*

Table 18-1. Study Areas for Cumulative Impacts

Resource	Cumulative Impact Study Area	Justification
Natural Ecological Systems	Study Area for this resource	The Project would have minimal impacts on natural resources with no potential to be felt outside the immediate vicinity of WUS.
Water Resources and Water Quality: **Surface water** **Groundwater** **Stormwater** **Wastewater** **Drinking water**	District District and Study Area for this resource District District District	Surface water quality, groundwater, stormwater, wastewater, and drinking water are District-wide interests managed at the District level. Groundwater may also cause localized cumulative impacts from ground subsidence.
Solid Waste Disposal **Hazardous Materials**	District Study Area for this resource	Solid waste disposal is a district-wide concern managed at District level. Potential cumulative impacts related to hazardous materials are linked to use and storage, generating risks at the local level.
Transportation	Study Area for this resource	Potential impacts on the transportation system, including cumulative impacts, would be felt predominantly at the local level (within the Local Transportation Study Area). They would quickly disperse outside of it.
Air Quality	District-Virginia- Maryland air quality region	Air quality is mostly a regional concern but local (hotspots) impacts from some pollutants are possible.
Greenhouse Gas Emissions **Resilience**	Global and District District and Study Area for this resource	The effects of greenhouse gas emissions on climate is a global issue. Management of emissions is at the District level. Resilience planning is a District-wide consideration implemented at the local level.
Energy Resources	District	Energy consumption and supply is managed at the District level.

Resource	Cumulative Impact Study Area	Justification
Land Use, Planning, and Property	Study Area for this resource	Potential impacts, including cumulative impacts, would be felt at the local level, within the Study Area for this resource.
Noise and Vibration **Aesthetics and Visual Quality** **Cultural Resources** **Parks and Recreation Areas**	Study Area for this resource	Potential impacts, including cumulative impacts, would be felt at the local level, within the respective Study Areas for these resources.
Social and Economic Conditions: **Demographics** **Community Disruption** **Employment** **WUS Revenue** **Other Economic Impacts**	 District Study Area for this resource District WUS District	Demographic, employment, and general economic impact are district-wide concerns. Community disruption is a local consideration and WUS revenue are a consideration for WUS only.
Public Safety and Security **Public Health, Elderly, and Persons with Disabilities** **Environmental Justice**	Study Area for this resource	Potential impacts, including cumulative impacts, would be felt at the local level, within the Study Area for these resources.

18.4 Methodology

18.4.1 Analysis

The potential cumulative impacts of the Action Alternatives were analyzed for the resources listed in **Table 18-1** above. For each resource, past, present, and reasonably foreseeable future impacts without the Project were considered. In general, the impacts of past projects are included in the existing conditions described in the *WUS Expansion Project, Affected Environment Technical Report* (**Appendix C2**). To minimize redundancy, these descriptions are not repeated in this section. For each resource, the discussion focuses on present and future impacts using the projects identified in **Section 18.4.2** below (cumulative projects) as an illustration or benchmark. This is followed by a description of what the Project would add to present, past, and reasonably foreseeable future impacts and an assessment of the resulting cumulative impacts.

18.4.2 Cumulative Projects

The cumulative projects were selected to include present and foreseeable future actions whose effects could combine with those of the Project to generate cumulative impacts by 2040. [7]Cumulative projects are those that meet the following criteria:

- Having the potential to result in measurable environmental impacts because of their size, scope, or other key characteristics;
- Having environmental effects that could cause a cumulative impact in conjunction with the impacts of other past, present, or future projects and activities;
- Being potentially capable of generating cumulative impacts that could reasonably be expected to affect the viability, sustainability, or value of a given resource (for example, by contributing to reaching or exceeding a regulatory "threshold" or standard); and.
- Undergoing or having completed permitting actions or NEPA reviews, or being programmed for construction.

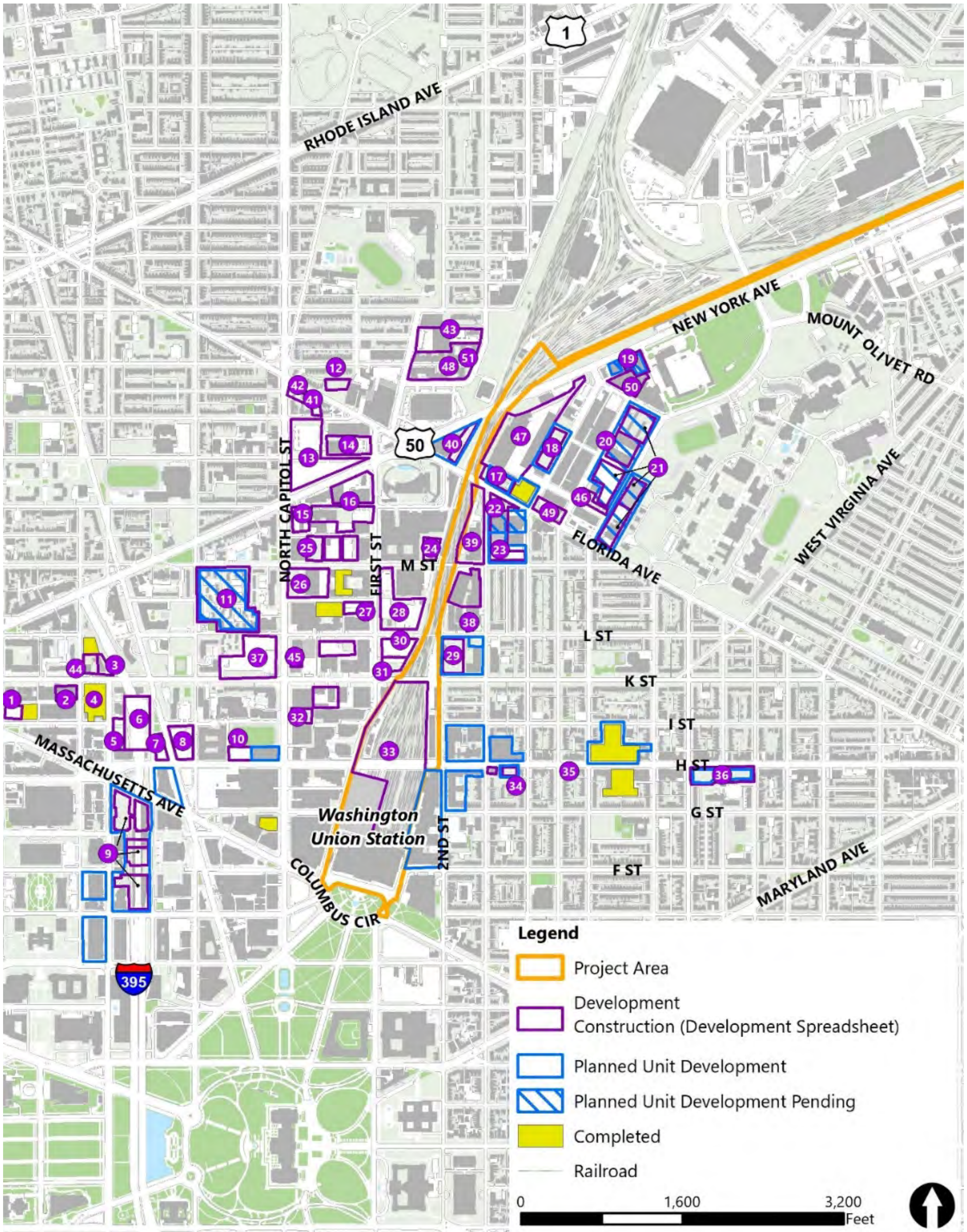
Figure 18-1 shows the location of those projects.

[7] For the stated reasons, the following transportation projects are not included in the cumulative impact analysis:

Baltimore-Washington SCMAGLEV Project - In 2016, FRA, jointly with the Maryland Department of Transportation, initiated the preparation of an Environmental Impact Statement (EIS) to evaluate the potential impacts of constructing and operating a high-speed superconducting magnetic levitation (SCMAGLEV) system between the District and Baltimore, MD. After a pause, preparation of the EIS resumed in spring 2020. An Alternative Report completed in late 2018 (available from http://www.bwmaglev.info/index.php/project-documents/reports, accessed on March 18, 2020) retained two potential locations for an underground terminus station in the District, both under New York Avenue and west of 5th Street NW, near Mount Vernon Square. Because of the distance to the Project Area and anticipated station access modes (no parking is proposed and the station would be close to the Mount Vernon Square/7th Street-Convention Center Metrorail Station; it is not likely to generate substantial additional traffic near the Project Area), the SCMAGLEV station, considered with the Project, has no potential to generate cumulative impacts that could reasonably be expected to affect the viability, sustainability, or value of the resources considered in this DEIS.

Washington DC to Baltimore Loop Project, Proposed by the Boring Company – The Federal Highway Administration (FHWA) issued a Draft Environmental Assessment (EA) for this project in April 2019 (available from https://www.dcbaltimoreloop.com/DraftLoopEA.pdf, accessed on March 18, 2020). The project would consist of an underground system transporting passengers in autonomous, high-speed electric vehicles. The District terminus station would be located near the intersection of New York and Florida Avenues. Although it would be a relatively short distance from the WUS Project Area, the potential Loop station, considered with the Project, is not likely to generate cumulative impacts that could reasonably be expected to affect the viability, sustainability, or value of the resources considered in this DEIS. It would be underground, have limited capacity (no more than 1,000 passengers per day in each direction). The terminus station would be close to the NoMA-Gallaudet U.-New York Avenue Metrorail station and include no parking, which would minimize any traffic the project would generate. The Draft EA does not identify adverse impacts from traffic.

Figure 18-1. Reasonably Foreseeable Development Projects near the Project Area (as of October 2018)



18.4.2.1 Station and Track Improvements

Union Station Redevelopment Corporation (USRC) and Amtrak have programmed identified improvements to WUS and track improvements for the next five years. These improvements would be completed by 2040. One project, the VRE Midday Storage Replacement Facility (MSRF), is near New York Avenue NE by VRE to address railcar storage needs. The new storage facility would be for storing commuter trains on weekdays between the inbound morning commute and outbound afternoon commute.[8] VRE and the Federal Transit Administration have prepared a Categorical Exclusion (CE) Evaluation for the MSRF. Other short-term projects by USRC would occur over the next few years, though their precise timing is not known at this juncture. Together, these projects would repair areas in need of renovation and rehabilitation; enhance train operations; provide additional space for WUS service functions; and address Americans with Disabilities Act (ADA) compliance issues.

18.4.2.2 Transportation Projects in Project Area

Transportation projects near WUS expected to be in place by 2040 include the extension of the DC Streetcar line; the replacement of the H Street Bridge; and access and capacity enhancements to the Washington Metropolitan Area Transit Authority (WMATA) Metrorail station at WUS.

Streetcar Extension

The DC Streetcar line, which opened in February 2016 and runs from WUS to Benning Road NE and Oklahoma Avenue NE, is programmed for extension eastward and westward. To the east, this project would extend the line along Benning Road to the Benning Road Metro Station. The western extension would carry the streetcar from WUS to Georgetown along H Street, New Jersey Avenue, Mount Vernon Square, and K Street. A new streetcar stop and the realignment of tracks on the H Street Bridge to accommodate the western extension would be included.[9]

H Street Bridge Replacement

The H Street Bridge extends from North Capitol Street to 3rd Street NE. DDOT is proposing to replace the bridge because the bridge deck is reaching the end of its useful life. The new

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8 Virginia Railway Express. 2017. "Midday Storage Facility." Accessed from https://www.vre.org/vre/assets/File/ProjectsPlans/MSF/NYY_20170623_Handout_VRE%20FactSheet.pdf. Accessed on June 12, 2018.

9 While the DC Council deleted the short-term funding for implementing the western extension during the FY2018 budget process, the western extension is included in the regional Constrained Long Range Plan.

bridge would be designed to accommodate the planned DC Streetcar extension and the track and platform (terminal infrastructure) plan at WUS. [10]

WMATA Station Access and Capacity Enhancements

The 2011 *Access and Capacity Improvement Study* commissioned by WMATA identified projects to address capacity problems at the WUS station:[11]

- Expanding and relocating the access to and from First Street NE from the North Mezzanine. The entrance ramp would be relocated to the exterior of the station, above the First Street sidewalk;
- Providing additional faregates and circulation space within the current footprint of the mezzanine; and
- Providing additional stairways to connect the North Mezzanine level to the Claytor concourse.

WMATA is pursuing capacity enhancements in coordination with Amtrak's Concourse Modernization Project, with expected completion by 2021.[12]

18.4.2.3 Private Development Projects

As of October 2018, 55 private development projects, including the private air-rights development above the WUS rail terminal were planned or under construction near WUS.

Private Air-rights Development[13]

The planned mixed-use private air-rights development would be constructed on decks built over the rail terminal. The development would consist of 3.7 to 3.8 million square feet of residential, hotel, office, and retail uses. It would involve modifications to the existing WUS platforms and canopies to integrate column and footing placement across the rail terminal and require the placement of support systems under the deck. These systems would include

[10] District Department of Transportation. *H Street Bridge Project*. https://www.hstreetbridgeproject.com/.

[11] Washington Metropolitan Area Transit Authority, Department of Planning and Joint Development. 2011. *Union Station Access and Capacity Improvement Study Project Report*. Accessed from https://www.wmata.com/initiatives/plans/upload/Final-Union-Station-Project-Report-Feb182011.pdf. Accessed on June 12, 2018.

[12] Union Station Redevelopment Authority. See also: WMATA Board Meeting Presentation, July 27, 2017. *Metro Union Station First Street Entrance and North Mezzanine Project*. Accessed from https://www.wmata.com/about/board/meetings/board-pdfs/upload/8C-CPPRE-Union-Station-1st-Street-Project-FINALIZED.pdf. Accessed on June 12, 2018.

[13] "Air rights" here refers to the right to develop the 14-acre area approximately 70 to 80 feet above the tracks, from north of the WUS historic building to K Street, excluding the area currently occupied by the Claytor Concourse, vehicular ramps, and WUS's bus and parking facility as well as the H Street Bridge.

fire suppression and safety systems, egress locations, and ventilation to remove train exhaust and smoke from the railroad terminal.

Other Development Projects in Proximity to the Project

The private air-rights development and other reasonably foreseeable development projects near WUS are listed and briefly characterized in **Table 18-2**. [14] Several of these projects are already complete or are under construction. Others are in early planning stages and the exact land use and size of the development are still undetermined. All are anticipated to be completed by 2040. Together, these developments comprise approximately 28.5 million square feet. They are expected to deliver approximately 15,200 residential units, 1.13 million square feet of retail, 6.9 million square feet of office space, 1,400 hotel rooms, and 3.2 million square feet of mixed-use space.

[14] Information on the near-term development activity was compiled and sourced from the following agencies: DC Office of Planning, the DC Department of Consumer and Regulatory Affairs, the DC Office of Zoning, the DC Zoning Commission, the DC Board of Zoning Adjustment, the DC Office of the Deputy Mayor for Planning and Economic Development, the Mount Vernon Triangle Business Improvement District, the NoMa Business Improvement District, the Capitol Hill Business Improvement District, and the local Advisory Neighborhood Commissions.

Table 18-2. Reasonably Foreseeable Development Projects near WUS

Project Number (See Figure 18-1)	Project Name	Land Use Type (Size/Quantity)				
		Residential (Units)	Retail (Square Feet)	Hotel (Rooms)	Office (Square Feet)	Mixed-Use/ Other
1	901 5th Street, NW	59	7,600	198	-	-
2	400 K Street, NW	324	13,410			
3	307 K Street, NW	223	-	-	-	-
4	300 K Street, NW	-	12,700	-	233,079	-
5	950 3rd Street, NW	-	-	-	117,788	-
6	801 3rd Street, NW	335	-	-	-	-
7	Capitol Vista H Street between 2nd and New Jersey Avenue	104	-	-	-	-
8	801 New Jersey Avenue, NW	-	-	-	400,000	-
9	Capitol Crossing 2nd Street between Massachusetts. Avenue and E Street, NE	150	75,000	-	876,000	1,249,000
10	55 H Street NW	-	9,500	-	265,000	-
11	Sursum Corda Redevelopment First and L Streets	1,100	-	-	-	-
12	50 Florida Avenue NE	182	7,500	-	-	-
13	O Street between North Capitol and First Street NE	-	-	-	-	1,000,000
14	Lot 854/O Street west of First Street NE	-	-	-	-	965,000
15	Northwest One (Phase II) 2 Patterson Street, NE	340	15,000	-	-	-

Project Number (See Figure 18-1)	Project Name	Land Use Type (Size/Quantity)				
		Residential (Units)	Retail (Square Feet)	Hotel (Rooms)	Office (Square Feet)	Mixed-Use/ Other
16	N Street NoMa 51 N Street NE	220	11,000	-	-	-
16	N Street NoMa 1250 First Street NE	-	17,000	-	240,000	-
16	N Street NoMa 50 Patterson Street NE	-	35,000	-	128,000	-
17	The Highline at Union Market 3rd Street and Florida Avenue NE	315	6,000	-	-	-
18	The Shapiro Residences 1270 4th Street NE	130	40,000	-	-	-
19	411 New York Avenue, NE	-	3,000	178	-	-
20	Union Market Office and Theater 340 Florida Avenue NE	187	28,000	-	-	-
21	Gallaudet University 6th Street NE Properties	1,800	134,830	-	63,000	-
22	301 Florida Avenue, NE	56	45,000	-	-	-
22	301/331 N Street NE	350	27,000	175	-	-
23	300 M Street NE	416	10,000	-	-	-
24	Constitution Square 170 M Street NE	-	-	-	494,000	-
25	Skanska USA 22 M Street NE	320	13,000	-	-	-
26	DC Housing Authority 1133 N Capitol Street NE	70	-	-	80,000	-
27	1150 First Street NE	-	12,000	-	350,000	-

Project Number (See Figure 18-1)	Project Name	Land Use Type (Size/Quantity)				
		Residential (Units)	Retail (Square Feet)	Hotel (Rooms)	Office (Square Feet)	Mixed-Use/ Other
28	NoMa Station Phases II-IV First Street between L and M Street, L Street between First Street and tracks	700	50,000	-	700,000	-
29	Toll Brothers City Living 200 K Street NE	296	8,000	-	-	-
29	Toll Brothers City Living - Phase II 200 K Street NE	229	5,000	-	-	-
30	Storey Park 1005 First Street NE	278	60,000	-	340,000	-
31	100 K Street NE	222	-	-	-	-
32	Union Square III 901 North Capitol Street	-	-	-	250,000	-
33	Private Air-rights Development, referred to as "Burnham Place"[15] Between First and 2nd Street over tracks	1,106	120,000	483	2,160,000	-
34	315-327 H Street NE	125	6,000	-	-	-
35	501 H Street NE	48	4,000	-	-	-
36	901 H Street NE	420	45,000	-	-	-
37	Northwest One (33 K Street NW)	-	-	-	-	-
38	1109 Congress Street NE	64	3,700	-	-	-

[15] For further description of the private air-rights development, see Section 18.4.2.3 above.

Project Number (See Figure 18-1)	Project Name	Land Use Type (Size/Quantity)				
		Residential (Units)	Retail (Square Feet)	Hotel (Rooms)	Office (Square Feet)	Mixed-Use/ Other
39	Central Armature Works 1200 3rd Street NE	850	50,000	-	-	-
40	Washington Gateway - Phases II and III 100 Florida Avenue NE	400	7,000	-	200,000	-
41	22 P Street NE	150	-	-	-	-
42	One Florida Avenue NE	230	75,000	-	-	-
43	Eckington Yards 1611-1625 Eckington Place NE	695	77,000	-	-	-
44	4th and K Streets, NW	33	TBD	200	-	-
45	John and Jill Ker Conway Residence 1005 North Capitol Street NE	124	2,200	-	-	-
46	500-530 Morse Street NE	280	20,290	-	-	-
47	Market Terminal Florida Avenue and 4th Street NE	927	43,313	-	-	-
48	Eckington Place NE	600	1,000	-	-	-
49	400 Florida Avenue NE	110	-	164	-	-
50	Maurice Electrical Building 500 Penn Street NE	300	23,500	-	-	-
51	1501 Harry Thomas Way	328	8,380	-	-	-

18.5 Impacts Analysis

18.5.1 Introduction

This section presents the cumulative long-term, operational impacts of the Project when added to those of past, present, future projects. For each resource, the cumulative impacts of the Project are summarized in bold lettering, followed by a more detailed analysis.

18.5.2 Natural Ecological Systems

The Project would have no cumulative impacts on natural ecological systems.

While the District contains large undeveloped areas, such as Rock Creek Park, none are located near WUS. As explained in **Section 2.5.2**, *Action Alternatives*, of this report, the Project would not have any long-term impacts on natural ecological systems due to the lack of natural resources in or near the Project Area. Construction of the Project would require the removal of approximately 26 ornamental trees along First Street NE. These trees would be replaced in accordance with District's policies on urban forestry. Therefore, the Project, under any of the Action Alternatives, would generate no cumulative impacts to natural ecological systems.

18.5.3 Water Resources and Water Quality

18.5.3.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Surface Waters

The impacts of past actions in the District generally have had an adverse impact on surface waters. Based on current improving trends and the continued enforcement of and compliance with the District's water quality regulations and policies, the reasonably foreseeable adverse impacts of present and future actions, including the cumulative projects, on surface waters are anticipated to be negligible.

The Project Area is located within the subwatershed of the Lower Anacostia River, a tidal river which flows into the Potomac River and ultimately the Chesapeake Bay. In the 2016 Water Quality Assessment Integrated Report,[16] the Department of Energy an Environment (DOEE) lists the Lower Anacostia River as a Category 4A for multiple pollutants (see **Appendix C2**, *Washington Union Station Expansion Project, Affected Environment Technical Report*,

[16] DC Department of Energy and Environment. *Water Quality Assessment 2016 Integrated Report to EPA*, Sections 305(b) and 303(d) Clean Water Act. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/2016%20Final%20IR.pdf. Accessed on April 30, 2018.

Section 3.5.1, *Surface Water*). Water quality within this segment of the Anacostia River does not support the river's designated uses.

The District has regulations and policies in place to address water quality issues. DOEE's Water Quality Division and the Inspection and Enforcement Division implement the water quality standards established under the authority of the Clean Water Act and the District of Columbia Water Pollution Control Act of 1984 and monitor the District's waters to identify and reduce impairments. The Watershed Protection Division and Regulatory Review Division manage the sediment and stormwater control programs that regulate land disturbing activities, stormwater management, and floodplain management. The District conducts stream restoration activities to improve habitat and implements a RiverSmart program that provides financial incentives to help property owners install green infrastructure to reduce polluted runoff. The District also coordinates with the District of Columbia Water and Sewer Authority (DC Water) for the construction of the Anacostia River segment of the stormwater storage tunnel under the Clean Rivers Project. Overall, the quality of the District's waters has been improving.[17]

Groundwater

The impacts of past and present actions in the District generally have had an adverse impact on groundwater in the District. The reasonably foreseeable adverse impacts of future actions, including the cumulative projects, on surface waters are anticipated to be negligible both at the District and local level.

DOEE collects groundwater elevation data to assess potential groundwater quantity issues. As reported in 2018, data indicated declines in hydraulic pressure at several wells in the Patuxent Aquifer although some recovery was measured at certain locations, including on the eastern bank of the Anacostia River. The declines were most likely due to several large DC Water Long Term Control Plan (Clean Rivers) dewatering projects underway along the Anacostia River. Dewatering rates for these projects and other construction sites along the Potomac and Anacostia Rivers typically exceed one million gallons per day at each location. Stresses on the aquifer from these projects seem to be preventing full recovery.

Future actions involving large-scale dewatering may continue to affect global groundwater levels but most urban development projects have no potential to have such effects. However, they may result in local impacts if dewatering is sufficient to create a risk of soil subsidence from local reductions in groundwater pressure. In this regard, the local, adverse impacts of the cumulative projects on groundwater would be negligible. In the vicinity of WUS, the cumulative projects may adversely affect groundwater to the extent that their foundations reach below groundwater levels and cause groundwater displacement or require

[17] DC Department of Energy and Environment. *Water Quality Assessment. 2018 Integrated Report to EPA*, Sections 305(b) and 303(d) Clean Water Act. Accessed from https://doee.dc.gov/publication/integrated-report-epa-and-us-congress-regarding-dcs-water-quality. Accessed on July 25, 2019.

short-term (construction) or long-term pumping and disposal of groundwater to keep basements or underground parking garages dry. Because these projects are located within a part of the District that is almost entirely developed, they have no potential to measurably affect groundwater recharge. While the impacts of each project would vary depending on its location, size, and design, it can be anticipated that each would be engineered to avoid and minimize the need for costly short-term and long-term groundwater withdrawal as much as possible. None of the projects are on a scale comparable to the Clean Rivers project that appear to have resulted in decline in hydraulic pressure, as described above. DDOE considers that long-term dewatering associated with basements and parking garages has no potential to significantly deplete groundwater. [18]

Stormwater

The impacts of past and present actions in the District generally have had an adverse impact on stormwater from the large amount of impervious surface typical of an urban environment. Through the enforcement of, and compliance with, District stormwater regulations, the adverse impacts of present and reasonably foreseeable future actions, including the cumulative projects, are expected to be minor.

Stormwater runoff is a major source of water pollution in the District, 43 percent of which consist of impervious areas. A 1.2 -inch storm in the District produces about 525 million gallons of runoff.[19] The District has regulations and policies in place intended to reduce the amount of runoff it generates. The District manages stormwater through its National Pollution Discharge Elimination System (NPDES) permit and the 2013 Stormwater Rule. The 2013 Stormwater Rule applies to major land-disturbing activities (more than 5,000 square feet of disturbance) and major substantial improvement activities (based on cost and size thresholds). Major land-disturbing activities must retain the first 1.2 inches of rainfall on site or through a combination of on-site and off-site retention. For major substantial improvement activities, the amount is 0.8 inches of rainfall. Regulated sites have the option to provide off-site retainage for half the amount to be retained under the regulation through an in-lieu fee or the acquisition or construction of Stormwater Retention Credits. The District's *Stormwater Management Guidebook* identifies best management practices that can be used to meet on- and off-site retainage requirements, including green roofs, rainwater harvesting, and permeable pavement systems, among others. The RiverSmart program further creates incentives to retrofit existing properties.

The cumulative projects would occur in a densely developed and mostly impervious area of the District. If currently pervious areas are made impervious, this could result in increased

[18] District Department of Energy and Environment. September 18, 2009. *Protection of the District's Groundwater and the EISF Review Process*. Accessed from: https://doee.dc.gov/publication/policy-protection-districts-groundwater. Accessed on July 11, 2019.

[19] District Department of Energy and Environment. *Why the District Needs Stormwater Retention*. Accessed from https://doee.dc.gov/node/240042. Accessed on July 24, 2019.

stormwater runoff flows depending on the number of projects subject to the 2013 Rule and the intensity of the storm event. This increase may be offset if regulated project replaced impervious land uses to which the regulation does not apply. Altogether, through the application of the District's stormwater regulations, adverse impacts are anticipated to be minor.

Wastewater

The impacts of past actions in the District generally have had an adverse impact on wastewater generation through many decades of growth and development. These impacts have been managed through the development and maintenance of an extensive collection and treatment system. Based on the current condition of this system, the impacts of present and reasonably foreseeable actions are anticipated to be minor.

DC Water collect the wastewater produced in the District and treats it at the Blue Plains Advanced Wastewater Treatment Plant (Blue Plains). Blue Plains receives wastewater from several other jurisdictions in the region. Altogether, DC Water operates 1,900 miles of sanitary and combined sewers and other conveyance facilities. Blue Plains has an average design capacity of 384 million gpd and peak wet weather capacity of more than one billion gpd. Currently, it treats an average of approximately 290 million gpd.[20]

In this context, the reasonably foreseeable adverse impacts of future actions, including the cumulative projects, would be minor. District growth will increase the amount of wastewater produced, mostly through residential and commercial development. Currently, Blue Plains operates at 75 percent of capacity on average, which leaves ample capacity to accommodate regional and District growth. As an illustration of the scale of impact from development projects, **Table 18-3** shows an order-of-magnitude estimate of the amount of wastewater the cumulative projects would generate daily based on the data summarized in **Table 18-2** and using the same methodology used for the No-Action Alternative in **Section 3.5.5.1**, *Direct Operational Impacts, Wastewater*, of this report. Based on this estimate, the wastewater generated by the cumulative projects would represent approximately 0.97 percent of Blue Plains' average daily capacity of 384 million gallons per day and 4 percent of the average unused capacity.

[20] *DC Water at a Glance*. Accessed from https://www.dcwater.com/dc-water-glance. Accessed on July 24, 2019.

Table 18-3. Estimated Cumulative Future Wastewater Generation

Use	Unit flow rate[1]	Total Units	Estimated average daily flow (gpd)
Residential	60 gpd/ resident	31,920 residents[2]	1,915,200
Hotel	0.25 gpd/ sf	1,190,000 sf[3]	297,500
Office	0.09 gpd/ sf	6,900,000 sf	621,000
Retail	0.05 gpd/ sf	1,130,000 sf	56,500
Mixed Use	0.25 gpd / sf[4]	3,200,000 sf	800,000
WUS (Without Expansion)	1.7 gpd/passenger	19,100 passengers	32,470
Total			3,722,670

gpd = gallons per day; sf= square feet
1. Rates based on Maryland Design Guidelines for Wastewater Facilities[21] unless otherwise noted
2. Assumes 2.1 residents per residential unit.
3. Assumes 850 square feet per key.
4. For the purposes of this estimate, the hotel flow rate was used for mixed use development.

Drinking Water

The impacts of past actions in the District generally have had an adverse impact on drinking water demand through many decades of growth and development. These impacts have been addressed through the development and maintenance of an extensive water treatment and distribution system. Based on the current condition of this system, the impacts of present and reasonably foreseeable actions are anticipated to be minor.

DC Water operates the drinking water distribution network in the District, including 1,350 miles of pipes, four pumping stations, and five reservoirs. In fiscal year 2016, DC Water pumped an average of 99 million gpd of water, in addition to storing 61 million gallons. DC Water purchases water from the Washington Aqueduct, a Federally owned and operated public water supply agency. The Washington Aqueduct withdraws water from the Potomac River at Great Falls and Little Falls and treats it at two drinking water treatment plants, Dalecarlia and McMillan, located in the District. The Aqueduct produces an average of 155 million gpd and serves approximately one million persons in the District and neighboring jurisdictions. [22]

District and regional growth will increase demand for drinking water, mostly through residential and commercial development. A 2015 study forecasting demand and resource

[21] Maryland Department of the Environment Engineering and Capital Projects Program (2016), *Design Guidelines for Wastewater Facilities.* Accessed from: https://mde.maryland.gov/programs/Permits/WaterManagementPermits/Documents/WastewaterDesignGuidelines-2016.pdf. Accessed on July 11, 2019.

[22] U.S. Army Corps of Engineers. *Washington Aqueduct*. Accessed from http://www.nab.usace.army.mil/Missions/Washington-Aqueduct/. Accessed on April 3, 2020.

availability to 2040 estimated that regional demand would increase by 12 percent between 2015 and 2040. [23] Recommendations included evaluating potential new storage facilities.

In this context, the reasonably foreseeable adverse impacts of future actions, including the cumulative projects, would be minor. The cumulative projects would contribute to the increased demand. Using the approach as for the No-Action Alternative in **Section 3.5.5.1**, *Direct Operational Impacts, Drinking Water*, of this report, an order-of-magnitude estimate of the drinking water demand generated by the cumulative projects can be developed based on the wastewater demand (**Table 18-3**) with an added factor of 10 percent to account for consumption, system losses, and other uses. On this basis, daily water demand from the cumulative projects would be approximately 4,094,937 gpd. This would represent approximately 2.6 percent of the current daily production of the Washington Aqueduct and 4 percent of the average amount distributed by DC Water daily in the District.

18.5.3.2 Cumulative Impacts of the Project

Surface Waters

In all Action Alternatives, when considered with past, present, and reasonably foreseeable future projects, the Project would have negligible adverse cumulative impacts on surface waters.

In all Action Alternatives, the Project would generate wastewater that would be conveyed through DC Water's combined sewer system to either Blue Plains or, during larger storms, CSO outfalls in the Anacostia River. This could result in a slightly greater risk of untreated wastewater being released into the Anacostia River relative to what the cumulative projects would cause. However, the contribution of the Project would be very small (from approximately 3 to 6 percent of the amount of wastewater generated by the cumulative projects, depending on the Action Alternative) and the risk would be substantially reduced by the completion of the Clean Rivers Project. Any adverse cumulative impacts on surface waters would be negligible.

Stormwater

In all Action Alternatives, when considered with past, present, and reasonably foreseeable future projects, the Project would no cumulative impacts on stormwater runoff.

Because the Project Area is already impervious, the Project would not add to the amount of stormwater runoff it generates. There would be no cumulative impacts.

[23] Ahmed, S.N. et al. August 2015. *2015 Washington Metropolitan Area Water Supply Study – Demand and Resource Availability Forecast for the Year 2040*. Accessed from: https://www.potomacriver.org/wp-content/uploads/2015/08/ICP15-04a_Ahmed.pdf. Accessed on July 24, 2019.

Groundwater

In Alternative A and Alternative A-C, when considered with past, present, and reasonably foreseeable future projects, the Project would have minor adverse cumulative impacts on groundwater. In Alternatives B through E, the Project would have moderate adverse cumulative impacts on groundwater.

The Project would add to the local adverse impacts of the cumulative projects on groundwater because of the construction-related and operational dewatering that would occur under all Action Alternatives. The scale of the dewatering would vary according to the depth of excavation and support of excavation method. It would be smallest in Alternatives A and A-C (less than 10 gallons per minute [gpm] during both construction and operation). Adverse cumulative impacts would be minor.

The rate of dewatering in Alternatives C and D would be an estimated 220 to 280 gpm during construction and an estimated 20 to 30 gpm in the long term (operational phase). In Alternatives B and E, the rate of construction-phase dewatering would be 260 to 430 gpm and the operational phase rate would be less than 10 gpm. These four Action Alternatives have the potential to aggravate the risk of ground settlement in the area near WUS once their impacts are added to those of past, future, and reasonably foreseeable future projects. Based on preliminary analysis, the features at greatest risk for drawdown induced settlement would be shallow utility infrastructure such as sewer lines, gas lines, and water lines in the Project Area and along adjoining public roadways; the WMATA Red Line station; and the adjoining neighborhoods or buildings that are supported by shallow foundation systems. The larger adjacent buildings around WUS likely stand on deep foundations and are unlikely to experience settlement from drawdown, although this may warrant further study.[24] This increased risk of settlement would be a moderate local adverse cumulative impact.

Wastewater

In all Action Alternatives, when considered with past, present, and reasonably foreseeable future projects, the Project would have minor adverse cumulative impacts on wastewater generation.

In all Action Alternatives, the Project would generate wastewater because of greater passenger and visitor activity at WUS and the potential development of the Federal air rights above the rail terminal. This wastewater would be conveyed through DC Water's sewer infrastructure. As shown in **Section 3.6**, *Comparison of Alternatives*, **Table 3-11** of this report, the amount of wastewater that the Project would generate ranges from approximately 104,530 gpd to approximately 219,030 gpd, depending on the Action Alternative. This would be a small addition to the volume the cumulative projects would generate (approximately 3,722,670 gpd or around 0.97 percent of Blue Plains' average daily capacity of 385 million

[24] Wood. February 2019. *Preliminary Report of Aquifer Pumping Test and Seepage Analysis, Union Station Washington, D.C.*

gpd), resulting in a total volume ranging from approximately 3,827,200 gpd to 3,941,700 gpd, or from 0.99 percent to 1.02 percent of Blue Plains' average daily capacity. Thus, the adverse cumulative impact of the Project on wastewater flows would be minor in all Action Alternatives.

Drinking Water

In all Action Alternatives, when considered with past, present, and reasonably foreseeable future projects, the Project would have minor adverse cumulative impacts on drinking water demand.

In all Action Alternatives, the Project would generate demand for drinking water from greater passenger and visitor activity at WUS and from the potential development of the Federal air rights above the rail terminal. As shown in **Section 3.6**, *Comparison of Alternatives*, **Table 3-11** of this report, projected water demand from the Project would range from approximately 99,143 gpd to approximately 193,443 gpd, depending on the Action Alternative. This would be a small addition to the demand the cumulative projects would generate (approximately 4,094,937 gpd, or 2.6 percent of the daily production of the Washington Aqueduct), resulting in a total demand ranging from approximately 4,194,080 gpd to 4,288,380 gpd, or from 2.70 percent to 2.76 percent of the Washington Aqueduct's average daily production. Thus, the adverse cumulative impact of the Project on drinking water demand would be minor in all Action Alternatives.

18.5.4 Solid Waste Disposal and Hazardous Materials

18.5.4.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Municipal Solid Waste

The impacts of past actions in the District generally have had an adverse impact on solid waste generation through decades of growth and development. These impacts have been addressed through the development and maintenance of a collection and disposal system managed by both private and public operators. Based on the current condition of this system and the District's waste diversion goals and policies, the impacts of present and reasonably foreseeable actions on municipal solid waste are anticipated to be minor.

In fiscal year 2016, District-owned waste transfer stations processed approximately 480,000 tons of municipal solid waste (MSW), including refuse, recyclables, and compostables. Of this total, 56 percent (approximately 271,000 tons) was exported to landfills. Waste-to-energy, recycling, and composting accounted for the remaining 44 percent. [25]

In fiscal year 2017, the District's transfer stations processed a total of approximately 464,000 tons of waste, 76 percent of which were landfilled. The proportion of waste sent to landfill increased substantially relative to the previous year, largely due to a fire at the waste-to-energy facility in Lorton, VA. [26]The majority (approximately 265,000 tons or 74 percent) of landfilled District waste was disposed of at facilities in Virginia. At the end of calendar year 2017, total sanitary landfill capacity in Virginia was just under 248 million tons, with an average remaining permitted life of 23.1 years.[27]

The District has a goal of diverting 80 percent of its waste stream away from landfills and waste-to-energy facilities. Thus, while future growth in the District may increase the quantity of municipal waste it produces, the amount of it that would be landfilled will likely decrease, reducing the impact on regional sanitary landfills. As an illustration, **Table 18-4** shows an order-of-magnitude estimate of the amount of SMW the cumulative projects alone would generate daily based on the information provided in **Table 18-2** above and the factors used in **Section 4.5,** *Solid Waste Disposal and Hazardous Materials,* **Table 4-1.**

[25] District Department of Public Works. *Washington DC Solid Waste Diversion Progress Report. Fiscal Year 2016 Data Addendum*. Accessed from https://dpw.dc.gov/sites/default/files/dc/sites/dpw/page_content/attachments/Waste%20Diversion%20Report-%20FY%2016%20Addendum.pdf. Accessed on June 3, 2019. This number does not include waste collected by private operators and delivered to other facilities for processing or disposal.

[26] District Department of Public Works. *Washington DC Solid Waste Diversion Progress Report. Fiscal Year 2017.* Accessed from https://dpw.dc.gov/sites/default/files/dc/sites/dpw/page_content/attachments/Solid%20Waste%20Diversion%20Report%20FY%2017-%20.pdf. Accessed on August 16, 2019. As already noted, this number does not include waste collected by private operators and delivered to other facilities for processing or disposal.

[27] Virginia Department of Environmental Quality. 2018 Annual Solid Waste Report for Calendar Year 2017. Accessed from: https://www.deq.virginia.gov/Portals/0/DEQ/Land/ReportsPublications/2018%20SWIA%20Report%20for%20CY2017%20-%20ADA.pdf?ver=2018-08-20-151437-490. Accessed on June 3, 2019.

Table 18-4. Estimated Cumulative Future MSW Generation

Use	Daily Production rate [1]	Total Units	Estimated SMW Produced (Tons per Year)
Residential	4.75 Pounds (lbs)/unit	15,200 units	13,177
Hotel	20 lbs/room	1,400 rooms	5,110
Office	2.75 lbs/100 sf	6,900,000 sf	34,629
Retail	5.5 lbs/100 sf	1,130,000 sf	11,342
Mixed Use	5.5 lbs/100 sf[2]	3,200,000 sf	32,120
WUS (Without Expansion)	N/A	N/A	765
Total			97,143

lbs = pounds; sf= square feet
1. Developed based on generation rates provided by District Department of Public Works, Office of Waste Diversion (January 2019) and volume-to-weight conversion factors obtained from EPA (https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf)
2. For the purposes of this estimate, the retail rate was used for mixed use development.

The cumulative projects would produce approximately 97,143 tons of MSW annually. Assuming the District achieves its 80 percent diversion goal, less than 20,000 tons would go to sanitary landfills. Adverse impacts from this amount would be minor.

Hazardous Materials and Waste

The area around WUS has been impacted by petroleum and hazardous material releases in the past and contain properties that generate small quantities of hazardous waste. The Project Area, in particular, has been an active railroad right-of-way since 1907. Railroad rights-of-way are often impacted with residual hazardous materials, including metals and pesticides, and with petroleum constituents. Depending on their age, some of the buildings in the Study Area may contain asbestos-containing materials (ACM) or lead-based paint. The cumulative projects may have a beneficial impact on these conditions to the extent that new construction provides the opportunity to address legacy issues from past land uses through compliance with current regulatory requirements (such as the prohibition of ACM or lead-based paints) but this impact would likely be very limited. None of the cumulative projects would introduce new land uses making use of significant amounts of petroleum products or hazardous materials. The cumulative projects consist of land uses that would only involve the storage and use of the type of hazardous materials found in residential and commercial buildings such as batteries, solvents, paints, or detergents, which are already in common use in the Study Area. If larger quantities of these materials are used or stored than is now the case, it would represent an adverse impact, but given the type of materials involved, this adverse impact is negligible.

18.5.4.2 Cumulative Impacts of the Project

Municipal Solid Waste

In all Action Alternatives, when considered along with past, present, and reasonably foreseeable future projects, the Project would have minor adverse cumulative impacts on municipal solid waste generation.

In all Action Alternatives, the Project would generate MSW from increased numbers of passengers and visitors at WUS as well as from the potential development of the Federal air rights above the rail terminal. As shown in **Section 4.6**, *Comparison of Alternatives*, **Table 4-3** of this report, the amount of MSW generated by the Project would range from approximately 2,744 tons per year to approximately 7,447 tons per year, depending on the Action Alternative. This amount would be a small addition to the MSW produced by the cumulative projects (for a total of approximately 99,887 to 104,590 tons per year) and the District as a whole. It is not likely to cause capacity problems at disposal facilities. Adverse cumulative impacts would be minor.

Hazardous Materials and Waste

In all Action Alternatives, when considered along with past, present, and reasonably foreseeable future projects, the Project would have minor adverse and beneficial cumulative impacts on hazardous materials and waste.

All Action Alternatives would involve excavating the rail terminal and disposing of soil that is likely to be contaminated. The amount of spoil would vary according to the alternative, with Alternatives A and A-C requiring the least excavation and Alternatives B and E the most. The removal and disposal of potentially contaminated soils in accordance with applicable regulations would positively contribute to the cumulative removal or cleaning up of legacy hazardous material issues in the Study Area. This beneficial cumulative impact would be minor because of the likely limited level of contamination that would be encountered and removed.

In all Action Alternatives, the Project would increase the amount of hazardous materials stored and used at WUS, in addition to what would be stored and used by the cumulative projects. While this increase would be an adverse cumulative impact, the storage, utilization, and disposal of hazardous materials would continue to be performed in compliance with applicable laws, regulations, and policies. The adverse cumulative impacts would be minor.

18.5.5 Transportation

18.5.5.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Commuter and Intercity Railroads

Past and present actions have shaped the current condition of commuter and intercity railroad service at WUS. The reasonably foreseeable impact of future actions, including the cumulative projects, would likely be adverse and major. This adverse impact would be partially offset by minor beneficial impacts. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased demand for commuter and intercity train service at WUS. Without the Project, rail operators and WUS would not be able to adequately meet this demand and there would be a major deterioration of passenger service and experience and major adverse impacts. The beneficial impacts from the station improvements included in the cumulative projects (see **Section 18.4.2.1**, *Station and Track Improvements*) would contribute to ameliorate these conditions but their scope is limited and they would not address capacity issues, as explained in **Section 5.5.1.1**, *Direct Operational Impacts, Commuter and Intercity Railroad*, of this report.

WMATA Metrorail

The current condition of Metrorail service at WUS are the result of numerous past and present actions. The reasonably foreseeable impact of future actions, including the cumulative projects, would be adverse and major. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased demand for Metrorail service at WUS. This would create capacity issues on trains and in the station, as described in **Section 5.5.1.1**, *Direct Operational Impacts, WMATA Metrorail*, of this report.

DC Streetcar

Multiple past and present actions shape the current condition of DC Streetcar service at WUS. The reasonably foreseeable impact of future actions, including the cumulative projects, would be beneficial and moderate. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased demand for DC Streetcar service at WUS. As explained in **Section 5.5.1.1**, *Direct Operational Impacts, DC Streetcar*, the streetcar could accommodate the demand without capacity issues. Therefore, the increase in ridership would be a beneficial impact. It would be moderate, as unused capacity would remain.

Intercity, Tour/Charter, and Sightseeing Buses

The current condition of Intercity bus service at WUS are the result of past and present actions. The reasonably foreseeable impact of future actions, including the cumulative projects, would be adverse and major. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased demand for intercity bus service. While this demand could be accommodated, without the Project, existing bus facilities would become overtaxed and passenger experience would degrade, as described in **Section 5.5.1.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses*, resulting in a major adverse impact.

Loading

There are no reasonably foreseeable future impacts on loading capacity or activities at WUS. Increased activities at WUS may cause an increase in deliveries but loading facilities are anticipated to be able to accommodate any likely increase.

Pedestrians

Current pedestrian circulation conditions at WUS are the result of past and present actions. Future actions would likely result in minor adverse impacts outside WUS and major ones within WUS. The cumulative projects, along with District and regional growth and resulting greater numbers of WUS passenger and visitors would result in increased pedestrian volumes in the Study Area, both in and outside WUS. Outside WUS, resulting adverse impacts would be minor. While sidewalks and pedestrian crossings may experience some congestion, maintenance of the existing infrastructure and continued consideration of pedestrian needs in DDOT's planning can reasonably be anticipated to minimize the risk of significant deterioration. Inside WUS, although the station improvement projects included in the cumulative projects would improve circulation in the station, they likely would not be sufficient to prevent frequent congestion in the concourses and access points to the station. This would be a major adverse impact.

Bicycle Activity

Present bicycle circulation conditions at WUS are the result of past and present actions. The impacts of future actions, including the cumulative projects, would likely be adverse and moderate. The cumulative projects, along with District and regional growth and resulting greater numbers of WUS passenger and visitors would result in increased bicycle activity in the Study Area, further compounded by the growing popularity of this mode of transportation. As explained in **Section 5.5.1.1**, *Direct Operational Impacts, Bicycle Activity*, of this report, this may result in a moderate adverse impact due to a shortage of storage spaces or Bikeshare docking stations.

City and Commuter Buses

Past and present actions have shaped the current condition of city and commuter bus service at WUS. The impacts of future actions, including the cumulative projects, on city and commuter buses would likely be adverse and moderate. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased demand on city and commuter buses, as would greater passenger numbers at WUS. As explained in **Section 5.5.1.1**, *Direct Operational Impacts, City and Commuter Buses*, bus ridership would increase and a total of 16 Metrobus routes would be over capacity in the Study Area. This overcrowding would be a moderate adverse impact.

Vehicular Parking and Rental Cars

The current condition of parking and car rental operations at WUS are the result of multiple past and present actions. Future actions, including the cumulative projects, would have no impacts on parking at WUS and minor adverse impacts on rental cars. While some of the developments included among the cumulative projects may not include parking due to District zoning restrictions, most would. Therefore, it is not anticipated that increased parking demand from the growth in residential and working population in the Study Area would create a parking shortage at WUS. The WUS parking facility could continue to accommodate WUS-related demand. Local growth, including the cumulative projects and greater WUS ridership, may lead to greater demand for rental cars at the station. This may result in a minor adverse impact on rental car operations at the station because of their already constrained operations (see **Section 5.5.1.1**, *Direct Operational Impacts, Vehicular Parking and Rental Cars*).

For-hire Vehicles

Current for-hire vehicle operations at WUS are the result of many past and present actions. The reasonably foreseeable impacts of future actions, including the cumulative projects, would likely be adverse and major. Increased activity at WUS would generate greater demand for for-hire vehicles to and from the station. As explained in **Section 5.5.1.1**, *Direct Operational Impacts, For-hire Vehicles*, without the Project, this WUS-related demand would create congested conditions and queuing in front of the station, resulting in a major adverse impact. The various developments included in the cumulative projects would also create additional demand for the services of for-hire vehicles, though to a lesser degree than WUS. This demand would be dispersed across the Study Area. All projected demand for for-hire vehicles was incorporated in the vehicular traffic impact analysis (**Section 18.5.5.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project), Vehicular Traffic* below).

Private Pick-up and Drop-off

Similarly, past and present action have shaped the condition of private pick-up and drop-off operations at WUS. Future actions, including the cumulative projects, would likely be adverse and major. As with for-hire vehicles, increased activity at WUS would generate greater private pick-up and drop-off activity at the station. As explained in **Section 5.5.1.1**, *Direct Operational Impacts, Private Pick-up and Drop-off*, without the Project, this WUS-related activity would create congested conditions and queuing in front of the station, resulting in a major adverse impact. The various developments included in the cumulative projects would also create additional private pick-up and drop-off activity, though to a much lesser degree than WUS. This activity would be dispersed across the Study Area. All projected vehicular trips generated by private pick-ups and drop-offs were incorporated in the vehicular traffic impact analysis (**Section 18.5.5.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project), Vehicular Traffic* below).

Vehicular Traffic

Traffic conditions in the vicinity of WUS have been shaped by past and present actions both local and regional. Future actions, including the cumulative projects, would result in major adverse impacts on traffic. The growth in residential and working population that would result from the cumulative projects, along with general District and regional growth, would generate increased traffic in the Study Area. Reasonably foreseeable future conditions without the Project are those described for the No-Action Alternative in **Section 5.5.1.1**, *Direct Operational Impacts, Vehicular Traffic*.

18.5.5.2 Cumulative Impacts of the Project

Commuter and Intercity Railroads

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in a major beneficial cumulative impact on commuter and intercity railroads.

All Action Alternatives would allow Amtrak, MARC, and VRE to increase service and accommodate planned growth in ridership through 2040 and beyond, as described in **Section 5.5.2.1**, *Direct Operational Impacts, Commuter and Intercity Railroad*. This would fully address the reasonably foreseeable adverse impacts the cumulative projects would cause. Therefore, when added to the impacts of past, present, and reasonably foreseeable projects, the Project would result in a major beneficial cumulative impact.

WMATA Metrorail

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in a moderate adverse cumulative impact on Metrorail.

The impact analyses presented in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail* for Alternative A and corresponding sections of this report for the other Action Alternatives show that in all Action Alternatives, the Project would have a moderate adverse impact on Metrorail ridership at WUS relative to the No-Action Alternative. The No-Action Alternative incorporates growth anticipated to result from past, present, and foreseeable future projects, including the cumulative projects. Therefore, the impacts analyzed in the referenced section are cumulative impacts of the Project.

DC Streetcar

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a minor beneficial cumulative impact on the DC Streetcar.

The impacts analysis presented in **Section 5.5.2.1**, *Direct Operational Impacts, WMATA Metrorail* for Alternative A shows that the Project would have a minor beneficial impact on DC Streetcar ridership when compared to the No-Action Alternative. All Action Alternatives would have a similar impact. The No-Action Alternative incorporates growth anticipated to result from past, present, and foreseeable future projects, including the cumulative projects. Therefore, the impacts analyzed in the referenced section are cumulative impacts of the Project.

Intercity, Tour/Charter, and Sightseeing Buses

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a moderate adverse cumulative impact on intercity, tour/charter, and sightseeing bus operations.

As explained above (**Section 18.5.5.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project), Intercity, Tour/Charter, and Sightseeing Buses)*, there would be reasonably foreseeable major adverse impacts on intercity bus operations at WUS from the cumulative projects because the bus facility would not adequately accommodate increased ridership. When added to past, present, and reasonably foreseeable projects, the Project, in all Action Alternatives, would remedy this condition by providing a new bus facility. However, the use of an "active management" approach at the bus facility would result in more trips in and out of the facility. This may create additional delays for bus operators and buses may need to lay over at other locations in the District or the region, resulting in moderate adverse impacts as described in **Section 5.5.2.1**, *Direct Operational Impacts, Intercity, Tour/Charter, and Sightseeing Buses* for Alternative A and corresponding sections for the other Action Alternatives. Because the No-Action Alternative incorporates growth anticipated to result from past, present, and foreseeable future projects, including the cumulative projects, the impacts analyzed in the referenced sections are cumulative impacts of the Project.

Loading

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in no cumulative impact on loading.

As explained above (**Section 18.5.5.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project), Loading*), without the Project, no reasonably foreseeable impacts on loading at WUS are anticipated. As explained in **Section 5.5.2.1**, *Direct Operational Impacts, Loading* of this report, the Project would have no impact on loading. This would be the case in all Action Alternatives. Therefore, the Project would have no cumulative impacts on loading at WUS.

Pedestrians

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a minor adverse cumulative impact on pedestrian circulation outside of WUS and a major (Alternatives A, B, and A-C) or moderate (Alternatives C through E) beneficial cumulative impacts on pedestrian circulation within WUS.

As explained in **Section 5.5.2.1**, *Direct Operational Impacts, Pedestrians* of this report for Alternative A, the Project would generate additional pedestrian trips relative to the No-Action Alternative both inside and outside WUS. This would be the case in all Action Alternatives and would result in a major or moderate beneficial impact inside WUS and a minor adverse impact outside WUS relative to the No-Action Alternative. Because the No-Action Alternative incorporates growth anticipated to result from past, present, and foreseeable future projects, including the cumulative projects, these impacts are also cumulative impacts.

Bicycle Activity

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a minor beneficial (Alternatives A and A-C) or minor adverse (Alternatives B through E) cumulative impact on bicycle circulation.

As explained in **Section 5.5.2.1**, *Direct Operational Impacts, Bicycle Activity* of this report, the Project would generate additional bicycle trips to and from WUS. The new storage and Bikeshare facilities the Project would provide would accommodate these new trips, resulting in a beneficial impact relative to the No-Action Alternative. Increased conflicts with pedestrians and vehicles would partially offset this benefit, resulting in a minor beneficial net impact. In Alternatives B through E, increased vehicular activity on K Street NE due to the new parking facility entrance would further diminish the benefit of added storage without canceling it, resulting in a net impact that would be adverse but minor. Because the No-Action Alternative incorporates growth anticipated to result from past, present, and foreseeable future projects, including the cumulative projects, the impacts analyzed in **Section 5.5.2.1**, *Direct Operational Impacts, Bicycle Activity* are cumulative impacts.

City and Commuter Buses

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would cause a minor adverse cumulative impact on City and commuter buses.

In All Action Alternatives, the Project would generate additional bus rides. As explained for Alternative A in **Section 5.5.2.1**, *Direct Operational Impact, City and Commuter Buses* of this report, in the aggregate, city buses serving the Study Area would continue to operate below capacity. This would be the case in all Action Alternatives. While sixteen Metrobus routes would operate over capacity, this also be the case without the Project. The No-Action Alternative incorporates growth in city and commuter bus ridership anticipated to result from past, present, and foreseeable future projects, including the cumulative projects, without the Project. Therefore, the impacts analyzed in **Section 5.5.2.1**, *Direct Operational Impact, City and Commuter Buses* are cumulative impacts.

Vehicular Parking and Rental Cars

When considered with other past, present, and reasonably foreseeable projects, the Project would cause a minor (Alternatives B and E) or moderate (all other Action Alternatives) adverse cumulative impact on vehicular parking at WUS. It would have minor beneficial cumulative impacts on rental car operations.

In all Action Alternatives, the Project would result in fewer parking spaces at WUS while the number of WUS passengers and visitors would increase. The reduction in WUS parking spaces, and resulting adverse impact, would vary from minor in Alternatives B and E (190 spaces) to moderate in the other Action Alternatives (455 to 575 spaces: see **Section 5.6**, *Comparison of Alternatives*, **Table 5-113** of this report). Because the cumulative projects would have no adverse impact on parking at WUS (**Section 18.5.5.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project), Vehicular Parking and Rental Cars*), the Project's adverse impacts are also cumulative impacts. All Action Alternatives would provide a new rental car facility as part of the new parking facility. This new facility would be designed to accommodate anticipated demand and address the issues that would occur without the Project. This beneficial cumulative impact would be minor because it would be partially offset by the increased number of rental car operations at WUS.

For-hire Vehicles

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would cause a moderate beneficial cumulative impact on for-hire vehicles at WUS because of the provision of new locations for pick-ups and drop

offs. It would also cause a major (Alternatives A and B) or moderate (other Action Alternatives) adverse cumulative impact due to queuing.

The impact analyses presented in **Section 5.5.2.1**, *Direct Operational Impacts, For-Hire Vehicles* for Alternative A and in the corresponding sections of this report for the other Action Alternatives show that in all Action Alternatives, the Project would generate additional for-hire vehicle trips from increased activity at WUS. These would contribute to adverse cumulative impacts on traffic operations and, as such, were incorporated in the *Vehicular Traffic* analysis (**Section 18.5.5.2**, *Cumulative Impacts of the Project, Vehicular Traffic* below). In all Action Alternatives, the Project would result in a beneficial cumulative impact by providing for new pick-up and drop-off locations at and near WUS and an adverse cumulative impact by increase queuing on H Street NE. This adverse impact would be major in Alternatives A and B and moderate in the other Action Alternatives because Alternatives A and B would have less deck-level queuing space due to the north-south train hall.

Private Pick-up and Drop-off

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would cause a moderate beneficial cumulative impact on private pick-up and drop-off operations at WUS. It would also cause a major (Alternatives A and B) or moderate (other Action Alternatives) adverse cumulative impact due to queuing.

The impact analyses presented in **Section 5.5.2.1**, *Direct Operational Impacts, Private Pick-up and Drop-off* for Alternative A and in the corresponding sections of this report for the other Action Alternatives show that in all Action Alternatives, the Project would generate additional vehicular trips from increased activity at WUS. Along with the trips generated by the cumulative projects, WUS-related trips would contribute to adverse cumulative impacts on traffic operations. As such, they were addressed as part of the *Vehicular Traffic* analysis (**Section 18.5.5.2**, *Cumulative Impacts of the Project, Vehicular Traffic* below). In all Action Alternatives, the Project would result in a beneficial cumulative impact by providing for new pick-up and drop-off locations at and near WUS and an adverse cumulative impact by increase queuing on H Street NE. This adverse impact would be major in Alternatives A and B and moderate in the other Action Alternatives because Alternatives A and B would have less deck-level queuing space due to the north-south train hall.

Vehicular Traffic

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in major adverse cumulative impacts on traffic operations.

In all Action Alternative, the Project would generate additional vehicular trips and impacts on the operation of the street and roadway system relative to the No-Action Alternative. The operational intersection analyses performed for the Action Alternatives and presented in **Section 5.5.2.1**, *Direct Operational Impact, Vehicular Traffic* of this report for Alternative A and corresponding sections for the other Action Alternatives incorporate the impacts of past, present, and foreseeable future projects as background. Therefore, the impacts presented in the referenced sections are cumulative impacts.

18.5.6 Air Quality

18.5.6.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

The impacts of past and present actions in the District generally have had an adverse impact on air quality due to pollutant emissions associated with decades of urban development. Based on current improving trends and continued enforcement of air quality regulations, the reasonably foreseeable adverse impacts of future actions, including the cumulative projects, are anticipated to be minor.

The District attainment status describes the impacts of past and present action on the area's air quality. As explained in **Section 6.4.1**, *Criteria Pollutants and General Conformity*, of this report, the District is a Marginal Nonattainment area for the 8-hour ozone (O_3) standard in an Ozone Transport Region and a Moderate Maintenance area for carbon monoxide (CO) and particulate matter less equal to or than 2.5 micrometers in size ($PM_{2.5}$). The District is an attainment for all other criteria pollutants. Foreseeable future projects, including the cumulative projects, would have negligible adverse impacts on regional air quality provided they comply, as applicable, with the State Implementation and Maintenance Plans in place for the District, and associated emission control programs.[28]

Locally, near WUS, the primary source of air emissions is and would remain mobile sources (vehicular traffic). A quantitative estimate of foreseeable future mobile-source air pollutant emissions excluding the Project is presented in **Section 6.5.1**, *No-Action Alternative*, of this report. The analysis was based on anticipated vehicular traffic levels under the No-Action Alternative, which include the traffic associated with the cumulative projects as well as general growth in the District and Study Area. The analysis included a hotspot analysis for carbon monoxide (CO) and particulate matter (PM) 2.5. It showed that anticipated local annual emissions would be well below the National Ambient Air Quality Standards (NAAQS). A mesoscale analysis of annual criteria pollutant emissions indicated that emissions of CO, $PM_{2.5}$, PM_{10}, Volatile organic compounds (VOC), and nitrogen oxides (NOx) (VOC and NOx are precursors to ozone) would be below the applicable *de minimis* thresholds for those pollutants. In general, future emissions of VOC, NO_X, CO, and $PM_{2.5}$ would decrease relative to existing conditions because of regulation and improved technology. PM_{10} emissions would increase compared to existing conditions because of greater traffic causing brake- and tire-wear emissions, but this adverse impact would be minor.

28 Department of Energy and Environment. *Air Quality Planning*. Accessed from https://doee.dc.gov/service/air-quality-planning. Accessed on April 3, 2020.

18.5.6.2 Cumulative Impacts of the Project

In all Action Alternative, considered with other past, present, and reasonably foreseeable projects, the Project would cause a minor adverse cumulative impact on regional air quality.

As explained in the air quality impact analysis presented in **Section 6.5.2***, Alternative A*, and corresponding sections of this report for the other Action Alternatives, the Project would generate additional emissions of criteria pollutants from mobile sources relative to the No-Action Alternative. The No-Action Alternative air quality analysis incorporated emissions from mobile sources associated with past, present, and reasonably foreseeable future projects, including the cumulative projects, through the inclusion of background traffic in the traffic analysis. Therefore, total emissions under the Action Alternatives represent the cumulative impacts of the Project on air quality.

Locally (hot-spot analysis), emissions would remain well below the NAAQS and cumulative impacts would be negligible. Regionally (mesoscale analysis), the greatest cumulative impact would be on CO emissions, as cumulative traffic within the study area for transportation would generate up to 104.4 tons per year of CO emissions, which is above the 100 ton-per-year *de minimis* threshold applicable to a CO Maintenance Area. While this has no regulatory implication since *de minimis* thresholds apply to individual projects, it suggests a relatively high level of cumulative CO emissions. The most recent available emission inventory for the region (2011) reports CO emissions of 617,710.29 tons per year.[29] By comparison, cumulative CO emissions from the transportation study area would be minor. Cumulative emissions of all other criteria pollutants would be much less than the corresponding *de minimis* and would also be minor.

18.5.7 Greenhouse Gas Emissions and Resilience

18.5.7.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions and their effect on climate are a global concern that is not adequately described at a local or regional level. Every activity anywhere that directly or indirectly generates GHG emissions has cumulatively contributed, and continues to contribute, to the accumulation of such gases in the Earth's atmosphere and resulting adverse impacts on climate conditions. The primary utility of regional, local, or project-level

[29] District Department of the Environment *et al*. July 2014. *2011 Base Year Emissions Inventory for the Washington DC-MD-CA 2008 Ozone NAAQS Nonattainment Area*. Available at: https://mde.maryland.gov/programs/Air/AirQualityPlanning/Documents/SIPDocuments/BY2011%20EI%20Document.pdf. Accessed on August 19, 2019.

inventories is to provide a baseline against which efforts to reduce current and future GHG emissions can be measured and the impacts of individual actions comparatively assessed.

The most recent inventory for the District of Columbia (for 2017) shows total GHG emissions of approximately 7.3 million metric tons of carbon dioxide equivalent (CO_2e), down from approximately 7.5 metric tons the previous year.[30] It represents a 30 percent reduction since the first inventory in 2006. Key drivers behind reductions since 2006 are an increasingly cleaner electric grid, reduced energy use intensity per square foot of building space, and increased vehicle fuel economy.[31] The District has set a goal of reducing District-wide GHG emissions by half between 2006 and 2032 and to be carbon-neutral by 2050. As of 2016, DC had met 56 percent of its 2032 emissions reduction goal. The District's *Clean Energy DC* plan, finalized in 2018, calls for cutting energy use in buildings, shifting to clean energy sources, and changing the way residents, employees, and goods move across the District. [32]

Foreseeable future projects, including the cumulative projects, will contribute additional GHG emissions from both stationary and mobile sources. Production of the energy needed to light, heat, cool, and ventilate the various projects would generate stationary-source emissions. A conservative order-of-magnitude estimate of these emissions can be developed by extrapolating emissions from the estimated energy consumption (**Section 18.5.8.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project)*, **Table 18-5** below) using the same methodology as used for the No-Action Alternative in **Section 7.5.1**, *No-Action Alternative*, of this report. On this basis, annual stationary-source CO_2 emissions caused by the cumulative projects would be approximately 266,841 metric tons. Mobile source emissions would be as estimated for the No-Action Alternative (**Section 7.5.1.2**, *Indirect Operational Impacts, Mobile Source Analysis*) because that analysis was based on anticipated traffic that incorporated background traffic growth, including the cumulative projects. Therefore, mobile source emissions of CO_2 would be approximately 31,284 metric tons per year. Altogether, total annual CO_2 emissions associated with the cumulative projects would be approximately 298,125 metric tons. This would amount to approximately 4 percent the District's 2017 GHG emissions (7.3 million metric tons of CO_2e) and approximately 5.9 percent of the District's 2032 annual target (5.05 million metric tons of CO_2e). However, this order-of-magnitude estimate does not account for reductions in energy consumption and GHG emissions that would result from the implementation of the strategies presented in the

30 District of Columbia Department of Energy and Environment (DDOE). *2006-2017 Greenhouse Gas Inventory*. Accessed from: https://doee.dc.gov/service/greenhouse-gas-inventories. Accessed on August 20, 2019.

31 DDOE. *2006-2016 Greenhouse Gas Inventory*. Accessed from: https://doee.dc.gov/service/greenhouse-gas-inventories. Accessed on August 20, 2019.

32 DDOE. August 2018. *Clean Energy DC. The District of Columbia Climate and Energy Action Plan*. Accessed from: https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Clean%20Energy%20DC%20-%20Full%20Report_0.pdf. Accessed on August 20, 2019.

District's *Climate and Energy Action Plan*, in particular through their incorporation into the District's building codes. [33] Taking this into consideration, the adverse impacts of the cumulative projects would be minor and unlikely to threaten the District's ability to achieve its 2032 GHG goal.

Resilience

In response to growing challenges, the District released *Resilient DC. A Strategy to Thrive in the Face of Change* in April 2019. [34] The strategy is organized around three main drivers of change: economic and population growth; climate change; and technological transformation. *Resilient DC* sets forth four goals (Inclusive Growth; Climate Action; Smarter DC; and Safe and Healthy Washingtonians); 16 objectives; and 68 initiatives. In general, with the implementation of the Strategy, the District's ability to withstand change, including change from evolving climate conditions, can be expected to increase in the mid and long term.

In the vicinity of WUS, future actions, including the cumulative projects, may contribute to this improvement to the extent that they incorporate features that support the plan's goals either through regulatory compliance or on a volunteer basis. For instance, the Strategy's Initiatives include "[ensuring] that all new buildings [are] climate-ready by 2032" and "retrofitting all at-risk buildings by 2050." Overall, the cumulative projects can be expected to have a beneficial impact on resilience in the District, though this impact would likely be minor in the context of the District and the District's resilience strategy as a whole.

18.5.7.2 Cumulative Impacts of the Project

Greenhouse Gas Emissions

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in negligible adverse cumulative impacts on GHG emissions.

As explained for Alternative A in **Section 7.5.2.2**, *Indirect Operational Impacts* of this report, and corresponding sections for the other Action Alternatives, the Project would generate additional emissions of CO_2 from both stationary and mobile sources. As shown in **Section 7.6**, *Comparison of Alternatives*, **Table 7-28**, based on order-of-magnitude estimates, Project-related annual emissions would range approximately from 17,370 to 26,453 metric tons, depending on the alternative. This would add to District-wide emissions, increasing the study area's contribution approximately from 298,125 metric tons to up to 324,578 metric tons, or about 4.4 percent of the District's 2017 GHG emissions and 6.4 percent of its annual emission

[33] DDOE. August 2018. *Clean Energy DC. The District of Columbia Climate and Energy Action Plan*. Accessed from: https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Clean%20Energy%20DC%20-%20Full%20Report_0.pdf. Accessed on August 20, 2019.

[34] Available at: https://resilient.dc.gov/. Accessed on August 20, 2019.

target for 2032. These are conservative estimates, which do not take into account reductions to be achieved under the District's GHG policies. Even on this basis, in the context of the global impact on climate of GHG emissions, the difference made by Project-related emissions, when added to those from past, present, and foreseeable future actions in District, would be negligible.

Resilience

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in a major beneficial cumulative impacts on resilience.

The Project, when added to past, present, and foreseeable future actions, would increase District-wide resilience, resulting in a major beneficial cumulative impact. Specifically, it would directly contribute to fulfilling one of *Resilient DC*'s initiatives, which is to "call on regional transit providers […] to improve regional integration (such as coordinated schedule, *increased Union Station capacity and frequency*, fare integration, free transfers) and expand night and weekend service for key residential and employment zones."[35] To the extent that the design of the Project incorporates features that enhance its ability to withstand climate change-related events, it would also cumulatively contribute to improving local resiliency.

18.5.8 Energy Resources

18.5.8.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

The impacts of past actions in the District generally have had an adverse impact on energy demand and consumption through many decades of growth and development. These impacts have been addressed through the development and maintenance energy production, acquisition, and distribution systems. Based on the current condition of these systems, and the District's energy goals and policies, the impacts of present and reasonably foreseeable actions can be anticipated to be minor.

In 2017, total energy consumption in the District was 168 billion kBTUs. [36] Most of this energy was produced outside the District. The District has no electrical plants with the exception of the General Services Administration's Central Heating Plant, which supplies various Federal facilities, including WUS, with electricity, steam, and chilled water. The Central Heating Plant

35 *Resilient DC. A Strategy to Thrive in the Face of Change*, page 73 (emphasis added). Accessed from https://resilient.dc.gov/. Accessed on August 20, 2019.

36 U.S. Energy Information Administration. *District of Columbia Energy Profile*. https://www.eia.gov/state/print.php?sid=DC. Accessed on August 21, 2019.

recently completed the addition of a 7.5 megawatt cogeneration facility.[37] The plant is fueled by natural gas. Most electricity used in the District comes from outside and is supplied by the local electric utility, Pepco.

The *Clean Energy DC* plan aims to reduce energy consumption in the District by 50 percent in 2032 through efficient building design and operations; modernized renewable energy supply; and vehicle electrification and fuel switching. [38]

Future development in the District both has the potential to increase total energy consumption and offers opportunities for improving efficiency and reducing per unit consumption. As an illustration, an order-of-magnitude consumption estimate can be developed for the cumulative projects based on land use. **Table 18-5** shows this estimate, developed using the information provided in **Table 18-2** and the same approach as used for the No-Action Alternative in **Section 8.5.1.1,** *Direct Operational Impacts,* **Table 8-1** of this report.

Table 18-5. Estimated Cumulative Future Energy Use

Use	Energy Star Site EUI[1]	Total Square footage	Estimated Annual Energy Use (kBTUs)
Residential	73.4	14,440,000 sf[3]	1,059,896,000
Hotel	73.4	1,190,000 sf[4]	87,346,000
Office	67.3	6,900,000 sf	464,370,000
Retail	93.7	1,130,000 sf	105,881,000
Mixed Use	73.4[2]	3,200,000 sf	234,880,000
Total			1,952,373,000

EUI = Energy Use Intensity; sf= square foot; kBTU = Kilo British Thermal Unit
1. EUI = Energy Use Intensity; values derived from Energy Star Portfolio Manager. March 2016. Technical Reference. U.S. Energy Use Intensity by Property Type.
2. For the purposes of this estimate, the hotel EUI was used for mixed use development.
3. Assumes an average of 950 gross square feet per unit.
4. Assumes 850 square feet per key.

The numerous private development projects in the Study Area would consume a large amount of energy. However, the estimate above does not account for improved energy efficiencies as mandated or encouraged by the District. [39] For that reason, it is conservative. Given the urban context, the moderate scale of most of the planned projects, and their

37 Architect of the Capitol. *Cogeneration at the Capitol Power Plant*. Accessed from https://www.aoc.gov/cogeneration. Accessed on August 21, 2019.

38 DDOE. August 2018. *Clean Energy DC. The District of Columbia Climate and Energy Action Plan*. Accessed from: https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Clean%20Energy%20DC%20-%20Full%20Report_0.pdf. Accessed on August 20, 2019.

39 District Department of Energy and Environment. 2018. "Energy Related Regulations." Accessed from https://doee.dc.gov/service/energy-related-regulations. Accessed on October 1, 2018.

implementation over many years, resulting increases in energy consumption would be manageable and are not likely to cause shortages or other supply issues. Altogether, based on the order-of-magnitude estimates showed in **Table 18-5**, the cumulative project's energy consumption would represent approximately 1.16 percent of the total amount of energy consumed in the District in 2017 (168 billion kBTUs). Adverse impacts would be minor.

18.5.8.2 Cumulative Impacts of the Project

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would cause a minor adverse cumulative impact on energy resources.

In all Action Alternatives, the Project would cause an increase in energy use in the Study Area to light, heat, cool, and ventilate the expanded WUS. As shown in **Section 8.6**, *Comparison of Alternatives*, **Table 8-21** of this report, the amount of energy used by the Project annually would range approximately from 41,208,000 to 103,923,000 kBTUs, depending on the Action Alternative. This would represent a very small increment (approximately 0.06 percent in Alternative B, the Action Alternative with the greatest increase) relative to the District's total energy consumption in 2017. Added to the energy used by the cumulative projects, it would result in a foreseeable future energy consumption ranging from 1,993,581,000 to 2,056,296,000 kBTUs, or approximately from 1.18 to 1.22 percent of the District's energy consumption in 2017, depending on the Action Alternative. The Project, when considered along with past, present, and reasonably foreseeable future actions, is not likely to cause energy shortages or other issues. Adverse cumulative impacts would be minor.

18.5.9 Land Use, Land Planning, and Property

18.5.9.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Zoning, Land Use, and Development

Zoning, land use, and development near WUS are the result of multiple past and present actions. Future actions, including the cumulative projects, would likely have major beneficial impacts. The multiple residential and commercial developments included in the cumulative projects would be subject to District zoning and land use regulations. Compliance with these requirements, as applicable, would ensure that new land uses are compatible with the existing urban fabric and approved city-wide and local plans. One of the most notable changes in land use in the Study Area would result from the private air-rights development above the WUS rail terminal. This would replace what is currently an open space dominated by railroad infrastructure and the H Street Bridge with a dense mixed-use neighborhood and would improve connectivity between the neighborhoods on either side of WUS. Another project, Capitol Crossing, is filling out a similar gap above Interstate 395 with mixed use development as well. Overall, with the cumulative projects, the Study Area would become a more unified, better connected, and economically vibrant part of the District.

Property Ownership, Land Acquisitions, and Displacements

The cumulative projects would have no impacts on property ownership, land acquisition, or displacement.

Consistency with Local and Regional Plans

The reasonably foreseeable future impacts of the cumulative projects on local and regional plans would be beneficial. [40] As noted above, the cumulative projects would be subject to District zoning and land use regulations and permitting requirements. Compatibility with applicable city-wide and local plans would be ensured through these processes. Collectively, it can be anticipated that the cumulative projects would contribute to implementing, or at least would not preclude, the successful implementation of the relevant plans' goals and objectives.

18.5.9.2 Cumulative Impacts of the Project

Zoning, Land Use, and Development

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a major beneficial cumulative impact on land use.

The expansion of WUS in all Action Alternatives would enhance WUS's functionality as a multimodal facility and improve connectivity among the neighborhoods on either side of the rail terminal. The expanded station would accommodate increased intercity and commuter train service, which in turn would support nearby existing and future residential and commercial developments by making the area more accessible. The Project would also make available for potential development between approximately 323,720 and 952,600 square feet of Federal air rights within the footprint of the existing WUS garage and existing Federal property, depending on the Action Alternative. This would further enhance land use in the Study Area. The Project would contribute and add to the beneficial impacts on land use that would result from the cumulative projects. Cumulative impacts would be major and beneficial.

Property Ownership, Land Acquisitions, and Displacements

When considered with other past, present, and reasonably foreseeable projects, the Project would result in a moderate (Alternatives A, B, D, E, and A-C) or major (Alternative C) adverse cumulative impact on private property.

[40] This beneficial impact is not assigned an intensity because how much the cumulative projects would support the goals and objectives of the relevant plans is difficult to assess in the aggregate.

As noted above, the cumulative projects would have no impact on property ownership, land acquisition, or displacement. Therefore, the Project's cumulative impacts on these factors are the impacts of the Project alone. These are described in **Section 9.2.5.1**, *Direct Operational Impacts, property ownership, land acquisition, or displacement* of this report for Alternative A and corresponding sections for the other Action Alternatives.

Consistency with Local and Regional Plans

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a beneficial cumulative impact on local and regional plans.

As explained for Alternative A in **Section 9.2.5.1**, *Direct Operational Impacts*, *Consistency with Local and Regional Plans*, of this report and corresponding sections for the other Action Alternatives, the Project would be consistent with and support many of the relevant plans' goals and objectives, especially those pertaining to transportation and connectivity. These beneficial impacts, when added to those of past, present, and foreseeable future projects, including the cumulative projects, would result in beneficial cumulative impacts.

18.5.10 Noise and Vibration

18.5.10.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Current noise and vibration levels near WUS reflect the impacts of multiple past and present actions. In the foreseeable future, the cumulative projects are anticipated to result in major beneficial or negligible adverse impacts depending on the location. None of the cumulative projects involve the establishment and operation of a significant stationary source of noise and vibration. Any changes in noise and vibration levels in the Study Area would be the result of changes in mobile source noise (trains and motor vehicles). **Section 10.5.1.1***, No-Action Alternative, Direct Operational Impacts* of this report presents an analysis of future noise levels in the Noise and Vibration Study Area without the Project. Overall, future ambient noise levels would range from 60 to 75 A-weighted decibels (dBA) day-night average sound level (Ldn) at most locations. This is typical of a dense urban area and similar to current noise levels. Near WUS south of K Street, there would be a major beneficial impact from a decrease in noise levels due to the private air-rights development that would be constructed above the rail terminal and cover the tracks that are currently in the open. In locations nearest the tracks, noise levels would be reduced by more than half. Elsewhere, noise level would increase but nowhere by more than 3 dBA, which is the threshold of perception. Noise levels are, and would remain, highest along the non-covered parts of the rail terminal and corridor (north of K Street) and along New York Avenue, Florida Avenue, North Capitol Street, K Street, H Street, and Massachusetts Avenue. Vibration levels would increase at location near VRE's MSRF but would remain below applicable thresholds (**Section 10.5.1.1**, *No-Action Alternative, Direct Operational Impacts, Operational Vibration).*

18.5.10.2 Cumulative Impacts of the Project

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would cause negligible adverse impacts on noise and vibrations in the Noise and Vibration Study Area, except at 14 modeled locations, where it would result in moderate adverse cumulative impacts on noise.

In all Action Alternatives, the Project would generate additional noise and vibration in the Study Area because of the associated increase in train and motor vehicle traffic. The noise analysis presented in **Section 10.5.2**, *Direct Operational Impacts* of this report for Alternative A, and in the corresponding sections for the other Action Alternatives, is cumulative in that it incorporates noise from present and foreseeable future traffic along with that associated with the Project. The analysis shows that noise levels in the Study Area would generally be within 1 to 3 dBA of No-Action Alternative levels, which is an imperceptible difference. Noise levels would continue to range from 60 to 75 dBA (Ldn), typical of an urban environment. Similarly, vibration levels from trains would not perceptibly change. Therefore, the cumulative adverse impacts of the Project would be negligible expect at 14 modeled locations where this slight increase would bring noise levels above the threshold for a moderate impact (these locations are shown in **Figure 10-11** of this report). At these locations, cumulative adverse impacts would be moderate.

18.5.11 Aesthetics and Visual Quality

18.5.11.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

The appearance of the District in the vicinity of WUS is the result of multiple past and present actions that have shape the neighborhoods on either side of the station. In the foreseeable future, the cumulative projects may have adverse or beneficial, major to negligible impacts on this appearance, depending on location and point of view. Continued development in the Study Area through 2040 will affect the aesthetic and visual environment. Because the Study Area is an already densely developed urban area, future developments mostly will fill in existing gaps in the urban fabric or replace older land uses. Among the cumulative projects, the private air-rights development has the highest potential to affect visual quality in the Study Area, as it would cover the WUS rail terminal south of K Street with new residential and commercial buildings. The visual impact analysis presented in **Section 11.5.1.1**, *Direct Operational Impacts*, found that this project has the potential to result in adverse impacts on 20 out of 27 views analyzed. However, because the project has not been designed, this analysis is based only on the massing, heights, and densities permitted by the applicable zoning regulations. How the private air-rights development, as well as the other cumulative projects being planned, would actually affect the visual quality of the Study Area depends on their actual design, height, and density. They have the potential to result in beneficial as well as adverse impacts, for instance through the creation or recreation of continuous street walls or the replacement of visually incompatible land uses with visually compatible ones. New developments are subject to the District's zoning regulations, including height and density limits, and can generally be expected to by visually compatible with their immediate environment.

18.5.11.2 Cumulative Impacts of the Project

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have potential negligible to moderate cumulative adverse and beneficial impacts on aesthetics and visual quality, depending on the location.

In general, the Project, when added to past, present, and future reasonably foreseeable actions, would introduce new visual elements in the Project Area, such as a new train hall, bus facility, and, in all but two Action Alternatives (B and E), a new parking facility in the Project Area. While these elements would be visible from area near WUS, the private air-rights development would surround, obscure, encompass, or balance them, reducing their visibility. The visual impact analysis presented in **Section 11.5.2,** *Alternative A* through **Section 11.5.7**, *Alternative A-C (Preferred Alternative)* of this report is cumulative in that it takes into account the private air-rights development when assessing anticipated changes in views. This development is the only other project with which the Project would generate noticeable cumulative impacts. The visual impact analysis, whose findings are summarized in **Section 11.6**, *Comparison of Alternatives*, **Table 11-21** of this report, shows that, depending on the Action Alternative, the Project may adversely affect from 5 to 10 of the 28 views and vistas considered and that adverse impacts would range from moderate to negligible. The Project may also have beneficial impacts on one to two views.

Most of the Project's visual impacts are conservatively described as adverse because the assessment is based only on massing and visibility. For this reason, these impacts are mostly potential. At this stage of design, there is not enough information on materials and specific architectural features to allow for a more refined evaluation. However, the Project Proponents are committed to a Project design that is compatible with the design of the historic station building and makes the expanded WUS into a grand gateway into the Nation's capital. Additionally, the Project would be subject to review and approval by the Commission of Fine Arts (CFA) and the National Capital Planning Commission, which would help ensure that it is in keeping with its visual and cultural environment. On this basis, the Project can be expected to be visually consistent with its surroundings.

18.5.12 Cultural Resources

18.5.12.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Cultural resources near WUS reflect the history of the neighborhoods on either side of the station. The foreseeable impacts of the cumulative projects on these resources have the potential to be adverse and major to negligible. The cumulative projects may adversely affect cultural resources in the Study Area. Some, such as private air-rights development above the

WUS rail terminal or the various improvement project at WUS, have the potential to have physical and visual adverse impacts on WUS itself, the WUS Historic Site, and the Railway Express Agency (REA) Building. For example, as explained in **Section 12.5.2.1**, *Direct Operational Impacts* of this report, construction of the foundations and columns to support the air-rights deck would involve alterations to the rail terminal that may compromise its integrity of design, materials, setting, workmanship, feeling, and association. It would also permanently disrupt its visual connections to the other elements of the Historic Site, including the REA Building. Additionally, much of the rail terminal has moderate to high archaeological potential. Although it contains no known archaeological sites, drilling for the private air-rights deck columns may inadvertently damage or destroy unknown significant archaeological deposits. The risk of such impacts would be minimized through compliance with historic preservation regulations. Federally funded projects are subject to review under Section 106 of the National Historic Preservation Act (Section 106). Although the private air-rights development is not a Federal Project, it is subject to review and approval by the District State Historic Preservation Office and CFA.

Most of the cumulative projects are private projects and, as such, not subject to Section 106. These projects could result in adverse impacts to cultural resources if they involve the demolition or alteration of a cultural resource such as a historic building; or if they sufficiently change the visual or aural setting of a resource to diminish its integrity of setting, feeling, or association. The risk of impacts on cultural resources would be minimized through compliance with the District’s historic preservation laws and regulations, including review by the Historic Preservation Review Board of projects that may affect cultural resources.

18.5.12.2 Cumulative Impacts of the Project

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have potential major cumulative adverse impacts on WUS and the WUS Historic Site.

In all Action Alternatives, the Project, when added to past, present, and future reasonably foreseeable actions, would result in major direct adverse impacts on WUS because of the removal of the Claytor Concourse, column removal in the Retail and Ticketing Concourse, and construction of Project elements adjacent to the historic station building. Because of the reconstruction of the rail terminal and column removal work, the Project would also increase the risk of major potential adverse impacts on archaeological resources if any are present. As much as possible, these impacts would be avoided, minimized, or mitigated through the Section 106 process. The Project would also contribute visual and noise-related impacts on multiple cultural resources in the Study Area additional to those of past, present, and reasonably foreseeable actions. These impacts would range from negligible to moderate, as summarized in **Section 12.6**, *Comparison of Alternatives*, **Table 12-3**, of this report.

18.5.13 Parks and Recreation Areas

18.5.13.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

The current condition of parks and recreation areas near WUS incorporates the impacts of past and present actions. The foreseeable future impacts of the cumulative projects on these resources likely would be adverse and moderate. There are multiple parks and recreation areas in the Study Area, including neighborhood and community parks, school recreational facilities, memorials, plazas, and other open areas accessible to the public. None of the cumulative projects would physically affect these areas, which would remain available to the public. However, growth of the local residential and working population would likely result in increased use, which may cause accelerated wear and tear of pavements and landscape elements and increase maintenance costs.

18.5.13.2 Cumulative Impacts of the Project

In All Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have minor cumulative adverse impacts on parks and recreation areas.

In all Action Alternatives, the Project would generate more activity at WUS, bringing more people to the area. Some of these people may make use of local park and recreation areas, leading to accelerated wear and tear and increased maintenance costs. The increase in visit and foot traffic attributable to the Project would likely be small, however, and cumulative adverse impacts would be minor.

18.5.14 Social and Economic Conditions

18.5.14.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Demographics

The current demographic make-up of the District is the result of past and present actions. In the foreseeable future, the cumulative projects would have a moderate impact on demography. The population of the District would grow through 2040. District of Columbia Office of Planning (DCOP) projections show a total population of approximately 941,000 in 2040, with an average growth of 11,000 a year.[41] The cumulative projects would add 15,200 residential units to the District. Assuming an average of 2.1 persons per household, this

[41] DCOP. *Forecasting the District's Growth. Results and Methodology*. November 2016. Accessed from https://planning.dc.gov/node/1212966. Accessed on January 30, 2019.

would provide housing for 31,920 persons.[42] This number does not include the residential units that would be constructed as part of the 3.2 million square feet of mixed-use development included in the cumulative projects. The job opportunities created by the cumulative projects may also encourage more people to move to the District. Based on projected 2040 population size and average annual growth, this would represent a moderate impact. [43]

Community Disruption and Other Social Benefits or Impacts

Current conditions in the neighborhoods around WUS are the result of multiple past and present actions. In the foreseeable future, the cumulative projects may have both adverse and beneficial impacts but these impacts would be moderate. The cumulative projects are part of and continue a long-term trend of densification and redevelopment across the Study Area, illustrated by the evolution of the NoMA neighborhood since the early 2000s after extensive planning in the 1990s.[44] This trend has had beneficial impacts on local communities, such as increased employment opportunities; more and better urban amenities; better connectivity among neighborhoods and sub-neighborhoods. The cumulative projects would contribute to these positive trends. Among these projects, the private air-rights development above the WUS rail terminal would substantially improve connections between the areas to the east and west of the terminal and fill in what is currently a large gap in the urban fabric. These same projects may also have adverse community impacts to the extent that they would cause an influx of new population and higher housing costs, which may result in the displacement of long-time residents, especially low-income and minority residents, a process generally referred to as gentrification. Because redevelopment and gentrification are long-term trends that the cumulative projects would continue but did not create, their impacts, both beneficial and adverse, can be considered moderate.

Employment

Existing levels and types of employment in the District incorporate the impacts of numerous past and present actions. The foreseeable future impacts of the cumulative projects on employment would be beneficial and moderate. Based on the square footage of commercial development, the cumulative projects would support 31, 515 jobs. [45] This number does not

[42] Household size assumption based on the weighted average of average household size of the census tracts in the Social and Economic Conditions Local Study Area as derived from 2011-2015 ACS 5-year estimates.

[43] This demographic impact is not characterized as adverse or beneficial because a change in residential population does not in itself represent a favorable or unfavorable outcome in the context of the District.

[44] Audrey Hoffer, "Where We Live: NoMa, the Wrong Side of the Tracks No More," *Washington Post*, February 6, 2015.

[45] Assumes 1 employee per 250 square feet of office space, 3 employees per 1,000 square feet of retail use, and 1 employee per 2.67 hotel rooms.

include the jobs that would be supported by the commercial uses that would be part of the 3.2 million square feet of mixed-use development included in the cumulative projects. According to the 2017 District's Economic Strategy report, as of October 2016, there were an estimated 783,200 jobs in the District. [46] The jobs associated with the cumulative projects approximately represent at least 4 percent of this total. They would represent at least 3.1 percent the 1,012,000 jobs projected by DCOP for 2040. Thus, although beneficial, the impacts would be moderate.

Washington Union Station Revenue

Current WUS revenue is the result of past and present action at the station. The reasonably foreseeable future impacts of the cumulative projects on WUS revenue would likely be beneficial but negligible. The cumulative projects would have a beneficial impact on WUS revenue to the extent that the activity they generate results in an increase in demand for services, such as parking, from which WUS derives a revenue. While this potential impact cannot be quantified, it is likely to be small and negligible in the context of WUS's total revenues.

Other Economic Impacts

Other reasonably foreseeable future economic impacts of the cumulative projects would be beneficial and moderate. The cumulative projects would create and support economic activity that would generate economic benefits through worker's wages and profit from commercial operations. The spending of private and commercial income would in turn generate more economic activity both locally and regionally. This activity would generate revenue for the District through sales, property, and income taxes. While these economic and fiscal benefit cannot be estimated, they are likely to amount to a moderate beneficial impact in the context of the District as a whole.

18.5.14.2 Cumulative Impacts of the Project

Demographics

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in a negligible cumulative impact on demography.

As explained for Alternative A in **Section 14.5.2.2**, *Indirect Operational Impacts, Demographics*, of this report, and corresponding sections for the other Action Alternatives, the Project, by improving connectivity and increasing activity at WUS may indirectly cause

[46] *DC's Economic Strategy* report, 2017. Accessed from http://dceconomicstrategy.com/wp-content/uploads/2017/03/Econ-Strategy_Full-Report-for-Distribution_03.07.17-1-1.pdf. Accessed on May 10, 2020.

more people to move to the Study Area, in addition to the increase in population associated with the cumulative projects. While not quantifiable, this impact would likely be negligible in the context of the District and Study Area. [47]

Community Disruption and Other Social Benefits or Impacts

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would result in a major beneficial cumulative impact with regard to community disruption and other social benefits.

In all Action Alternatives, the Project, when added to past, present, and reasonably foreseeable actions, would have a major beneficial impacts by providing more and better intermodal connectivity that would benefit both the Study Area and the District as a whole. It would make the Study Area more accessible, providing residents and employees with improved commuting options. This would support ongoing and future development and contribute to addressing the consequences of this development on transportation system. The Project would also directly contribute additional economic activity through new retail at WUS, from 72,000 to 100,000 square feet, depending on the Action Alternative, though it would be a small increment to the retail included in the cumulative projects. In all Alternative except Alternative A, the Project would also potentially lead to the development of the remaining Federal air rights above the rail terminal, further contributing to the economic development of the Study Area and the District.

Employment

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a minor beneficial cumulative impact on employment.

As explained for Alternative A in **Section 14.5.2.1**, *Direct Operational Impacts, Employment*, of this report, and corresponding sections for the other Action Alternatives, the Project would add to the number of jobs the cumulative projects would support. Depending of the Action Alternative, the Project would support from 1,445 to 5,255 jobs from increased activity and new retail at WUS and the potential development of the Federal air rights above the WUS rail terminal. While this would be a beneficial cumulative impact, it would be minor compared to the jobs supported by the cumulative projects as well as to present and future employment in the District as a whole.

[47] The demographic impact is not characterized as adverse or beneficial because a small change in residential population does not in itself represent a favorable or unfavorable outcome.

Washington Union Station Revenue

When considered with other past, present, and reasonably foreseeable projects, the Project would have a moderate (Alternatives A and A-C) or major (other Action Alternatives) adverse cumulative impact on WUS revenue.

In Alternatives A and A-C, the Project would reduce the number of parking spaces at WUS (**Section 14.5.3.1**, *Direct Operational Impacts, Washington Union Station Revenue*), thereby reducing the revenue the station derives from parking. In the other Action Alternatives, all parking would be located outside the station's lease area, eliminating the parking revenue stream altogether. Adding these adverse impacts to the negligible beneficial impacts of the cumulative projects would result in a moderate adverse cumulative impact in Alternatives A and A-C and in a major adverse cumulative impact in the other Action Alternatives.

Other Economic Impacts

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have a minor beneficial cumulative impact on economic conditions.

The Project would have beneficial cumulative impacts on the economy through the economic activity it would support and promote at WUS and in the Study Area, including the provision of new retail at WUS and support of 1,445 to 5,255 jobs, in addition to the activity supported by the cumulative projects. The spending of Project-generated private and commercial income would in turn generate more economic activity both locally and regionally. This activity would generate revenue for the District through sales, property, and income taxes. While these economic and fiscal benefit cannot be estimated, they likely would be proportionately small and minor compared to the benefits of the cumulative projects.

18.5.15 Public Safety and Security

18.5.15.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Conditions pertaining to public safety and security at and near WUS are the result of multiple past and present actions. The future foreseeable impacts of the cumulative projects on public safety and security would be adverse and major. Development and growth in the Study Area would result in increased demands on police and emergency services. It would also create security risks by offering new targets to potential terrorist attacks. A notable source of risk would be the provision of parking within the private air-rights development deck above the WUS rail terminal. Greater vehicular traffic and pedestrian circulation would increase the risk of conflicts or accidents. In general, however, these are impacts that commonly occur in active urban area and near large public facility such as WUS. None of cumulative projects would generate special or unusual public safety concerns. Emergency services would have time to plan for increases in personnel and equipment need. Adverse impacts would be moderate.

18.5.15.2 Cumulative Impacts of the Project

In all Action Alternatives, when considered with other past, present, and reasonably foreseeable projects, the Project would have moderate beneficial impacts on security and moderate adverse impacts on public safety.

In all Action Alternatives, the Project would create new security risks at WUS but also provide the opportunity to enhance security measures at the station, as described in **Section 15.5.2.1**, *Direct Operational Impacts*, of this report. At WUS, this would result in net beneficial impacts on security that would be major (Alternatives A, B, and A-C) or moderate (other Action Alternatives). When added to the impacts of the cumulative projects, given the prominence of WUS as a potential target of terrorist attacks, this would result in a beneficial cumulative impact, although a moderate one, as it would only affect WUS and its immediate surroundings.

The Project would also have an adverse cumulative impact on safety, as it would add further to the demand for emergency services that the cumulative projects would generate. For the same reason as for the cumulative projects (see **Section 18.5.15.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project)* above), this adverse cumulative impact would be moderate.

18.5.16 Public Health, Elderly, and Persons with Disabilities

18.5.16.1 Impacts of Past, Present, and Foreseeable Future Actions (without the Project)

Current conditions pertaining to public health, the elderly, and persons with disabilities at WUS and nearby incorporate the impacts of numerous past and present actions. In the foreseeable future, the cumulative projects would have no impacts on public health. They may have negligible adverse impacts on the mobility of the elderly and persons with disabilities. None of the cumulative projects would create public health concerns. They are development projects typical of an active urban environment. Emissions of criteria air pollutants would remain below the NAAQS (See **Section 18.5.6.1**, *Impacts of Past, Present, and Foreseeable Future Actions (without the Project)*). Greater density and vehicular circulation may create challenges to the mobility of the elderly and persons with disabilities. However, it can be anticipated that such issues would be alleviated through continuing improvements and upgrades to the transportation system, such as provision of high-visibility sidewalks with wheelchair ramps and detectable warning surfaces to aid visually impaired individuals and accessible pedestrian signal equipment. Projects would also have to comply with ADA requirements, as applicable. Therefore, any adverse impacts would be negligible.

18.5.16.2 Cumulative Impacts of the Project

When considered with other past, present, and reasonably foreseeable projects, the Project would have a negligible adverse cumulative impact on public health in all Action Alternatives. It would have a major (Alternatives A and A-C) or moderate (other Action

Alternatives) cumulative beneficial impacts on the transportation and mobility of the elderly and persons with disabilities at WUS. Outside of WUS, it would have a minor adverse impact in all Action Alternatives.

The Project would not create conditions that would directly threaten or diminish public health when considered with other past, present, and reasonably foreseeable projects. As explained in **Section 18.5.6.2**, *Cumulative Impacts of the Project*, above, the Project would result in relatively high cumulative emissions of CO. The potential for this air quality impact to affect public health is negligible because it would occur at a regional scale. Microscale emission analysis (**Section 6.5.2.1**, *Direct Operational Impacts, Microscale Analysis: CO Hotspot* for Alternative A and corresponding sections of this report for the other Action Alternatives) shows that localized emissions of CO near roadways, which is where potential adverse health effects from outdoor CO generally occur,[48] would remain well below the NAAQS under all Action Alternatives.

In all Action Alternatives, the Project would have a major cumulative beneficial impact on the mobility of the elderly and persons with disabilities at WUS in Alternatives A and A-C, and a moderate cumulative beneficial impact in the other Action Alternatives for the reasons explained in **Section 16.5.2.1**, *Direct Operational Impacts* of this report for Alternative A and corresponding sections for the other Action Alternatives. The Project would also contribute to increasing pedestrian, bicycle, and vehicular activity, which would result in adverse impacts on the mobility of the elderly and persons with disabilities outside of WUS, but it would also include improvement that would partially offset these impacts, as described in **Section 16.5. 2.2**, *Indirect Operational Impacts.* Therefore, cumulative adverse impacts on circulation outside of WUS would be minor.

18.5.17 Environmental Justice

As explained in **Section 17**, *Environmental Justice*, of this report, the Project would not result in disproportionately high and adverse impacts on environmental justice (EJ) communities, nor would EJ communities be denied any benefits from the Project. None of the cumulative impacts identified in this section would amount to disproportionately high and adverse impacts on EJ communities for the same reasons as presented in **Section 17**, *Environmental Justice*.

[48] U.S. Environmental Protection Agency. July 2010. *Quantitative Risk and Exposure Assessment for Carbon Monoxide – Amended*. *Section 2.2, Exposure Pathways and Important Microenvironments*. Individual exposure to CO primarily occurs indoors, in near-traffic microenvironments, and inside vehicles.

18.6 Avoidance, Minimization and Mitigation Evaluation

The previous sections covering the individual resource areas document measures being considered to avoid, minimize, and mitigate the impacts of the Project. These measures would also serve to avoid, minimize, and mitigate cumulative impacts.