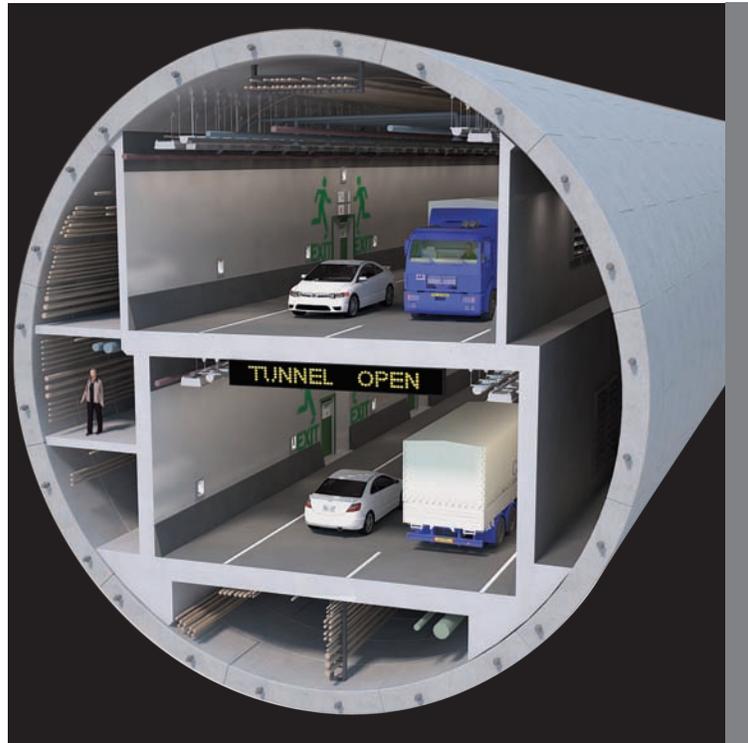


# ALASKAN WAY VIADUCT REPLACEMENT PROJECT

## 2010 Supplemental Draft Environmental Impact Statement

### APPENDIX K Public Services & Utilities Discipline Report



Submitted by:  
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Prepared by:  
PARAMETRIX



OCTOBER 2010

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# **Alaskan Way Viaduct Replacement Project**

## **Supplemental Draft EIS**

### **Public Services and Utilities Discipline Report**

The Alaskan Way Viaduct Replacement Project is a joint effort between the Federal Highway Administration (FHWA), the Washington State Department of Transportation (WSDOT), the City of Seattle. To conduct this project, WSDOT contracted with:

**Parsons Brinckerhoff**

999 Third Avenue, Suite 3200  
Seattle, WA 98104

**In association with:**

Coughlin Porter Lundeen, Inc.  
EnviroIssues, Inc.  
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HDR Engineering, Inc.  
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Magnusson Klemencic Associates, Inc.  
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Parametrix, Inc.  
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## ACRONYMS AND ABBREVIATIONS

BMP	best management practice
CEQ	Council on Environmental Quality
City	City of Seattle
CO <sub>2</sub>	carbon dioxide
DoIT	Seattle Department of Information Technology
EBI	Elliott Bay Interceptor
EIS	Environmental Impact Statement
ELI	Electric Lightwave, LLC
FWHA	Federal Highway Administration
I-5	Interstate 5
kV	kilovolt
LOS	level of service
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NRDS	North Recycling and Disposal Station
Program	Alaskan Way Viaduct and Seawall Replacement Program
project	Alaskan Way Viaduct Replacement Project
PSE	Puget Sound Energy
SCL	Seattle City Light
SDOT	Seattle Department of Transportation
SFD	Seattle Fire Department
SPD	Seattle Police Department
SPU	Seattle Public Utilities
SR	State Route
SRDS	South Recycling and Disposal Station
TBM	tunnel boring machine
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

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# Chapter 1 INTRODUCTION AND SUMMARY

## 1.1 Introduction

This discipline report evaluates the Bored Tunnel Alternative, the new alternative under consideration for replacing the Alaskan Way Viaduct. This report and the Alaskan Way Viaduct Replacement Project Supplemental Draft Environmental Impact Statement (EIS) that it supports are intended to provide new information and updated analyses to those presented in the March 2004 Alaskan Way Viaduct and Seawall Replacement Project Draft EIS and the July 2006 Alaskan Way Viaduct and Seawall Replacement Project Supplemental Draft EIS. The discipline reports present the detailed technical analyses of existing conditions and predicted effects of the Bored Tunnel Alternative. The results of these analyses are presented in the main volume of the Supplemental Draft EIS.

The Federal Highway Administration (FHWA) is the lead federal agency for this project, primarily responsible for compliance with the National Environmental Policy Act (NEPA) and other federal regulations, as well as distributing federal funding. As part of the NEPA process, FHWA is also responsible for selecting the preferred alternative. FHWA will base their decision on the information evaluated during the environmental review process, including information contained within the Supplemental Draft EIS and the subsequent Final EIS. FHWA can then issue their NEPA decision, called the Record of Decision (ROD).

The 2004 Draft EIS (WSDOT et al. 2004) evaluated five Build Alternatives and a No Build Alternative. In December 2004, the project proponents identified the cut-and-cover Tunnel Alternative as the preferred alternative and carried the Rebuild Alternative forward for analysis as well. The 2006 Supplemental Draft EIS (WSDOT et al. 2006) analyzed two alternatives—a refined cut-and-cover Tunnel Alternative and a modified rebuild alternative called the Elevated Structure Alternative. After continued public and agency debate, Governor Gregoire called for an advisory vote to be held in the city of Seattle. The March 2007 ballot included an elevated alternative and a surface-tunnel hybrid alternative. The citizens voted down both alternatives.

Following this election, the lead agencies committed to a collaborative process to find a solution to replace the viaduct along Seattle’s central waterfront. This Partnership Process is described in Appendix S, the Project History Report. In January 2009, Governor Gregoire, King County Executive Sims, and Seattle Mayor Nickels announced that the agencies had reached a consensus and recommended replacing the aging viaduct with a bored tunnel.

The environmental review process for the Alaskan Way Viaduct Replacement Project (the project) builds on the five Build Alternatives evaluated in the 2004

Draft EIS and the two Build Alternatives evaluated in the 2006 Supplemental Draft EIS. It also incorporates the work done during the Partnership Process. The bored tunnel was not studied as part of the previous environmental review process, and so it becomes the eighth alternative to be evaluated in detail.

The Bored Tunnel Alternative analyzed in this discipline report and in the Supplemental Draft EIS has been evaluated both quantitatively and qualitatively. The Bored Tunnel Alternative includes replacing State Route (SR) 99 with a bored tunnel and associated improvements, such as relocating utilities located on or under the viaduct, removing the viaduct, decommissioning the Battery Street Tunnel, and making improvements to the surface streets in the tunnel's south and north portal areas.

Improvements at the south portal area include full northbound and southbound access to and from SR 99 between S. Royal Brougham Way and S. King Street. Alaskan Way S. would be reconfigured with three lanes in each direction. Two options are being considered for new cross streets that would intersect with Alaskan Way S.:

- New Dearborn Intersection – Alaskan Way S. would have one new intersection and cross street at S. Dearborn Street.
- New Dearborn and Charles Intersections – Alaskan Way S. would have two new intersections and cross streets at S. Charles Street and S. Dearborn Street.

Improvements at the north portal area would include restoring Aurora Avenue and providing full northbound and southbound access to and from SR 99 near Harrison and Republican Streets. Aurora Avenue would be restored to grade level between Denny Way and John Street, and John, Thomas, and Harrison Streets would be connected as cross streets. This rebuilt section of Aurora Avenue would connect to the new SR 99 alignment via the ramps at Harrison Street. Mercer Street would be widened for two-way operation from Fifth Avenue N. to Dexter Avenue N. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N. Two options are being considered for Sixth Avenue N. and the southbound on-ramp:

- The Curved Sixth Avenue option proposes to build a new roadway that would extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have a signalized intersection at Republican Street.
- The Straight Sixth Avenue option proposes to build a new roadway that would extend Sixth Avenue N. from Harrison Street to Mercer Street in a typical grid formation. The new roadway would have signalized intersections at Republican and Mercer Streets.

For these project elements, the analyses of effects and benefits have been quantified with supporting studies, and the resulting data are found in the discipline reports (Appendices A through R). These analyses focus on assessing the Bored Tunnel Alternative's potential effects for both construction and operation, and consider appropriate mitigation measures that could be employed. The Viaduct Closed (No Build Alternative) is also analyzed.

The Alaskan Way Viaduct Replacement Project is one of several independent projects that improve safety and mobility along SR 99 and the Seattle waterfront from the South of Downtown (SODO) area to Seattle Center. Collectively, these individual projects are often referred to as the Alaskan Way Viaduct and Seawall Replacement Program (the Program). This Supplemental Draft EIS evaluates the cumulative effects of all projects in the Program; however, direct and indirect environmental effects of these independent projects will be considered separately in independent environmental documents. This collection of independent projects is categorized into four groups: roadway elements, non-roadway elements, projects under construction, and completed projects.

### **Roadway Elements**

- Alaskan Way Surface Street Improvements
- Elliott/Western Connector
- Mercer West Project (Mercer Street improvements from Fifth Avenue N. to Elliott Avenue)

### **Non-Roadway Elements**

- First Avenue Streetcar Evaluation
- Transit Enhancements
- Elliott Bay Seawall Project
- Alaskan Way Promenade/Public Space

### **Projects Under Construction**

- S. Holgate Street to S. King Street Viaduct Replacement
- Transportation Improvements to Minimize Traffic Effects During Construction

### **Completed Projects**

- SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)
- S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)

## 1.2 Summary

This section summarizes the key findings of the analysis of project-related effects on public services and utilities.

### 1.2.1 Existing Land Use Characteristics

#### Public Services

The affected environment for public services includes the following services that are provided by governmental agencies or private companies:

- Fire suppression
- Public schools and transportation
- Solid waste collection, disposal, and recycling
- Postal services
- Law enforcement services
- Emergency medical services/emergency technical rescue
- Disaster preparedness

#### Utilities

The affected environment for utilities includes the following utilities that are owned, operated, and maintained by governmental agencies or private companies:

- Electrical power
- Water
- Sanitary sewer, storm drainage, and combined sewer conveyance system and outfalls
- Natural gas
- Steam
- Petroleum
- Telecommunications

### 1.2.2 Operational Effects, Mitigation, and Benefits

Public service or utility providers are expected to experience an increase in operational requirements following project construction. The Bored Tunnel Alternative would require new utility infrastructure and additional resource use, which would increase operational requirements for utility providers. Operational effects for public services and utilities are presented in further detail in Chapter 5.

## Public Services Operational Effects

The following summarizes the operational effects on public services:

- Fire suppression services: risk of spill of hazardous materials or fires due to accidents, natural events, or human-caused events.
- Law enforcement services; emergency medical services; disaster preparedness; solid waste collection, disposal, and recycling; and postal services: the Bored Tunnel Alternative would modify the transportation network in and around downtown but is not expected to result in significant adverse operational effects on the provision of these public services. Depending on the route used, some public service providers would experience additional traffic-related delay. Others would experience less traffic-related delay.
- School bus routes in the study area: some school bus routes through the corridor and to the waterfront may be altered.

## Utilities Operational Effects

The Bored Tunnel Alternative would require new utility infrastructure and additional resource use, which would increase operational requirements for utility providers. The following summarizes the operational effects on utilities:

- Water: new utility infrastructure would require more maintenance. The bored tunnel fire suppression system would increase demand for water.
- Telecommunications: new utility infrastructure would require more maintenance.
- Electrical power: increase in operational electrical power consumption and infrastructure would require more capacity and maintenance.
- Sanitary, storm drainage, combined sewer conveyance system and outfalls: new utility infrastructure would require more maintenance.

## Public Services Operational Mitigation

The following summarizes the potential mitigation measures for operational effects on public services:

- Fire suppression services: restrict flammable and hazardous materials in the bored tunnel in accordance with the City of Seattle (City) amendments to National Fire Protection Association (NFPA) 502: Standard for Road Tunnels, Bridges, and Other Limited Access Highways.
- Law enforcement services; emergency medical services; disaster preparedness; solid waste collection, disposal, and recycling; and postal services: the Bored Tunnel Alternative is not expected to result in significant adverse operational effects on the provision of these public services. Therefore, mitigation for these services is not warranted.

- School bus routes through the corridor and to the waterfront: coordinate with the Seattle School District to maintain school bus service for routes traveling through the study area.

#### Utilities Operational Mitigation

Operational mitigation includes mitigation measures that would be needed during the life of the project to mitigate the increased operational requirements due to new infrastructure and additional resource use. The following summarizes potential mitigation measures for operational effects on utilities.

- Continue coordinated discussion to determine utility upgrades and the associated responsibilities.
- Design the tunnel drainage system to discharge to the combined sewers at a rate that would not exceed capacity in the sewer system. The Washington State Department of Transportation (WSDOT) may need to upgrade the Seattle Public Utilities (SPU) system or install new conveyance piping from the bored tunnel to the Elliott Bay Interceptor (EBI) to ensure sufficient capacity during base flows (seepage) and peak flows (testing or emergencies). This analysis and design will be required for permitting.
- Include measures to minimize electrical power consumption.
- Minimize groundwater infiltration into the bored tunnel.

#### 1.2.3 Construction Effects and Mitigation

Construction effects on public services and utilities are the effects on public service providers or utility providers likely to occur during construction. Construction effects differ from operational effects and are presented in further detail in Chapter 6.

##### Public Services Construction Effects

Construction effects are anticipated for all public service providers, mainly because of traffic delays during construction. Major sources of construction-related congestion that may affect response or service times for public services include the following:

- Increased traffic volumes on surface streets.
- Limited open lanes for the existing viaduct and Alaskan Way surface street.

### Utilities Construction Effects

Construction effects are anticipated for all utilities because relocation or protection would be required during construction. Such construction effects may include the need for the following additional work:

- Field observation/inspection.
- Utility relocations.
- Temporary utility shutoffs.
- Connections to existing utility systems.
- Emergency repairs due to unforeseeable circumstances.

### Public Services Construction Mitigation

The following summarizes the potential mitigation measures for effects on public services during construction:

- Hold coordination meetings with public service providers to maintain emergency response times or provide satisfactory mitigation.
- Coordinate with City of Seattle, King County Metro Transit, and Port of Seattle police and fire departments, transportation divisions, and other appropriate agencies during final design and operation of the proposed facilities to maintain reliable emergency access, identify alternative plans or routes to avoid delays in response times, and ensure that general emergency management services are not compromised.
- Coordinate planning and preparation for tunnel rescue services with the Seattle Fire Department (SFD).
- Ensure emergency egress from structures.
- Notify SFD regarding any compromised fire and life safety systems, including power and communications, and establish alternative supply lines.
- Coordinate with construction personnel and the Seattle Police Department (SPD) to ensure adequate staffing for traffic and pedestrian movement control.
- Provide additional temporary law enforcement or security officers for site security.

### Utilities Construction Mitigation

The following summarizes the potential mitigation measures for effects on utilities during construction:

- Review utilities on a case-by-case basis to determine those that need to be protected and supported in place during construction.

- Before final design and construction, field-verify (by potholing, where appropriate) the exact locations and depths of underground utilities and conduct condition checks as necessary.
- Coordinate with utility providers to develop a cost-effective solution and schedule for potential infrastructure relocations.
- Provide on-site electrical generation to minimize or eliminate power outages to customers, as determined by Seattle City Light (SCL) on a case-by-case basis.
- Develop schedules, contingency measures, and policies with utility providers to manage potential utility service disruptions so that customers can be prepared for potential service outages.
- Ensure that traffic control plan measures and traffic revision equipment and personnel are provided during utility relocations or repair.
- Reduce construction activities during peak hours, when possible, to lessen traffic effects.
- Provide utility protective measures to minimize or avoid potential damage to exposed utilities and contingency measures to repair or replace utilities damaged during construction.
- Use construction techniques, such as drilled shafts in lieu of driven piles, to avoid or minimize vibration effects on utilities.
- Coordinate with SCL to provide safety watch during construction, and establish emergency electrical power restoration procedures to minimize the potential for electrical service interruption.
- Coordinate construction-related mitigation with other major projects in the vicinity, such as Sound Transit's University Link light rail, and the S. Spokane Street Viaduct, to minimize utility and traffic disruptions.
- Coordinate planned schedule, sequencing, and areas of outages with utility providers.
- Address hazardous materials encountered during utility construction and mitigation in accordance with Appendix Q, Hazardous Materials Discipline Report.
- Address archaeological resources encountered during utility construction and mitigation in accordance with Appendix I, Section 106: Historic, Cultural, and Archaeological Resources Discipline Report.

- Use construction methods as needed to minimize the transport of hazardous material or contaminated media along utility trenches in accordance with Appendix Q, Hazardous Materials Discipline Report.
- Relocate or preserve access to existing utilities within proposed staging areas.

#### 1.2.4 Cumulative Effects

Chapter 7, Cumulative Effects, includes a qualitative discussion of the effects expected from the other roadway elements of the Program (the Alaskan Way Surface Street Improvements, Elliott/Western Connector, and Mercer West Project) and the non-roadway elements of the Program (the Elliott Bay Seawall Project, Alaskan Way Promenade/Public Space, First Avenue Streetcar Evaluation, and Transit Enhancements).

Attachment A, Cumulative Effects Analysis, also discusses the potential cumulative effects of the following planned projects in the vicinity of the bored tunnel:

- Alaskan Way Viaduct and Seawall Replacement Moving Forward projects
- SR 520 Bridge Replacement and HOV Program
- Interstate 5 (I-5) Improvements
- South Lake Union Redevelopment
- Sound Transit University Link Light Rail Project

All of these projects will affect future traffic patterns, which may result in travel time delays for public service vehicles. Increased development could lead to increased demand for public services. The environmental review for these projects will include mitigation measures to reduce these combined effects.

During construction of these projects, utilities may need to be relocated. The effects of utility relocations can be mitigated by coordinating with the utility purveyors during project planning and design, implementing a consolidated utility relocation plan to minimize disruption to services, and providing access for maintenance and repairs.

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## Chapter 2 METHODOLOGY

### 2.1 Study Area

The south and north boundaries of the study area for public services and utilities are approximately S. Atlantic Street and Roy Street, respectively. In general, public services and utilities within three to five blocks of existing or proposed facilities are identified as being within the study area for potential construction or operational effects. There are exceptions to this rule; some facilities (such as hospital emergency rooms) are located outside of the study area but have been included in the analysis because they offer critical services to the study area. Also, utility relocations may affect utility infrastructure and customers outside the study area.

### 2.2 Applicable Regulations and Guidelines

The following regulations and guidelines provided information that was considered in evaluating effects on public services and utilities within the study area:

- WSDOT *Utilities Manual* (M 22-87.01)
- Code of Federal Regulations, Title 23 (Subpart A): Reimbursement for Utility Relocation
- WSDOT Utilities Accommodation Policy (M 22-86.01)
- Washington Administrative Code, Chapter 468.34 (WAC 468.34): Utility Franchises and Permits
- Washington State Department of Health Water System Design Manual
- Revised Code of Washington, Chapter 47.44: Franchises on State Highways
- WAC 173-201A: Water Quality Standards for Surface Waters of the State of Washington
- WAC 173-204: Sediment Management Standards
- WAC 173-221: Discharge Standards and Effluent Limitations for Domestic Wastewater Facilities
- WSDOT *Environmental Procedures Manual* (M 31-11)
- FHWA Technical Advisory T6640.8A
- WAC Part Q, Sections 296-155-725–730: Underground Construction
- City of Seattle Ordinances and Director's Rules
- City of Seattle Fire Code
- City of Seattle Franchise Agreements with Other Agencies

- SCL Overhead and Underground Construction Guidelines
- City of Seattle *Standard Plans for Municipal Construction and Standard Specifications for Road, Bridge, and Municipal Construction* (2008a, 2008b)
- Seattle Municipal Code, Titles 21 and 22

## 2.3 Data Needs and Sources

The data sources were conceptual project drawings and various utilities reports provided by the project design team.

## 2.4 Analysis of Existing Conditions

Existing conditions for public services were analyzed for the study area. Some facilities that are located outside of the study area, such as hospital emergency rooms, were also considered. The following types of public services are discussed in Chapter 4, Affected Environment:

- Fire stations and emergency medical services
- Public schools
- Solid waste collection, disposal, and recycling
- Postal services
- Law enforcement services
- Disaster preparedness and emergency management

The analysis of existing conditions for utilities included utility providers within the study area and locations of existing utility infrastructure likely to be affected by the Bored Tunnel Alternative. The following types of utilities are discussed in Chapter 4, Affected Environment:

- Electrical power
- Water
- Sanitary sewer, storm drainage, and combined sewer conveyance system and outfalls
- Natural gas
- Steam
- Petroleum
- Telecommunications

## 2.5 Analysis of Environmental Effects

Potential direct and indirect operational and construction effects were identified and analyzed. This analysis included establishing thresholds for levels of effect by type of utility or service.

### 2.5.1 Operational Effect Analysis

Potential operational effects on public services were determined by reviewing the traffic analysis and the level of service (LOS) results for the Viaduct Closed (No Build Alternative) and Bored Tunnel Alternative in Appendix C, Transportation Discipline Report. Factors considered for the analysis of operational effects included increased demands on public services, impaired access to public services, and potential risks from the Bored Tunnel Alternative on public services.

Potential effects on utilities were determined by reviewing the utility placement, the existing utility locations, and the preliminary project design. The types of potential effects analyzed include restricted maintenance access to utilities and the need to construct new facilities due to increased demand or inaccessible routing. If the utility purveyors find a utility cost or difficulty of relocation to be prohibitive, project design modifications would be explored to minimize the effects. The effect discussions will be refined as additional information on the project design and funding becomes available. In addition, the discussion will be modified, if necessary, as additional information is acquired from local utility purveyors.

### 2.5.2 Construction Effect Analysis

Potential construction effects on public services were determined by reviewing the traffic analysis and the LOS results for the Viaduct Closed (No Build Alternative) and Bored Tunnel Alternative in Appendix C, Transportation Discipline Report. LOS reductions due to lane closures and related congestion during construction could affect response times for fire, police, and emergency medical services, as well as mobility and access in the corridor.

Utilities would be relocated or replaced according to the standards of their respective owners. Utility construction staging and duration would be designed to minimize temporary service interruptions to businesses and customers in the area. Efforts would be made to develop estimates of temporary service disruptions and identify temporary measures needed to maintain critical services.

## 2.6 Determining Mitigation Measures

Proposed mitigation measures are based on NEPA requirements, WSDOT and City of Seattle policies, mitigation proposed for other projects, and discussions with agencies during the planning process. The mitigation measures will be refined and additional or more specific measures will be developed as the planning and design process continues.

Potential mitigation measures for operational and construction effects on public services have been developed in the following ways:

- Coordinate with the police and fire departments for the City of Seattle and the Port of Seattle police and other appropriate agencies to ensure reliable emergency access and alternative plans or routes to avoid delays in response times.
- Coordinate with transit providers to maintain services and alternative routes during construction.
- Consider the implementation of intelligent transportation systems (ITS), such as intelligent traffic signalization measures.

Operational effects on utilities will be reduced by designing systems according to City of Seattle and Washington State guidelines and code requirements. Relevant operational utility policies and strategies listed in the City of Seattle Comprehensive Plan, Utilities Element, will be followed (City of Seattle 2005d). Potential construction mitigation measures for utilities will be developed during the design process through coordination with utility providers.

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## Chapter 3 STUDIES AND COORDINATION

This section describes the coordination and studies that were used to identify existing facilities and providers of public services and utilities in the study area. Many resources were used to analyze the affected environment, including various regulations, municipal plans, Internet and website information, literature review, and discussions with public service and utility providers. Additional resources have been identified in Chapter 8, References, at the end of this report. Coordination was conducted with authors of other discipline reports to maintain accuracy of the information and analysis for this report.

### 3.1 Studies

Existing conditions data for public agencies and service providers for services or facilities in the study area are reflected in the following documents. Data were collected from the following sources, and these documents are incorporated by reference.

#### 3.1.1 Public Services

- *Emergency Traffic Management and Closure Plan for the Alaskan Way Viaduct and Surface Alaskan Way* (City of Seattle 2005c)
- *City of Seattle Comprehensive Plan, Capital Facilities Appendix* (City of Seattle 2005a)
- *City of Seattle Comprehensive Plan, Utilities Appendix* (City of Seattle 2005b)
- *Prevention and Control of Highway Tunnel Fires* (FHWA 2003)
- *Perspectives: Seattle Police Department 2007 Annual Report* (SPD 2007b)
- *Seattle All-Hazards Mitigation Plan* (SEM 2009a)
- *Mayor's Recommendations: Seattle Central Waterfront Concept Plan* (City of Seattle 2006)

#### 3.1.2 Utilities

- *Utility Impact Report – Bored Tunnel Alternative* (Jacobs 2009)
- *SR 99 Bored Tunnel Alternative: Summary Level – Stormwater Report* (Parsons Brinckerhoff 2009)
- *Draft Steam and Petroleum Systems Relocation Basis of Design Report – Tunnel Alternative* (Jacobs Civil 2007a)
- *Draft Communications Systems Relocation Basis of Design Report – Tunnel Alternative* (Jacobs Civil 2007b)
- *Draft Natural Gas System Relocation Basis of Design Report – Tunnel Alternative* (Jacobs Civil 2007c).

- *Draft Waterfront Tunnel Drainage Study Technical Memorandum* (RWE 2007)
- *Draft Water Transmission and Distribution Valve Structure Siting Study for the Tunnel Alternative* (RWE 2006a)
- *Draft Electrical Transmission and Distribution Facilities Basis of Design* (POWER Engineers 2006)
- *Draft Drainage Basis of Design Report for the Tunnel Alternative* (RWE 2006b)
- *Draft Water Infrastructure Basis of Design – Tunnel Alternative* (RWE 2006c)
- *Draft CSO and Stormwater Outfall Basis of Design* (Cosmopolitan Engineering Group, Inc., et al. 2006)
- *SR 99: Alaska Way Viaduct and Seawall Replacement Program Basis of Design Report for the Combined Sewer System* (HDR 2007)
- *Final Utilities Design Criteria and Standards, SR 99: Alaskan Way Viaduct Project* (Parsons Brinckerhoff 2004)
- *City of Seattle Comprehensive Plan, Utilities Element* (City of Seattle 2005d)
- *Draft Utilities Design Criteria and Standards, SR 99: Alaskan Way Viaduct Project* (RWE 2002b)
- *Final Drainage Technical Memorandum, SR 99: Alaskan Way Viaduct Project* (RWE 2002c)
- *Final Existing Utilities Technical Memorandum, SR 99: Alaskan Way Viaduct Project* (RWE 2002d)
- *Conceptual Design Maps, SR 99: Alaskan Way Viaduct Project* (RWE 2002e)
- *Design Criteria for Relocation of Electrical Transmission and Distribution Facilities* (PB Power 2002)
- *City of Seattle Comprehensive Plan, Attachment 12: Capital Facilities Appendix A, Reference Resource for Public Services and Utilities* (City of Seattle 2005a)

## 3.2 Coordination

### 3.2.1 Public Agencies and Service Purveyors

The following public agencies and service providers or their websites were consulted for information on the facilities and services in the study area:

- Bonneville Power Administration
- Seattle Fire Department (SFD)
- Seattle Police Department (SPD)
- Seattle Public Schools
- Seattle Public Utilities (SPU)
- Seattle Department of Information Technology (DoIT)

- Seattle City Light (SCL)
- Seattle Department of Transportation (SDOT) Street Use and Utilities Franchises
- Seattle Emergency Management
- Port of Seattle
- King County Wastewater Treatment Division
- King County Solid Waste Management
- King County Metro
- U.S. Postal Service

### 3.2.2 Private Utility or Service Providers

The following private organizations or their websites were consulted for information on the facilities and services in the study area:

- Puget Sound Energy (PSE) (natural gas)
- Seattle Steam
- Allied Waste Systems

### 3.2.3 Communications Providers

Communications providers in the study area include the following:

- 360networks
- AboveNet (formerly Metromedia Fiber Network)
- Allstream (formerly Starcom and AT&T Canada)
- Broadstripe (formerly Millennium Digital Media)
- Comcast (formerly TCI/AT&T)
- Electric Lightwave, LLC (ELI) (owned by Integra Telecom)
- Global Crossing (also known as US Crossings, Inc.)
- Level 3 (acquired Looking Glass Network)
- Qwest (acquired OnFiber)
- Sprint/Nextel
- TW Telecom of Washington, LLC (formerly GST)
- Verizon Business (formerly MCI WorldCom and MFS)
- XO Communications
- Yipes Enterprise Services (owned by Reliance Globalcom)

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## Chapter 4 AFFECTED ENVIRONMENT

### 4.1 Public Services

This section includes descriptions of the public services that would be affected by the Bored Tunnel Alternative. Other community services are discussed in Appendix H, Social Discipline Report.

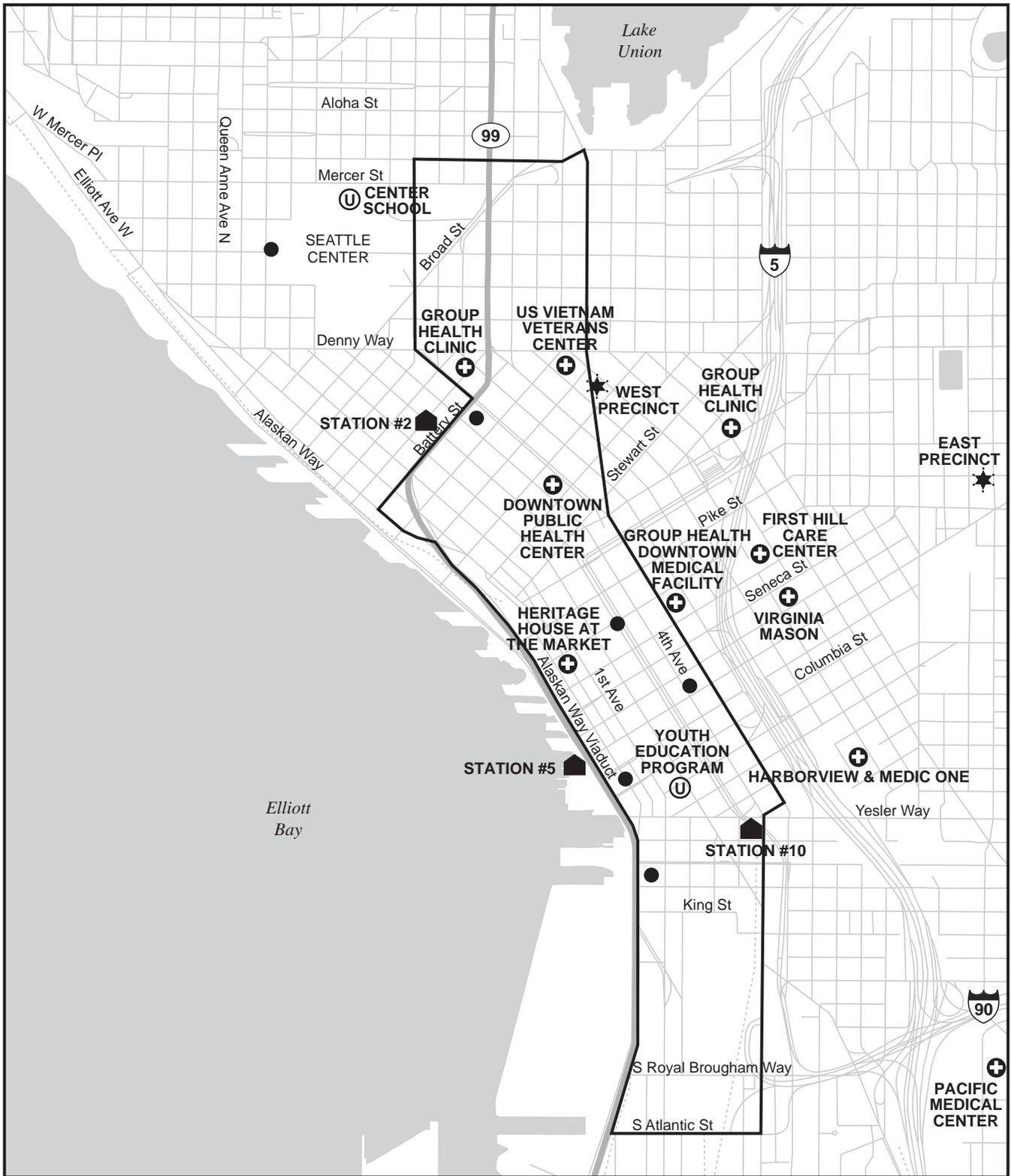
Exhibit 4-1 displays the locations of public services and utilities in the study area.

#### 4.1.1 Fire Stations and Emergency Medical Services

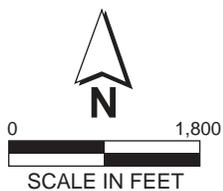
SFD provides fire suppression and emergency medical services to a metropolitan urban population of over 560,000 people within a land area of approximately 83.9 square miles and approximately 193 miles of waterfront (U.S. Census Bureau 2000). In 2008, SFD responded to approximately 80,000 incidents (SFD 2009a).

The department employs more than 1,456 uniformed and nonuniformed personnel serving Seattle at 35 fire stations and other facilities located throughout the city. At its disposal are 33 fire engines, 11 ladder trucks, 4 aid units (basic life support), 7 medic units (advanced life support), 2 air trucks, 2 fireboats, 2 hose wagons, and 1 foam trailer. Miscellaneous special equipment is also used by the following specializations: mobile communications and command unit, marine unit, hazardous materials unit, mobile ventilating unit, mobile air compressor unit, mobile generator and carbon dioxide (CO<sub>2</sub>) unit, mass casualty incident unit, urban search and rescue, metropolitan medical strike team, weapons of mass destruction Decontamination Trailer, and technical rescue unit (high angle, confined space, trench, and dive rescue) (SFD 2009b).

Seattle fire stations serving the study area are mapped in Exhibit 4-1 and listed in Exhibit 4-2. Seven SFD stations are available for first response to fire and medical emergencies within the study area. Fire Station No. 10 is within the study area and three others (including the Medic One Headquarters at Harborview Medical Center) are near the study area, as shown on Exhibit 4-1. The remaining three stations are not shown on the map (see Exhibit 4-2 for addresses). The Seattle Fire Alarm Center is located at Fire Station No. 10, at 400 S. Washington Street. Emergency fire and medical units are generally dispatched from the station nearest the call site, although units can be dispatched from other stations as well. SFD's average 2008 response times (from the time units were dispatched after a 911 call to their arrival time at the site) are as follows: 4.32 minutes for fire and hazardous materials responses, 3.75 minutes for basic life support responses (fire and aid cars), and 3.76 minutes for advanced life support (Medic One) (SFD 2009c).



554-1585-030/CC(07) 3/26/10



- Postal Services
- Fire Stations
- ★ Police
- ⊕ Hospitals
- Ⓢ Schools
- Approximate Study Area

**Exhibit 4-1  
Public Services and Utilities  
Within or Near the Study Area**

## Exhibit 4-2. Seattle Fire Stations In or Near the Study Area

Station	Location	Equipment
14	3224 Fourth Avenue S.	Aid unit, ladder, and rescue unit
10	400 S. Washington Street	Aid unit, ladder, engine, Deputy Chief/shift commander, hazardous materials unit, and staff coordinator
5	925 Alaskan Way	Fireboat, engine
25	1300 E. Pine Street	Aid unit, ladder, engine, Battalion Chief, hose wagon, and power/CO <sub>2</sub> unit
2	2334 Fourth Avenue	Aid unit, ladder, engine, and Safety Chief
8	100 Lee Street	Ladder, engine
Harborview Medic One	325 Ninth Avenue, Harborview Medical Center	Two medic units

Fire Station No. 5 is located at the seawall, in the immediate vicinity of the Alaskan Way Viaduct. It currently houses one marine company that operates the fireboat (Engine 4) and one land-based company that operates Engine 5 and acts as marine backup. Current response constraints for Engine 5 include ferry and other traffic delays on Alaskan Way, as well as delays associated with the railroad crossing at Broad Street.

### 4.1.2 Law Enforcement Services

SPD provides law enforcement and responds to 911 emergency calls in and throughout Seattle and the study area. SPD has approximately 1,250 sworn personnel and nearly 500 civilian personnel (SPD 2009a).

SPD is divided into five precincts: the South Precinct (3001 S. Myrtle Street), the Southwest Precinct (2300 S.W. Webster Street), the East Precinct (1519 12<sup>th</sup> Avenue), the West Precinct (810 Virginia Street), and the North Precinct (10049 College Way N.). Additionally, the Seattle Police headquarters shares the Seattle Justice Center at 610 Fifth Avenue with the Seattle Municipal Court. This office opened in 2002 and does not function as a precinct (SPD 2009b).

In 2007, SPD's 911 Center received over 800,000 incoming calls. Of that number, over 230,000 calls were dispatched to patrol units (SPD 2007a). The study area falls within the West Precinct. There is a Downtown Neighborhood Service Center located at 820 Virginia Avenue. Seattle police precinct locations adjacent to but outside the study area are shown in Exhibit 4-1 (SPD 2009b).

The Port of Seattle Police Department also maintains jurisdiction along the central waterfront and Elliott Bay at Port-owned properties such as Pier 69 and Terminals 25, 30, and 46. The Port of Seattle Police Department provides law enforcement response and patrol services for the commercial properties located at the piers and

terminals in this geographic area. The U.S. Department of Homeland Security also has customs staff and facilities at Terminal 46 to inspect container cargo and respond to emergencies. The container terminals are located in the south harbor area, and crimes related to container cargo unloading and loading include the smuggling of people, drugs, and equipment into the United States and the export of stolen cars (Watts 2003).

Bell Street Pier 66 provides moorage for Norwegian Cruise Lines. Typical crimes affecting cruise lines include drug smuggling, theft aboard ship during transit, and travelers who have outstanding warrants for their arrest. There are no reports of tourists being targeted by pickpocket activities (Watts 2003).

### Crime Data

The City of Seattle maintains statistics related to crime in its jurisdiction. Crimes are typically divided into Part I and Part II crimes. In general, Part I crimes (also known as the “Crime Index”) are more serious and include felony crimes such as homicide, rape, robbery, aggravated assault, burglary, theft, auto theft, and arson. Part II crimes include all other crimes, such as simple assault, vandalism, forgery, prostitution, weapons offenses, drug and liquor violations, disorderly conduct, loitering, and other offenses.

In 2008, SPD reported 36,267 Part I Index crimes, representing a decrease of approximately 4 percent from 2007. In general, crime rates in Seattle have been slowly declining over the past decade (SPD 2008).

The study area lies within the region of the city listed as “Considerably Above the Median” (i.e., it includes approximately 15 percent of census tracts with most offenses) for both violent crimes and property crimes (SPD 2007a).

### 4.1.3 Postal Services

Several postal facilities are located within the study area. Facilities west of Fourth Avenue and within the study area are summarized in Exhibit 4-3. Each of the primary post offices distributes mail to its respective surrounding area and has counter service for residents to purchase stamps and mail parcels.

#### Exhibit 4-3. Postal Services in the Study Area

Neighborhood Center	Location	Facilities
Pioneer Square	91 S. Jackson Street	Post office
Federal Finance Facility	909 First Avenue	Post office
Bank of America	1001 Fourth Avenue	Post office
Midtown Post Office	301 Union Street	Post office and automated services
CPU Harbor Heights 111	2512 Fifth Avenue	Post office

Source: USPS 2009.

#### 4.1.4 Disaster Preparedness and Emergency Management

##### Seattle Department of Transportation

In the *Emergency Traffic Management and Closure Plan for the Alaskan Way Viaduct and Surface Alaskan Way* (City of Seattle 2005c), SDOT describes the emergency response approaches for four viaduct closure scenarios:

1. Complete closure of the existing viaduct and Alaskan Way surface street.
2. Complete closure of the existing viaduct with Alaskan Way open.
3. Traffic-incident-based temporary closure of the existing viaduct.
4. Additional weight restrictions.

The management plan addresses communication among several agencies and the public and identifies major routes to be used during the closure. It is possible that these routes would also be used during some construction phases of the project.

In August 2010, WSDOT will begin installing a system designed to automatically close the viaduct in the event of a moderate to severe earthquake in the greater Seattle area. The new system will consist of nine traffic gates strategically placed on the viaduct and controlled by an earthquake detection system. When the earthquake monitoring system detects significant ground movement, it will simultaneously lower all nine traffic gates and safely close the viaduct in 2 minutes (WSDOT 2010).

##### Seattle Emergency Management

The Office of Emergency Management is a City of Seattle agency devoted to citywide disaster preparedness, response, recovery, and mitigation (SEM 2009b). The unit consists of a staff of 12 people whose principal responsibilities involve encouraging individual and community preparedness and providing a key liaison function between the City and its state and federal emergency management counterparts (SEM 2009b).

The primary functions of the Office of Emergency Management include (1) maintaining the City's emergency command center, (2) developing disaster plans, (3) educating the public, (4) protecting and repairing City infrastructure, (5) coordinating mitigation projects and managing recovery processes, (6) managing outside assistance, and (7) planning and conducting emergency exercises and training.

#### 4.1.5 Public Schools

With more than 45,000 students, Seattle Public Schools is the largest school district in Washington State. The system includes 63 elementary schools, 10 middle schools, 12 high schools, and a number of alternative schools and

special programs (Seattle Public Schools 2009a). Three public school facilities operate within the study area (see Exhibit 4-1). Other schools are discussed in Appendix H, Social Discipline Report.

The Center School serves approximately 280 high school students inside the Center House, on the Seattle Center grounds. The Youth Employment Program, which is part of Interagency Academy, is located at 810 Third Avenue in the central section of the study area. This school serves nearly 90 students.

The north section of the study area is located within the Queen Anne/Magnolia region of the Seattle Public School District. The school nearest to the north section is John Hay Elementary (K–5), which is within seven blocks of Aloha Street (see Exhibit 4-1). According to the Facilities Department of the Seattle School District, enrollment in 2009 to 2010 for John Hay Elementary was 467 students (Seattle Public Schools 2009c).

Seattle Public School transportation services in the study area are summarized in Exhibit 4-4.

**Exhibit 4-4. Distribution of Seattle Public School Transportation in the Study Area**

Trip Times	Trip Status	Total Buses
6:00–7:30 a.m.	Drivers only	10
7:00–9:00 a.m.	Students aboard	19
8:45–9:30 a.m.	Drivers only	28
1:20–3:00 p.m.	Drivers only	35
2:25–4:15 p.m.	Students aboard	19
4:00–5:00 p.m.	Drivers only	8
4:30–6:00 p.m.	Students aboard	7

Source: Seattle Public Schools 2009b.

While student transportation within the study area is provided by contract with First Student (Seattle Public Schools 2009b), coordination of routes is managed by the Seattle School District Transportation Office. Buses serving Seattle Public Schools travel in the study area on a daily (weekday) basis. School buses make 45 trips along the viaduct corridor daily. Driver-only buses, traveling to and from bus yards, make an additional 81 trips through the study area daily (Anderson 2003). Detailed information about exact routes and times has been withheld for security reasons. However, it is assumed that the bus routes travel through the study area along the adjacent surface streets in downtown Seattle. In addition, Seattle Public School students use King County Metro regular bus routes for transportation to and from schools.

#### 4.1.6 Solid Waste Collection, Disposal, and Recycling

SPU currently contracts with the following private firms to collect and haul residential and commercial waste and recyclable materials and to provide hauling services. The firm that provides the service is based on geographic location.

- Waste Management of Washington, Inc.
- CleanScapes

Collected residential or commercial waste or self-haul waste is delivered to one of two City-owned facilities operated by SPU or to one of two private facilities. The City-owned facilities are the North Recycling and Disposal Station (NRDS), located immediately north of Lake Union, and the South Recycling and Disposal Station (SRDS), located in the South Park area (SPU 2009a). The two private transfer stations are Waste Management's Eastmont Station (located in the South Park area near the City's SRDS) and the Allied Waste Systems-owned station (located at Third Avenue S. and S. Lander Street). Materials from the NRDS and SRDS, as well as materials from the Eastmont or Allied Waste Systems transfer stations that are to be disposed of, are transferred to the Argo Intermodal Facility in south Seattle, where they are transported by rail to the Columbia Ridge Landfill in Oregon. Some material from the Allied Waste Systems transfer station may also be transported to the Roosevelt Landfill in eastern Washington. Waste material includes general municipal solid waste and construction demolition waste.

Self-haul recyclable materials may be taken to any of the four stations, where they are subsequently delivered to the recycle processor. Collected residential and commercial recyclable materials are taken directly to the recycle processor. Recyclable materials that are delivered to the NRDS, SRDS, Eastmont, or Allied Waste Systems stations are subsequently hauled to the recycle processor. Recyclable materials include metals, paper, wood, glass, plastics, tires, and used oil.

##### Capacity of Waste Processing Facilities

The NRDS and SRDS have the current available capacity to process 300,000 to 400,000 tons of waste per year. In 2002, the NRDS and SRDS processed over 153,500 and 171,400 tons, respectively. The Eastmont and Allied Waste Systems transfer stations have the current available capacity to process 300,000 to 400,000 tons of waste per year, including waste from Seattle's businesses. In 1999, the two stations processed 225,000 tons of garbage from Seattle (City of Seattle 2005b). Waste Management's Alaska Street facility has an annual capacity of approximately 500,000 tons of waste and handled approximately 398,000 tons of waste in 2008, including contaminated soils (Borghese 2003).

The Columbia Ridge Landfill in Oregon opened in 1990 and has a current unused capacity of 284 million tons (Spears 2007). The Roosevelt Landfill in Washington

has a lifespan of 100+ years and had an initial capacity of 217 million tons (Maines 2007). The landfill handles approximately 2.5 million tons of waste per year and has a current available capacity of 199 million tons. The local transfer and recycling stations and the regional landfills have indicated that their facilities have sufficient capacity to handle increases in the amount of solid waste expected from both growth in Seattle and potential demolition of the Alaskan Way Viaduct (Jiries 2003). In addition, although the rail transfer capacity between the transfer stations and the landfills has doubled in recent years, the rail system is expected to have sufficient capacity to manage area growth and project waste (Borghese 2003).

### **Disposal of Materials From Roadway and Building Demolition Projects**

The difference between a roadway demolition project and a building demolition project in terms of the disposal of materials depends primarily on the type of materials involved. Roadway demolition projects generate materials such as asphalt, concrete, and steel, while building demolition projects generate wood, metal, drywall, roof shingles, and other wastes. Some companies, such as Construction Waste Management, contract with a construction contractor to sort the materials on site and direct the materials to different processing and recycling facilities.

Currently, as much as 40 percent of construction and demolition waste is recyclable, and recycling is considerably less expensive than the traditional reliance on landfills. As a result, recycling on construction projects is increasing. Asphalt and concrete are two materials that can be recycled. Recycled concrete can be ground into a finer material used for retaining wall blocks or gravel for temporary roads or as a base course for permanent roads. Asphalt can be reused for temporary roads on construction sites or in a final blacktop product.

Building materials such as wood and metal are sent to the Eastmont and Allied Waste Systems transfer stations, where they are compacted and then transferred by rail to landfills in Oregon and Washington. While the Columbia Ridge and Roosevelt Landfills handle a range of solid wastes, several demolition-only landfills for inert materials are located in western Washington; they are regulated by the Washington State Department of Ecology according to guidance in the Washington Administrative Code (Keller 2003).

### **Disposal of Contaminated Materials**

Contaminated soils are either buried at a disposal facility or burned to remove contaminants. This cleaned soil can then be reused as fill for construction or land reclamation projects or as an ingredient in making cement (Keller 2003).

## Recycling

Two private material recovery facilities serve as the processing and transfer facilities for most of the recyclable materials collected from Seattle residents. In 2000, these facilities processed nearly 320,000 tons of recyclable materials. Recycle Seattle is located south of downtown, on S. Lander Street in the South Park area (City of Seattle 2005b).

## Residential Organics

In 2008, SPU collected nearly 70,000 tons of leaves, grass clippings, vegetative food waste, and food-soiled paper (SPU 2009a). Seattle's food and yard waste collection service reduces garbage, saves landfill space, and reduces landfill methane (a potent greenhouse gas). The collected materials are processed into compost and used in local parks and gardens (SPU 2009b).

## 4.2 Utilities

### 4.2.1 Electrical Power

SCL supplies electric power to customers in Seattle and some portions of King County north and south of the city limits, including the study area. SCL, a municipal electric utility, serves approximately 131 square miles and generates 56 to 75 percent of the energy that it sells to retail customers from its own facilities (City of Seattle 2005b). SCL owns and maintains approximately 656 miles of 115-kilovolt (kV) and 230-kV transmission lines that carry power to its distribution substations. SCL also owns and maintains 2,523 circuit miles of distribution lines within Seattle that deliver power from the principal distribution stations to over 380,000 customers (SCL 2009).

Electrical power is dispersed from these substations via primary voltage feeder lines to numerous smaller distribution substations and overhead and underground transformers, which reduce the voltage to required levels for customers.

In the study area, the SCL system uses a combination of overhead and underground electrical transmission and distribution lines. SCL has a combination of transmission and distribution lines running along and under the existing viaduct structure. The downtown area is served by a 13.8-kV network service and 26-kV distribution service. This system serves the downtown area from S. King Street to Denny Way, and east to First Hill. Substations in the study area include the Massachusetts Substation at Colorado Avenue and S. Massachusetts Street, the Union Substation at Western Avenue and Union Street, and the Broad Substation at Sixth Avenue and Broad Street. Overhead and underground distribution lines are also located along many streets in the study area. Although the system is designed and operated to minimize the likelihood that a problem in one area

would cascade into other areas, the system must still be approached as an integrated whole because one area could affect another.

SCL has increased its system security and provisions for continued reliability to minimize potential effects of both criminal acts and natural disasters. For more information on security measures taken by SCL, refer to the *Seattle All-Hazard Mitigation Plan* (SEM 2009a).

#### 4.2.2 Water

SPU provides potable water to more than 1.3 million King County customers (City of Seattle 2009a) through two surface water sources. The Cedar River provides approximately 70 percent of the SPU service area's annual average consumption (City of Seattle 2009b), and the South Fork Tolt River provides approximately 30 percent (City of Seattle 2009c). The major water main located within the study area includes sections of 20- and 21-inch-diameter welded steel lines along the Alaskan Way surface street and sections of 24-inch-diameter ductile iron pipe and 20- and 16-inch-diameter cast iron pipe along First Avenue S. (Jacobs 2009). Other mains about the existing viaduct corridor at major intersections, including on Broad Street, Union Street, Madison Avenue, Yesler Way, S. Main Street, S. Jackson Street, S. King Street, S. Washington Street, and S. Atlantic Street. The system consists of transmission and distribution mains, fire hydrants, water services and service lines, corrosion protection systems and valves, and water valve chambers. The entire study area is served by a single pressure zone (RWE 2002a). SPU owns, operates, maintains, inspects, and repairs the water system. SPU also installs water services, hydrants, or other appurtenances on any charged water system. SFD tests all city hydrants annually.

Typically, water lines are located about 3 to 6 feet underground, and smaller pipes are often less than 3 feet underground. Water lines typically run beneath and parallel to streets and are placed in various locations ranging from the center of the roadway to the periphery.

#### 4.2.3 Sanitary Sewer and Storm Drainage

Within the study area, the storm drainage, sanitary, and combined sewer system varies by function and jurisdiction (e.g., King County and City of Seattle). Seattle has a combined sewer system in the downtown area. Within the study area, the sewer and storm drainage system consists of combined, separated, and partially separated sewer areas, with a variety of pipes, regulator structures, low-flow diversions, outfalls, and backups. The King County Department of Natural Resources, Wastewater Treatment Division (formerly Metro), provides sewage treatment services throughout the study area.

SPU operates, maintains, inspects, and repairs wastewater (sewer) pipes in the study area to protect public health and avoid property and environmental

damage from both sanitary sewer and combined sewer system overflows and backups. Wastewater in the study area is conveyed to King County's West Point Treatment Plant, which processes an average of 133 million gallons per day (King County 2009b). The pipelines and other conveyance facilities within the study area are owned, operated, and maintained by SPU or the King County Wastewater Treatment Division. Individual sewer service and service drain lines are owned privately by the property owners they serve.

### Major King County Combined Sewer Interceptors

The major King County combined sewer facilities in the vicinity of the project area include the EBI, the Lake Union Tunnel, the Mercer Street Tunnel, and the Central Trunk at Dexter Avenue N. (RWE 2002c). Within the study area, the EBI extends from S. Spokane Street north to Denny Way. The EBI is subdivided into several sections of various dimensions and materials. From S. Spokane Street to S. King Street, the EBI runs parallel to Colorado Avenue S., turning east at S. Massachusetts Street. It then proceeds north on Occidental Avenue S. to approximately S. King Street as a 96-inch-diameter concrete pipe. At S. King Street, it intersects a 30- to 42-inch-diameter pipe leading from the King County regulator. From approximately S. King Street to Denny Way, the EBI runs below Second Avenue as a 102-inch-diameter tunnel, reaching its maximum depth of 140 feet below the surface at Pike Street. A lateral adit structure pipe connects to the EBI and also crosses over the location of the proposed bored tunnel at Pike Street (RWE 2002c).

The Lake Union Tunnel is a 72-inch-diameter brick-lined tunnel that extends from the Denny Way regulator northeast to Lake Union at Terry Avenue N. and Republican Street (RWE 2002c).

The Mercer Street Tunnel is a 6,200-foot-long pipe with a diameter of 14 feet, 8 inches that runs primarily beneath Mercer Street from Eighth Avenue W. to Elliott Avenue W. This tunnel was designed to store flows diverted from the EBI, the Lake Union Tunnel, City of Seattle pipelines, the Dexter Central Trunk, and the Elliott West combined sewer overflow pipeline. The Mercer Street Tunnel can store up to 7.2 million gallons until the EBI has capacity available to transport the wastewater to the West Point Treatment Plant.

The Elliott West Combined Sewer Overflow Control Facility is located at the west end of the Mercer Street Tunnel, near Elliott Avenue W. Connected to this facility are the Elliott West pipelines, which consist of a south-flowing 96-inch-diameter effluent pipeline connected to the Elliott West outfall and a north-flowing 84-inch-diameter combined sewer overflow pipeline that connects the Denny Way diversion structure to the Elliott West Combined Sewer Overflow Control Facility.

A central sewer trunk line owned by King County is located beneath Dexter Avenue N., near South Lake Union. As part of the Elliott West Combined Sewer Overflow Control Facility project, a new pipeline and a diversion structure were constructed to connect this line to the Mercer Street Tunnel.

New South Lake Union combined sewer pipelines, a trunk diversion structure, and the Lake Union Tunnel regulator now connect with the Mercer Street Tunnel for storage.

### Outfalls and Drainage System

Most stormwater in the study area ultimately drains into Puget Sound; however, a small portion of the stormwater at the north end of the project area drains into Lake Union. Stormwater flowing into the combined sewer system is transported to the West Point Treatment Plant for treatment and then discharged directly to Puget Sound. Separated stormwater is discharged into Elliott Bay through City of Seattle outfalls. During peak events, when the quantity of combined sewer discharge exceeds the conveyance capacity, excess combined sewage is discharged to Elliott Bay as combined sewer overflows through either SPU or King County combined sewer overflow structures. Discharges into Elliott Bay are ultimately transported by currents to Puget Sound.

These study area outfalls drain to Elliott Bay:

- City of Seattle separated storm drainage outfalls located at Pine Street, Seneca Street, and S. Washington Street.
- City of Seattle shared outfalls, which discharge both stormwater and combined sewer overflows, located at Madison Street and University Street.
- City of Seattle combined sewer overflow structures located at Vine Street and S. Washington Street.
- King County combined sewer overflow structures at Denny Way and S. King Street.
- The Kingdome/Connecticut outfall structure, which has shared ownership between the City and King County. The outfall pipe is owned and maintained by the City, the storm drain flows are considered City discharges, and the combined sewer overflows are King County discharges.
- King County Elliott West Combined Sewer Overflow Control Facility outfall located near Denny Way.

These study area outfalls drain to Lake Union:

- City of Seattle separated storm drainage outfalls located at Broad Street.
- King County combined sewer overflow structures at Dexter Avenue.

This study area outfall drains to Puget Sound:

- King County West Point Treatment Plant outfall.

Within the study area, bridge drains from the existing viaduct connect to the existing drainage system and/or combined sewer system via a series of downspouts. These downspouts are attached to the exterior of bent columns on the existing viaduct structure. Some locations do not have bridge drains, possibly because portions of the existing viaduct are super-elevated, with bridge drains on the lower side of the structure. However, settlement may have occurred since the initial construction, creating low spots in the deck that result in ponding (RWE 2002c). For more detailed analysis of surface water and storm drainage (including wet weather flow capabilities for secondary and primary treatment), refer to Appendix O, Surface Water Discipline Report.

#### 4.2.4 Natural Gas

PSE provides natural gas service throughout the study area, serving more than half of the residents of Washington State over a 6,000-square-mile service area. PSE's nearly 750,000 natural gas customers are located primarily in western Washington (PSE 2009).

Natural gas mains, along with distribution and service lines, are located within the study area. A 12-inch-diameter high-pressure line is located along the study area between S. Main and Blanchard Streets. PSE's network consists of distribution pipes, pressure controls, valves, meters, and service lines (RWE 2002b).

#### 4.2.5 Steam

Privately owned Seattle Steam Company provides steam service within the study area. The steam distribution lines located in the study area include a 12-inch-diameter intermediate-pressure line running north-south along First Avenue and low-pressure and high-pressure lines running north-south along Western Avenue. Seattle Steam continues to pump steam through four main boilers, with operating pressures of 140 pounds per square inch, to service an 18-mile system of underground pipes dating back to the late 1880s.

Originally called the Seattle Steam Heat and Power Co. when it opened in 1893, today Seattle Steam operates in Seattle via a franchise agreement with the City (PSBJ 2001). Seattle Steam operates around the clock, every day of the year, using natural gas to make nearly 500,000 pounds of steam per hour (average during the winter peak season). In the summer, it produces about 100,000 pounds of steam per hour. More than 200 downtown buildings are customers. The three largest users are Swedish, Harborview, and Virginia Mason medical centers, which use steam to heat their buildings and to sterilize instruments. Hotels are the next largest customers, using steam for heat and to generate hot water for showers and laundry (PSBJ 2001).

#### 4.2.6 Petroleum

No active petroleum lines are located within the study area.

#### 4.2.7 Telecommunications

Qwest provides local telephone service throughout Seattle, including the study area. Telephone lines in urban areas are typically located within street rights-of-way, aboveground on utility poles in most areas, and underground in some areas (including part of downtown Seattle). Qwest also has fiber-optic lines in the study area, as well as underground feeders located along Broad, Wall, Pike, Spring, Marion, and S. Washington Streets (RWE 2002e). It also provides service to the Port of Seattle.

Comcast (formerly AT&T Cable Services) is the primary provider of cable television and fiber-optic services in Seattle and the study area.

Several private companies and public utilities also own fiber-optic cable or provide long-distance or other telecommunication services in downtown Seattle and the surrounding area. These providers include but are not limited to 360networks, AboveNet (formerly Metromedia Fiber Network), Allstream (formerly Starcom and AT&T Canada), Broadstripe (formerly Millennium Digital Media), City of Seattle Department of Information Technology (DoIT), Comcast (formerly TCI/AT&T), ELI (owned by Integra Telecom), Global Crossing (also known as US Crossings, Inc.), Level 3 (acquired Looking Glass Network), Qwest (acquired OnFiber), Sprint/Nextel, TW Telecom of Washington, LLC (formerly GST), Verizon Business (formerly MCI WorldCom and MFS), XO Communications, and Yipes Enterprise Services (owned by Reliance Globalcom) (Jacobs 2009).

DoIT provides telecommunications, telephone, data network, and cable management services in the study area. DoIT provides a data network connecting the City's computers and City departments. It also operates and maintains the City's private telephone network, consisting of about 12,000 telephones, voicemail, a telephone management system, and the City's telecommunications and data networking functions (City of Seattle 2005b).

The basic fiber-optic system typically consists of cables, manholes, conduits, and switching stations. Switching stations are usually located inside buildings. Conduits and cables are buried in public rights-of-way throughout the study area, including under Alaskan Way. Conduits and cables are also mounted on the existing viaduct or separate overhead infrastructure and are routed down the columns in various locations and into manholes to allow connections to the buried system. Fiber-optic companies sometimes find it necessary to lease copper wire space from the telephone company to access the switching station locations within the buildings (RWE 2002a, 2002b, 2002c, 2002d, and 2002e).

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## Chapter 5 OPERATIONAL EFFECTS, MITIGATION, AND BENEFITS

Operational effects are those effects that occur over the long term once the facility is in operation. Unless otherwise noted, operational effects apply to all sections of the study area.

The construction and operation of the project would largely be within public rights-of-way, where utilities are also generally located. The project design accommodates, to the extent practicable, utility zones that would allow utilities that are currently within the right-of-way to be relocated within the right-of-way. However, depending on the constraints of the final design of the selected alternative, private utilities may need to obtain permanent easements outside the project right-of-way. The need for private utilities to obtain permanent easements would be determined as the design proceeds. Access requirements for private utilities located in easements outside the right-of-way will be determined by the private providers separately from the project.

The following information is based on the Utility Impact Report (Jacobs 2009) prepared in support of the Supplemental Draft EIS. The report was based on existing project utility mapping; City of Seattle Geographic Information System (GIS) mapping of gravity and water utilities; City Franchise Utility Maps; records from PSE natural gas, Seattle Steam, multiple telecommunications providers, and site visits.

The operational effects summarized below are presented as potential risks and benefits. This analysis may need to be modified as additional information is acquired from local utility providers.

### 5.1 Operational Effects of the Viaduct Closed (No Build Alternative)

Federal and Washington State regulations require agencies to evaluate a No Build Alternative to provide baseline information about existing conditions in the project area. For this project, the No Build Alternative is not a viable alternative since the existing viaduct is vulnerable to earthquakes and structural failure due to ongoing deterioration. Multiple studies have found that retrofitting or rebuilding the existing viaduct is not a reasonable alternative. At some point in the future, the roadway will need to be closed.

The Viaduct Closed (No Build Alternative) describes what would happen if the Bored Tunnel Alternative or some other build alternative is not implemented. We know that if the existing viaduct is not replaced it will be closed, but it is unknown when that would happen. However, it is very unlikely that the existing structure

could be in use in 2030. For these reasons, this report compares the effects of the proposed Bored Tunnel Alternative to a 2015 Existing Viaduct. The 2015 Existing Viaduct assumes that the existing viaduct will continue to be part of the transportation network between S. King Street and Denny Way in the year 2015.

The Viaduct Closed (No Build Alternative) describes the consequences of suddenly losing SR 99 along the central waterfront based on two scenarios described below. These consequences would last until transportation and other agencies could implement a new, permanent solution. The planning and development of the new solution would have its own environmental review.

The Viaduct Closed (No Build Alternative) considers two scenarios that would eliminate the use of SR 99 for approximately 110,000 vehicle trips daily:

- Scenario 1 – Sudden unplanned closure of the viaduct due to structural damage from a minor earthquake or other reasons for partial structural failures that would render the viaduct unsafe or unusable.
- Scenario 2 – Catastrophic failure and collapse of the viaduct.

#### 5.1.1 Scenario 1: Sudden Unplanned Closure of the Viaduct

Under Scenario 1, there would be a sudden, unplanned closure of SR 99 between S. King Street and Denny Way due to structural deficiency, weakness, or minor earthquake. Under this scenario, SR 99 would be closed for an unknown period until a viaduct replacement could be built. Severe travel delays and congestion would be experienced, and utilities on and underneath the viaduct would likely be damaged and would require repair or replacement.

This disruption would considerably affect utilities and public services, including operations for disaster preparedness (Seattle Office of Emergency Management, Port of Seattle, Washington State Ferries), Fire Stations No. 5 and No. 14, and SFD headquarters.

Underground utilities could be damaged and services to the piers could be disrupted. Potential loss of utility services on or underneath the existing viaduct due to damaged utility lines or inability to access lines in need of maintenance could also occur. The sudden, unplanned loss of these utility lines would substantially affect the operations of utilities and public services because “fire flow” to piers would be eliminated, along with electricity to power alarm systems and security lighting. Damage to the combined sewer system could result in sewage overflows and backups. Potential loss of traffic lanes related to this scenario could also restrict and inhibit access of emergency and nonemergency public service vehicles and overall mobility within the corridor.

## 5.1.2 Scenario 2: Catastrophic Failure and Collapse

Scenario 2 considers the effects of a catastrophic failure and collapse of SR 99. Under this scenario, a seismic event of similar or greater magnitude than the 2001 Nisqually earthquake could trigger failure of portions of the viaduct. This scenario would have the greatest effect on people and the environment. Failure of the viaduct could cause injuries and death to people traveling on or near the structure at the time of the seismic event. This type of event could cause buildings to be damaged or collapse and cause extensive damage to utilities. Travel delays would be severe. The environmental effects and length of time it would take to repair the SR 99 corridor are unknown, but the effects would be substantial.

The ripple effect from this catastrophic event would include disruption to all public services and utilities in the study area. Failure of the existing viaduct would cause significant interruption of utilities within the downtown area. Although this effect could be short term, such utility interruption would affect a large portion of the downtown area. Other direct effects may include damage to the economy due to loss of business, the displacement of housing (due to loss of utility services such as heat, power, and potable water), traffic detours (related to signal outages), and corresponding response time and travel time delays to public services.

In addition to potential loss of services due to damaged utility lines or inability to access lines in need of maintenance, the following are also potential results:

- Flooding and soil loss related to broken water mains, storm drain pipes, or sewer pipes.
- Fire events related to damaged or exposed electrical equipment and natural gas, as well as fires related to heating system failures.
- Large-scale power outage due to inability to access failed electric transmission lines suspended from and buried below the existing viaduct; such outages could last several weeks.
- Hazardous materials seepage related to damaged natural gas pipes.

The proximity of electrical systems to natural gas lines could produce a second catastrophic incident if sparks ignite flammable materials or result in an explosion. Loss of water flow due to damaged water pipes could prevent firefighters from containing incidents in a reasonable amount of time to ensure public safety. In November 2003, 69 percent of Seattle residents voted to approve the Fire Facilities and Emergency Response Levy. Over a 9-year period, this program, which started in 2004, will use levy proceeds and other funding to accomplish the following:

- Upgrade, renovate, or replace 32 neighborhood fire stations.
- Construct a new training facility and a new Fire Alarm Center.

- Establish emergency preparedness facilities and disaster response equipment that includes a modern, seismically safe Emergency Operations Center, emergency community supplies, emergency shelter power generators, and emergency water supply capacity for firefighting in the event the City's fire hydrants are disabled.
- Build a new large fire boat, a new small fire boat, and renovate the *Chief Seattle* fireboat (City of Seattle 2009d).

Other effects would include delays in emergency service responses due to decreased mobility in the corridor, as well as increased demand on emergency management agencies (City of Seattle, Seattle Office of Emergency Management, Port of Seattle, Washington State Ferries) for disaster readiness and response.

## 5.2 Operational Effects of the Bored Tunnel Alternative

### 5.2.1 Operational Effects on Public Services

Potential operational risks for public services as a result of the Bored Tunnel Alternative involve location-specific changes in access for public services and related roadway changes and transportation conditions, which may affect response times and travel times. For changes in access locations, see Appendix C, Transportation Discipline Report. Effects on public services as a result of changes in traffic patterns could include delays of emergency and nonemergency service providers, reduced access to public services due to traffic congestion, changes in the transportation system, and reduced parking space. For a detailed comparison of roadway LOS under the Bored Tunnel Alternative and Viaduct Closed (No Build Alternative), refer to Appendix C, Transportation Discipline Report.

Although the transport of hazardous materials through the bored tunnel would generally not be allowed, spilled wastes from vehicle accidents or natural or human-caused hazards could occur in the tunnel. The operational effect of such spills would be increased because of the difficulty of accessing the tunnel during an incident. Depending on the location and extent, a spill incident could affect a number of emergency management agencies, including the Seattle Office of Emergency Management, Port of Seattle, Washington State Ferries, and the City of Seattle. The existing viaduct currently operates within the jurisdiction of each of these agencies, and emergency management functions are in place.

#### Response Time Effects

Roadway LOS is one of the most common terms used to describe how “good” or “bad” traffic is projected to be. LOS is also one measure used to identify response time effects on public services such as police, fire, and emergency medical aid. LOS is a measure of roadway congestion and ranges from LOS A (least congested) to LOS F (most congested).

The Bored Tunnel Alternative would modify the transportation network in and around downtown but is not expected to result in significant adverse operational effects on the provision of public services. Depending on the route used, some public service providers would experience additional traffic-related delay. Others would experience less traffic-related delay. For example, since the Columbia ramp would no longer provide midtown access, somewhat longer response times would result. However, offsetting this change would be the improved access at the south portal from the S. Royal Brougham Way ramps which would result in improved response times.

Effects on public services as a result of changes in traffic patterns could include some delays for fire, police, and emergency service vehicles; postal carriers; solid waste and recycling carriers; and school buses. Depending on location, there could be reduced access to public services due to traffic congestion, changes in the transportation system, and/or a reduction in available parking. In other locations, benefits to public services could include reduced levels of congestion and improved access.

#### 2015 Existing Viaduct

With the 2015 Existing Viaduct highly congested conditions would occur at six intersections:

- Alaskan Way S./ferry holding and SR 99 ramp (LOS F during AM peak)
- First Avenue and Columbia Street (LOS F during PM peak)
- Mercer Place W. and Elliott Avenue W. (LOS F during PM peak)
- Aurora Avenue northbound and Denny Way (LOS F during PM peak)
- Westlake Avenue N. and Mercer Street (LOS F during PM peak)
- Fairview Avenue N. and I-5 ramp (LOS F during PM peak)

The 2015 Existing Viaduct would result in greater overall effects on response time based strictly on the number of congested intersections (six). The congested intersections could result in response difficulties and travel time delays for Fire Stations No. 2, No. 5, No. 8, No. 10, and No. 14, as well as other units needed to respond to larger incidents, and for backup units. Travel time delays could also be experienced by other public services, such as solid waste and recycling services, postal services, and school buses.

#### 2015 Bored Tunnel Alternative

Under the 2015 Bored Tunnel Alternative, highly congested conditions would occur at four intersections:

- First Avenue and Yesler Way (LOS F during PM peak)
- Mercer Place W. and Elliott Avenue W. (LOS F during PM peak)

- Westlake Avenue N. and Mercer Street (LOS F during PM peak)
- Fairview Avenue N. and I-5 ramp (LOS F during PM peak)

With a total of four congested intersections, congestion with the 2015 Bored Tunnel Alternative would be proportionately less than with the 2015 Existing Viaduct.

Peak-hour travel times for SR 99 through trips generally would not vary noticeably between the 2015 Existing Viaduct and the 2015 Bored Tunnel Alternative, with the majority of the times expected to be within 1 to 2 minutes of each other. Travel times with the 2015 Bored Tunnel Alternative would be much faster than those with the Viaduct Closed (No Build Alternative).

Other benefits of the Bored Tunnel Alternative include the following:

- Improved mobility in the South Lake Union area due to the connection of three east-west streets (John, Thomas, and Harrison Streets) across SR 99.
- Improved access from Mercer Street to southbound SR 99 as a result of the extension of Sixth Avenue N. to Mercer Street.
- A new connection between downtown and Uptown due to the Sixth Avenue N. extension.

Areas in which the Bored Tunnel Alternative is expected to result in degraded performance as compared to the 2015 Existing Viaduct include the following:

- Alaskan Way is expected to carry more vehicles with the Bored Tunnel Alternative than it would with the 2015 Existing Viaduct because it would be the primary access route from SR 99 into downtown from the south. This is expected to create congestion along the roadway, particularly near the Seattle Ferry Terminal at Colman Dock, without further improvements to Alaskan Way.
- The ability of Alaskan Way to serve as a primary travel corridor for Elliott/Western traffic is limited by the rail crossing at Broad Street and multiple cross streets. The Elliott/Western Connector, proposed in the Program, would address this issue.
- Under the Bored Tunnel Alternative, consolidation of access between downtown and SR 99 to Alaskan Way S. south of S. King Street would attract more trips on First Avenue S. through Pioneer Square in comparison to the 2015 Existing Viaduct.

As a result of the decreased number of congested intersections and the mobility benefits listed above, the Bored Tunnel Alternative is not expected to adversely affect public service response times and operations compared to the 2015 Existing Viaduct (see Appendix C, Transportation Discipline Report).

## 2030 Bored Tunnel Alternative

Population growth in the central Puget Sound region is expected to continue from 2015 to 2030. This population growth would likely result in additional traffic growth and congestion within the study area. However, this congestion would not be caused by the Bored Tunnel Alternative, so its effects and mitigation are not discussed here.

### Accidents and Safety (SR 99 Mainline and Ramps)

The new ramps at the south portal would be constructed to current standards and are expected to reduce congestion and improve safety.

In the vicinity of the north portal, limited access (right-on and right-off) from the side streets would no longer be allowed under the Bored Tunnel Alternative, and the off-ramp to Mercer Street would be eliminated. On- and off-ramps at Republican Street would improve safety along this portion of SR 99 (refer to Appendix C, Transportation Discipline Report).

### Hazardous Materials

Other operational effects include the risk of potential catastrophic spills of hazardous materials or wastes resulting from accidents. Specifically for the Bored Tunnel Alternative, such an incident would represent an additional risk factor for public services in terms of emergency service response and/or fire and life safety concerns. Fires within enclosed tubes, such as the bored tunnel, are difficult and dangerous to fight. Even with ventilation and suppression systems in place, tunnel fires can quickly become unmanageable and require fire personnel to allow them to burn out before approaching (FHWA 2003). Therefore, the transport of flammable and hazardous materials in the bored tunnel would be prohibited in accordance with the City amendments to NFPA 502, Standard for Road Tunnels, Bridges, and Other Limited Access Highways.

## 5.2.2 Operational Effects on Utilities

Potential operational risks associated with utilities include design elements that could affect capacity, disrupt service, and impair access and maintenance functions. Examples of these potential risks are discussed below, although it is anticipated that these risks would be minimized or avoided through refinements in the project design.

The location of the roadway alignment and support structures could complicate long-term maintenance of underground utilities when these structures are located in the immediate vicinity of the utility, although utility locations will be considered in the roadway design. Where foundations or structures might limit access, these issues will be addressed on a case-by-case basis during final design.

The impairment of access and maintenance functions could result in operational effects on utilities. Closures of roadways that are heavily used and frequently congested would require frequent interagency coordination and advance planning. Emergency repairs could potentially lead to secondary effects on traffic, primarily due to the necessity of closing traffic lanes that may be needed to access utilities. Access and maintenance functions are being addressed as the design proceeds, and efforts are being made to reduce conflicts wherever possible. Therefore, these risks are discussed only as potential effects.

#### **Electrical Power**

Because of life safety requirements, additional uninterrupted electrical power would be required for tunnel lighting, ventilation, pump operation, and impressed current for corrosion control. Pump operation would be required to discharge stormwater, groundwater seepage, and water used for fire suppression to the storm drain or combined sewer system.

#### **Water**

Inside the bored tunnel, the fire suppression system would be operated during emergencies and periodically for system testing and maintenance. Removal of water from the tunnel after operation of the fire suppression system and other discharges to the sewer system are regulated activities, and WSDOT will comply with the permitting requirements. This includes adhering to water quality standards and limits on dewatering flows that enter the City of Seattle and King County drainage/sewer facilities. The method of conveyance, pumping, and discharge locations would need to be determined during ongoing coordination among the design team, King County, SPU, and SFD as the drainage system design proceeds.

#### **Sanitary Sewer and Storm Drainage**

In the vicinity of the south and north portals, additional system components are necessary to address stormwater management issues. Such additional components could include stormwater treatment facilities or larger pipes that provide conveyance and in-line storage. Additional components would require additional maintenance practices to ensure proper operation.

Additional inflows to the storm drain and/or combined sewer system are likely to occur due to periodic testing of the fire suppression system, groundwater seepage from the tunnel, and discharge from the tunnel's fire suppression system during an emergency. The inflow due to the fire suppression system during an actual event would depend on the length of the event. The method of conveyance and pumping and discharge locations would need to be determined during ongoing coordination among the design team, King County, SPU, and SFD as the drainage system design proceeds.

## Natural Gas

No operational changes to the natural gas utility infrastructure are anticipated. Natural gas lines would typically be relocated under roadways adjacent to SR 99, so lane closures for maintenance access would continue to be required.

## Steam

No substantial increases in the operational requirements for steam systems are anticipated.

## Petroleum

There are no known active petroleum systems in the study area.

## Telecommunications

Operational effects on the telecommunication utility infrastructure would include modified maintenance requirements. Telecommunication lines attached to the existing viaduct would be replaced with underground lines. If maintenance access is required after construction is completed, lane closures may be required. Because some portions of the telecommunication systems may be located outside existing right-of-way, access would need to be addressed in easement agreements.

Additional connections to the telecommunication infrastructure would be needed for the telecommunication systems required for the tunnel, as well as cellular service, if it is provided in the tunnel.

## 5.3 Operational Mitigation

Along with design standards of the utilities systems, the guidelines below would help to reduce the operational effects of the Bored Tunnel Alternative on public services and utilities.

To minimize the potential risk associated with a tunnel fire, a variety of measures would be implemented. One of these is a restriction on flammable and hazardous materials in tunnels in accordance with the City amendments to NFPA 502, Standard for Road Tunnels, Bridges, and Other Limited Access Highways. The following are examples of materials that would be prohibited from the bored tunnel:

- Explosives
- Poisonous gases
- Materials that are dangerous when wet
- Materials that pose inhalation hazards
- Materials that must be stowed away from foodstuff
- Flammable materials
- Oxidizers
- Radioactive materials

Transport of these materials through tunnels in either tanks or containers is prohibited; their transport is already prohibited in the Battery Street Tunnel at all times and on the existing viaduct during peak times. There are also restrictions on empty tank vehicles that have transported certain types of materials. Other measures include designing tunnels to provide emergency access and evacuation, as well as designing ventilation and fire suppression systems in accordance with NFPA 502 and other codes and regulations. Access to the bored tunnel would need to be maintained at all times to ensure prompt response times and the safety of both passengers and service providers.

As the design process proceeds, a consolidated utility relocation plan could be prepared to identify existing, temporary, and new locations for utilities and access; to sequence and coordinate the schedules for utility work; and to provide a detailed description of expected service disruptions. This plan would be reviewed by and discussed with affected utility providers as the design proceeds and prior to the start of construction to reduce effects.

Where feasible, utilities would be relocated prior to roadway construction to avoid potential operational effects. Utilities would be reviewed on a case-by-case basis to determine the ones that need to be protected and supported in place during construction.

In the vicinity of the south and north portals, the exact locations and depths of underground utilities would be field-verified (by potholing where appropriate) before final design and construction, and condition checks would be conducted as necessary. Prior to potholing, checking for hazardous materials would be performed as discussed in Appendix Q, Hazardous Materials Discipline Report.

The utilities design team will continue coordinating with utility providers to develop a cost-effective solution and schedule for potential infrastructure relocations.

Business relocations and their associated effects on utilities may be necessary for project construction. See Appendix G, Land Use Discipline Report, for further information regarding business relocations. Additional utility effects may be determined in future design phases as business relocation plans are prepared. Such effects on specific businesses would be addressed in the future as additional details are determined.

Along with design aspects of the utilities systems, following the guidelines and regulations cited below would help to reduce operational effects on utilities:

- City and state energy, building, fire, and other applicable code requirements for all design aspects of the roadway facility.

- Relevant operational utility policies and strategies listed in the adopted City of Seattle Comprehensive Plan, Utilities Element (i.e., LOS, conservation strategies, and coordination of service providers) (City of Seattle 2005d).
- City amendments to NFPA 502 that restrict flammable and hazardous materials in the bored tunnel.

During use of the fire suppression system, the amount of water applied to the bored tunnel may exceed the capacity of the existing storm drain or combined sewer system. Consequently, the discharge rates may need to be restricted. If the discharge rates are restricted, in-line storage may be required. Such storage could be provided in a vault at the pump, at a tunnel operations building, or in a larger-diameter pipe. Also, the pumping system would need to be designed to shut down in the event of an actual emergency to prevent discharges of hazardous materials to the storm drain or combined sewer system. The pumping rates and the need for in-line storage would be determined during continued, ongoing coordination among the design team, King County, SPU, and SFD as the drainage system design proceeds. Groundwater seepage may be conveyed to the same pump systems for discharge into the City's sewer system. The method of conveyance and pumping and discharge locations would need to be determined during ongoing coordination among the design team, King County, SPU, and SFD as the drainage system design proceeds.

## 5.4 Operational Benefits

The potential exists for utility infrastructure upgrades at selected locations. The details of these upgrades would be specified later as part of preliminary and final design in consultation with the utility providers. In effect, utility system upgrades that enhance system reliability and capacity could achieve a long-term operational benefit. Furthermore, implementation of the Bored Tunnel Alternative would significantly reduce the risk associated with a catastrophic failure of the existing facilities under the Viaduct Closed (No Build Alternative), which would lead to moderate to severe utility effects.

Operation of the bored tunnel would benefit public services by providing enhanced mobility through the study area, which would reduce traffic congestion and improve access.

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## Chapter 6 CONSTRUCTION EFFECTS AND MITIGATION

Construction effects are those that occur over a relatively short period. This chapter begins with a general overview of the approach used to determine construction effects on utilities, construction assumptions relating to utility relocations, and a brief introduction to construction sequencing. The next section gives a general description of the construction effects on public services and utilities.

### 6.1 Construction Effects

#### 6.1.1 Public Services Effects

During construction, public services would be affected by increased traffic congestion and delays on the primary roads affected by construction and on roads around the construction area. This would have a direct effect on emergency vehicle access to and through the construction area. Response times for police, fire, and emergency medical aid to locations within and near the construction area would likely increase.

Increased travel time could be experienced by other public services, such as solid waste and recycling collection and disposal services, postal services, and school buses.

Construction effects are specifically related to areas where earthwork is anticipated, including the removal of spoils (particularly in the south portal area), or where the physical placement of project-related temporary or permanent facilities or structures would occur on or adjacent to public services or travel routes of public services. This activity could result in potential disruptions to access, response times, and mobility in the corridor. Generally, the project-related effects on public services fall into two main categories. The first category is increased travel time for emergency vehicles due to lane or road closures, restrictions in access through the construction area, impedance of emergency egress from structures, or increases in traffic in other locations. Increased travel time for emergency vehicles can be a serious problem during life safety emergencies and for disaster preparedness. The second category is increased demand for public services, such as police or emergency medical services, caused by the construction activities; however, this should be a minor effect because first-aid personnel would be required on site during construction activity, as would 24-hour security.

#### Fire and Emergency Medical Services Effects

Lane closures, traffic routing, detours, and construction staging could affect overall traffic congestion on roadways under construction and on adjacent

roadways. Emergency response times could increase due to traffic congestion and lane or roadway closures. Fire and emergency medical services outside the study area also could be affected due to changes in traffic patterns on local roads. Refer to Appendix C, Transportation Discipline Report, for a discussion of LOS effects.

During construction, fire hydrants may need to be relocated. Most of these relocations would occur along at-grade sections (surface streets) requiring sidewalk and street curb relocations. Water line relocations during construction could temporarily affect water supplies that are used for fire suppression. Water service and hydrant relocations on live systems are typically performed by SPU.

Construction of the bored tunnel would require appropriate tunnel rescue services in accordance with WAC 296-155-730(10), Safety Standards for Underground Construction Work. Tunnel rescue can be provided either by construction personnel or by SFD. SFD currently provides similar services for other projects, including the Sound Transit Link Light Rail Project, which includes the Beacon Hill Tunnel and the University Link Tunnel (currently under construction).

#### **Law Enforcement Services Effects**

Construction of at-grade and elevated sections in some high-volume traffic and pedestrian areas could require additional police support services to direct and control traffic and pedestrian movements. Traffic mobility during construction in heavily traveled areas could be most difficult, especially during peak hours. The project would be responsible for maintaining security at sites and staging areas during construction.

#### **School Bus Route Effects**

Delays for school buses and other school traffic could occur due to traffic congestion and lane or roadway closures. Construction of at-grade and elevated sections would delay buses traveling on, crossing, or making turns on the roadway under construction. Major north-south school bus thoroughfares, including the Alaskan Way surface street and adjacent surface streets, would likely be affected at key intersections along these roads. School bus routes outside the study area also may be affected due to changes in traffic patterns on local roads. Refer to Appendix C, Transportation Discipline Report.

#### **Solid Waste Collection and Disposal Effects**

Solid waste haulers could experience delays or disruptions in collection routes during construction activities, especially along route sections that include curbside, driveways, or other collection points that could be closed or more

difficult to access. Collection and haul routes outside the study area also may be affected due to changes in traffic patterns on local roads.

In addition, waste and debris generated during construction would need to be collected and disposed of.

### Disaster Preparedness Effects

Construction could affect disaster preparedness and cause delayed response times. This may affect the Seattle Office of Emergency Management, the Port of Seattle, and Washington State Ferries operations, especially during peak hours.

### 6.1.2 Utilities Effects

An extensive network of utilities is located in the study area. Potential construction effects on utilities are based on a review of available utility maps, discussions, and meetings with utility representatives; a data and literature review; and an ongoing field survey. See Chapter 8, References, for reports that have been consulted regarding effects on and relocation of existing utilities. Exact locations and depths of critical utilities and effects on them will be researched further and verified with utility providers during design and prior to construction of the selected alternative. During final design, construction methods and best management practices (BMPs) will be developed in consultation with the utility providers to provide spacing and protection measures specific to each site. These measures would minimize lack of access, damage to facilities, settlement, vibration, groundwater dewatering, and hazardous materials, and help to provide erosion and sediment control. Relocations will be performed according to agency regulations and permits, utility provider requirements, and proper BMPs.

Utilities could be directly affected during construction, depending on their depth below grade, their material composition, the construction excavation limits, the exact location of the proposed transportation facility, the associated foundation, and other factors. Additionally, relocation of some utilities may have a subsequent effect on other utilities near the relocation activities. Utilities along the bored tunnel alignment also could be indirectly affected by settlement induced by tunnel boring.

The potential effects have been described broadly in this section. In addition, the Bored Tunnel Alternative is being designed to accommodate, where feasible, the utilities currently located in the study area; however, it is important to note that construction may require that utilities be moved from their existing locations.

All underground utility relocations share relatively common construction effects, including pavement demolition, excavation, repaving, ground support systems, groundwater control, relocation effects on other localized utilities, dust and noise control requirements, traffic disruptions, and lane or sidewalk closures. For

aboveground utilities, direct effects typically include placement of new or temporary poles. Direct effects on all utilities would include disruptions to utility service during the cutover from existing to temporary service feeds, and again when the permanent utilities are completed.

In general, most underground utilities within the study area could be affected. Utility pipes, conduits, cables, and other infrastructure in construction areas would need to be relocated, protected, or otherwise avoided during construction. Pipes that cannot be supported or protected in place would be relocated. All utilities would be reviewed and approved on a case-by-case basis prior to being relocated.

Several major construction activities could result in the need to temporarily interrupt utility service to customers within the study area. Portions of the utility system that are temporarily taken out of service would need to be removed to connect new facilities to the existing facilities and convert operations. These outages would be planned in advance.

Removing concrete pavement and installing foundations or other structures are anticipated activities with potential adverse effects on vibration- and settlement-sensitive underground utilities, such as water lines. Cast-iron lead-joint water lines, sewers, and drains could require replacement or joint reinforcement before these construction activities begin.

Temporary or permanent relocation of utilities might be required prior to constructing support or excavation-retaining walls, fill embankments, foundations, or soil improvements. Underground utilities beneath or near fill might settle or displace laterally or could experience vertical and/or lateral loading due to embankment loading and settlement of subgrade soils beneath the fill. In addition, abandoned utilities that are not plugged could become conduits for water or gases, which could affect existing and future facilities. Other utilities may need to be relocated to facilitate construction activities.

Effects could result if contaminated soil or groundwater is encountered during construction activities such as utility relocations, drilled shafts, piles, deep soil mixing, soil strengthening, or excavation. Some existing electrical transmission lines in the study area are high-pressure systems containing a highly refined dielectric fluid; these transmission lines would need to be carefully handled during removal from the existing viaduct. For additional discussion of hazardous materials, see Appendix Q, Hazardous Materials Discipline Report.

For aboveground utilities, direct effects typically include placement of new or temporary poles. Lane or sidewalk closures and utility service interruptions could be necessary during the cutover from existing to temporary service feeds, and again when permanent utilities are located in their final position.

Inadvertent damage to underground utilities could occur during construction. While such incidents do not occur frequently, they could temporarily disrupt service and result in effects on other environmental elements, such as water quality and public health, if not properly mitigated.

Utility construction activities could also affect access to businesses near construction areas by creating detours, delays, and temporary displacement of parking or loading areas. As with any major construction project, proposed activities could cause increased localized congestion, traffic delays, and truck traffic. In addition, water lines and fire hydrants could be obstructed, which could affect utility services and fire suppression capabilities if alternative supplies are not provided.

Other typical construction effects relate to the accuracy of the base mapping and subsurface utility information. Typically, it is not economically feasible to provide an exact horizontal and vertical location of all existing utilities within a study area. If required, certain utilities or locations could be field-verified during design. If these utilities or locations are not field-verified during design, then effects caused by differences in invert elevations, materials, sizes, or utility quantities could occur during construction.

#### **Potentially Affected Utilities**

Potentially affected utilities within the study area that have been considered in the Utility Impact Report (Jacobs 2009) are discussed below. The final design will need to account for all existing utilities, such as utility lines smaller than the sizes indicated here.

- Wet vaults or regulators, which are underground structures that are typically larger than appurtenances such as catch basins and manholes. These structures may be used for water quality treatment, flow control, containment of discharges during fire flow events, or control of diversions to the combined sewer system.
- Water distribution mains (8- to 12-inch-diameter lines), large water feeder mains (16- to 48-inch-diameter lines), water services, and hydrants.
- Sanitary sewer mains (8- to 12-inch-diameter lines), large conveyances (16- to 48-inch-diameter and 60-inch-diameter and greater), and manholes.
- Storm drainage and combined sewer facilities, which vary depending on system design. For discussion of these issues, refer to Appendix O, Surface Water Discipline Report.
- Low-pressure, intermediate-pressure, and high-pressure gas lines and valves.
- Low-pressure and high-pressure steam lines, valves, and vaults.

- Telephone service and fiber-optic cable lines would likely be relocated into a common duct bank for the entire project duration. These relocations would occur prior to roadway construction and relocation of most other utilities.
- Electrical distribution network (underground), electrical distribution non-network, and transmission lines. For the electrical distribution network (underground), categories include trench, primary lines, secondary lines, individual lines, manholes/handholes, vaults, transformers, and switches. For the electrical distribution non-network, categories include overhead primary, overhead secondary, underground primary, and underground secondary facilities, which include transformers, switches, ducts, vaults, and manholes. The transmission facilities include ducts, vaults, and high-voltage pressurized dielectric underground cable.
- Electrical systems (underground and overhead wire) serving transit systems.

The potential utility effects described below are general because the engineering data are at the conceptual stage. The conceptual engineering data will continue to be refined, and more detailed information will be available later in the design process.

### 6.1.3 South Portal

The south portal of the bored tunnel would be constructed with a combination of techniques, including cut-and-cover and open trench. Both of these techniques require a type of shoring or bracing system to allow for excavation, such as a secant pile wall, soldier pile wall, or slurry wall system, or other yet-to-be-determined methods. Regardless of the technique used, numerous relocations of public and private utilities would be required.

#### Electrical Power

The south portal construction would affect SCL's transmission lines. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place. Relocation work for the 115-kV system would need to consider lead times required to obtain line and equipment clearances during construction. SCL would need to be consulted to ascertain the latest clearance lead times. Once a preferred plan is selected, load flow, soil thermal conductivity, and cable-rating studies may be required to ensure that capacity requirements are met by any temporary or permanent modifications to the existing 115-kV system (POWER Engineers 2008).

The existing SCL 26-kV overhead system located along the west side of Alaskan Way S. from S. Royal Brougham Way to S. King Street would be affected by south

portal construction. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place. Relocation and mitigation options must be explored further, and ongoing coordination with SCL is needed to minimize service disruptions before, during, and after construction.

#### **Water**

Water lines and water mains would be affected by south portal construction activities. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place. Coordination with SPU will be required to determine the appropriate fire flow rating to the south portal corridor that must be maintained during and after south portal construction.

Consideration must be given to excavation, ground loading, or other construction in the vicinity of existing water mains. Some of the cast iron pipe was constructed as early as 1891 and is more subject to failure due to construction effects because of the brittle properties of cast iron (RWE 2006d). Cathodic protection may be required, depending on the soil conditions.

It is anticipated that existing fire hydrants, water valves, and water services would need to be relocated to accommodate the new road layout and other south portal construction activities.

#### **Sanitary Sewer and Storm Drainage**

Coordination with SPU and King County will be required to determine the best way to maintain service connections in the south portal area.

The large-diameter pipes in S. Royal Brougham Way are not expected to be affected by south portal construction. The large-diameter pipes in S. King Street could be affected by south portal construction and will need to be monitored.

It is anticipated that the outfalls at S. Royal Brougham Way and S. King Street, the West Point overflow structure, and the Kingdome regulator structure would not be affected by the Bored Tunnel Alternative. The project will be designed to avoid the EBI.

#### **Natural Gas**

PSE's natural gas facilities would be affected by south portal construction. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place.

#### **Steam**

No direct effects on steam facilities are anticipated.

#### **Petroleum**

No direct effects on petroleum facilities are anticipated.

## Telecommunications

Broadstripe, Comcast, ELI, Qwest, Sprint, TWT, Verizon, and XO systems may be affected by south portal construction. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place.

### 6.1.4 Bored Tunnel

Tunnel boring could induce settlement that may affect utilities along the bored tunnel alignment. The amount of settlement would vary depending on the location along the tunnel alignment. For more information about settlement and the condition of subsurface soils, refer to Appendix P, Earth Discipline Report.

The following utilities are expected to be most affected by tunnel boring-induced settlement: SCL clay tile ductbanks, cast-iron lead-joint water mains, water main thrust blocks, gravity utilities, side sewers, water services, steam lines, and natural gas mains. Coordination with SPU, King County, SCL, DoIT, private communications providers, PSE, and Seattle Steam should occur to verify that they are aware of potential settlement and vibration caused by tunnel boring and to seek their guidance for mitigation.

Cast-iron lead-joint water mains are susceptible to settlement. Per City of Seattle Standard Specification 1-07.16(1), "cast iron pipe joints have been known to develop leakage when disturbed by shifting earth, or excessive vibrations, or adverse effects of any other construction excavation work" (City of Seattle 2008).

For gravity utilities, if the ground settles significantly, the flow, capacity, structural integrity, and joints of pipelines could be affected. Coordination with SPU and King County is needed to determine the amount of settlement that is acceptable to their gravity systems. Special consideration should be given to the 48-inch-diameter pile-supported brick sewer aligned in S. King Street.

Some steam lines are installed with a slope to allow for drainage of condensate. If the ground settles significantly, the drainage of the steam lines could be affected. If steam lines are affected, asbestos abatement may be required. Coordination with Seattle Steam is needed to determine the amount of settlement that is acceptable to its systems.

If settlement caused by the tunnel boring machine (TBM) either during construction or for an extended period after construction results in damage to utilities, emergency repairs would be required. These repairs could result in lane closures and surface excavations, which could cause traffic delays.

### 6.1.5 North Portal

The north portal of the bored tunnel would be constructed with a combination of techniques, including cut-and-cover and open trench. Both of these techniques

require a shoring or bracing system to allow for excavation, such as a secant pile wall, soldier pile wall, or slurry wall system, or some other yet-to-be-determined method. Regardless of the technique used, numerous relocations of public and private utilities would be required.

#### **Electrical Power**

The existing circuits in the ductbank on the east side of SR 99, the circuits in the ductbanks crossing SR 99 at Thomas and Harrison Streets, the Broad Substation, and the 115-kV transmission line in Thomas Street would be affected by north portal construction. These systems would need to remain in service during and after construction. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place.

Coordination with utility providers would be needed to minimize service disruptions before, during, and after construction.

#### **Water**

SPU water lines would be affected by north portal construction. It may be possible to reroute the water system to adjacent lines or to a temporary location adjacent to the north portal, but this action must be reviewed with SPU.

Coordination with SPU and King County will be required to ensure continued service level performance, regulatory code compliance, and appropriate fire flow rating to the north portal corridor.

Consideration must be given to excavation, ground loading, or other construction near existing water mains. Some cast iron pipe was constructed as early as 1891 and is more subject to failure due to construction effects because of its less forgiving lead joints and the brittle properties of cast iron (RWE 2006d). Cathodic protection may be required depending on the soil conditions.

It is anticipated that existing fire hydrants, water valves, and water services would need to be relocated to accommodate the new road layout and other north portal construction activities.

#### **Sanitary Sewer and Storm Drainage**

The existing combined sewers near the centerlines of SR 99 and Broad Street and the sewer lines aligned in Sixth Avenue N., Republican Street, and Harrison Street would be affected by north portal construction. These pipes collect surface storm drainage and have multiple side sewer connections. The existing separated storm drain aligned in Broad Street would also be affected by north portal construction. Coordination with SPU and King County will be required to determine how best to relocate these systems and maintain their services.

### Natural Gas

PSE's natural gas facilities would be affected by north portal construction. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place.

### Steam

No direct effects on steam facilities are anticipated.

### Petroleum

No direct effects on petroleum facilities are anticipated.

### Telecommunications

DoIT's existing system aligned along SR 99 would be affected by north portal construction. Coordination with DoIT will be required to determine how best to relocate this system. DoIT's system that crosses SR 99 at Thomas Street may also be affected.

Broadstripe, Comcast, ELI, Global Crossing, Level3, Qwest, TWT, and Verizon systems may be affected by north portal construction. It may be possible to temporarily relocate systems to an aboveground location, thereby vacating the SR 99 corridor. Some providers may need to cross the SR 99 corridor in some locations during construction.

### 6.1.6 Viaduct Removal

All utilities attached to the existing viaduct and expected to remain in service would need to be relocated prior to viaduct demolition. It is anticipated that for the viaduct removal, replacement may be necessary for the utilities buried beneath the viaduct. Some of these relocations or replacements may require excavation. The same is true for the removal of viaduct columns and footings to an estimated depth of 5 feet below existing grade. Coordination with the owners of these utilities would be required to understand and mitigate the effects on these utilities.

The surface features of existing utilities located beneath the viaduct may need to be adjusted to be flush with the new surface. Grade changes in this area are expected to be minimal, which would limit effects on utilities.

### Electrical Power

SCL's transmission lines 1 and 2 are attached to the existing viaduct and would need to be relocated prior to viaduct demolition. Coordination with SCL would be required. Relocation work for the 115-kV system would need to consider lead times required to obtain line and equipment clearances during construction. SCL will need to be consulted to ascertain the latest clearance lead times. Once a

preferred plan is selected, load flow, soil thermal conductivity, and cable-rating studies may be required to ensure that capacity requirements are met by any temporary or permanent modifications to the existing 115-kV system (POWER Engineers 2008).

Any electrical lines attached to the underside of the existing viaduct would require relocation prior to removal of the viaduct.

Coordination with utility providers will be needed to minimize service disruptions before, during, and after construction.

#### **Water**

It is anticipated that existing fire hydrants, water valves, and water services would need to be relocated to accommodate viaduct demolition and surface restoration construction activities.

#### **Sanitary Sewer and Storm Drainage**

Existing utilities beneath the existing viaduct would potentially be affected by the viaduct removal. Coordination with the owners of these utilities will be required to understand and mitigate the effects on these utilities.

#### **Natural Gas**

The 12-inch-diameter high-pressure gas main crosses over multiple existing viaduct pile caps. These facilities will be monitored as the design process proceeds and would be either relocated or protected in place.

#### **Steam**

No direct effects on steam facilities are anticipated. However, coordination with Seattle Steam would be advisable to ensure that steam lines would not be affected by construction activities.

#### **Petroleum**

No direct effects on petroleum facilities are anticipated.

#### **Telecommunications**

DoIT infrastructure is attached to the existing viaduct from S. Washington Street south and would need to be relocated prior to demolition of the viaduct. Coordination with DoIT will be required.

Broadstripe, 360networks, Comcast, ELI, Qwest, and XO have infrastructure attached to the existing viaduct that would need to be relocated prior to demolition.

### 6.1.7 Battery Street Tunnel Decommissioning

The Battery Street Tunnel would be closed after the bored tunnel is opened to traffic. The cross streets above the Battery Street Tunnel and the utilities would be maintained. The current proposal is to use crushed rubble recycled from the existing viaduct to fill the tunnel approximately two-thirds full, and then pump in a low-strength concrete slurry to solidify the rubble. The concrete slurry mix to fill the remaining clearance space would be poured from openings in the street (Battery Street) above the tunnel. The concrete mix would need to be poured in several locations along the alignment of the tunnel.

Before filling the Battery Street Tunnel, the project would remove materials associated with tunnel system components and other elements, such as asbestos transite conduit, lead-based paint, light fixtures, and light tubes containing heavy metals. The combined sewer piping would be maintained. The ends of the tunnel would be sealed with concrete, and barricades would be placed to prevent entry to the tunnel.

After the closure of the tunnel, a new method would be needed to reach the utilities currently accessed from within the tunnel. This method will be developed during final design and may require an alternative to the proposed method of tunnel abandonment. A component of the decommissioning process for the Battery Street Tunnel will be ensuring that utilities are completely disconnected and separated from the serving utility and that customers relying on these utilities are provided with new service. No other public services or utilities effects are expected from the decommissioning of the Battery Street Tunnel.

## 6.2 Construction Mitigation

This section discusses mitigation measures to help minimize potential construction effects on public services and utilities. Proposed mitigation measures are based on NEPA principles, WSDOT and City of Seattle policies, mitigation proposed for similar projects, and coordination with affected agencies. These measures need to be refined, and additional or more specific mitigation measures will be developed as the planning and design process continues.

The proposed construction mitigation is based on the construction effects discussed above. For a complete description of the overall construction sequencing, including traffic detours and staging, refer to Appendix B, Alternatives Description and Construction Methods Discipline Report.

The project team will continue coordinating with City and Port of Seattle police and fire departments, regional transportation agencies, and other appropriate agencies during preliminary and final design of the selected alternative. The objectives of this coordination are to provide or develop reliable emergency

access and alternative plans or routes to avoid delays in response times, and to ensure that general emergency management services are not compromised. Early notice of detours and lane restrictions will be provided to emergency and nonemergency public service providers.

Additional coordination will occur with the police and fire departments. The utilities design team will coordinate with SFD regarding any water line relocations that would affect water supply for fire suppression, establish alternative supply lines prior to any breaks in service, and coordinate electrical and telephone disconnections and relocations that would affect the fire and life safety systems. The project team will also coordinate with construction personnel and, if necessary, with local police departments to ensure adequate staffing is available during construction for traffic and pedestrian movement control and other necessary policing efforts.

The City and WSDOT will coordinate with solid waste services to minimize effects on solid waste collecting operations.

Temporary east-west pedestrian routes through the construction areas may be provided at various locations during construction. Such locations would need to be determined during future design phases and during construction. Utility effects associated with the temporary routes may include such elements as utility relocations, additional catch basins, or other effects to be determined. Such utility effects would be addressed as needed during preliminary and final design and construction.

Other measures could include the following:

- Provision of backup on-site electrical generation, as needed, to minimize or eliminate power outages to customers as determined by SCL on a case-by-case basis.
- A customer service plan and contact information for utility customers for use during construction.
- A utility contact plan that identifies up to two contacts within each utility for redundancy in notification. These two primary contacts would be responsible for coordinating with appropriate staff within the utility to discuss project-related information.
- A public service contact plan that identifies up to two contacts for each service provider to allow for redundancy in notification. These two primary contacts would be responsible for coordinating with appropriate staff within the organization to discuss project-related information.

## 6.2.1 Public Services

### Fire and Emergency Medical Services

Intelligent traffic signal controls at signalized intersections could be used as a partial mitigation measure for response time effects on fire and emergency medical services, particularly during construction. If intelligent traffic signals are unable to adequately mitigate the effects on emergency response, additional staff, apparatus, and facilities may be necessary.

During water line and fire hydrant relocation, advanced coordination and schedule notification would be provided to affected fire stations, SPU, and hospitals to allow advanced planning and to reduce the effects associated with service interruptions.

### Law Enforcement Services

The need for additional police support services could be addressed by providing additional permanent or temporary law enforcement officers and/or stations.

### School Bus Routes

The Seattle School District has rerouting plans in place for times when the existing viaduct is unusable. It is anticipated that the School District would implement these rerouting plans to address school bus travel through the corridor during construction.

### Solid Waste Collection and Disposal Effects

Construction waste and debris could be disposed of at a number of disposal facilities in the Puget Sound region. A portion of the debris, including clean wood waste, metals, gypsum, and other materials, could be recycled at facilities such as Seattle's recycling and disposal stations. Sufficient capacity exists at area transfer stations and regional landfills to accommodate the construction waste and debris generated from construction activities proposed under the Bored Tunnel Alternative. It is important to note that the disposal of construction waste and debris is unresolved at this time, and pending selection of the alternative to be built and more refined engineering, a detailed analysis will need to be provided.

Waste processing haulers and facilities should be informed that additional loads would occur during construction. Additional haul trucks, operators, barges, or train cars may be required.

### Disaster Preparedness

The project team will continue coordinating with City and Port of Seattle police and fire departments, regional transportation agencies, and other appropriate

agencies during preliminary and final design of the selected alternative. The objectives of this coordination are to provide or develop reliable emergency access and alternative plans or routes to avoid delays in response times, and to ensure that general emergency management services are not compromised. Early notice of detours and lane restrictions will be provided to the providers of emergency and nonemergency public services.

In August 2010, WSDOT will begin work to install a system designed to automatically close the viaduct in the event of a moderate to severe earthquake in the greater Seattle area. The new system will consist of nine traffic gates strategically placed on the viaduct and controlled by an earthquake detection system. When the earthquake monitoring system detects significant ground movement, it will simultaneously lower all nine traffic gates and safely close the viaduct in 2 minutes (WSDOT 2010).

### 6.2.2 Utilities

Working with utility owners, the project team would coordinate utility relocation plans that identify utility impacts and potential temporary and final locations for relocated utilities. Designers and contractors would be required to develop construction sequence plans and coordinate schedules for utility work to minimize service disruptions and provide ample advance notice when service disruptions are unavoidable consistent with utility owner policies. Relocation plans and service disruptions would be reviewed and approved by the affected utility providers before construction begins.

The following is a list of potential measures that could be used to mitigate effects on utilities. As final design proceeds, utility owners will develop specific measures as needed.

- Coordinate utility relocation plans with utility owners and customers to minimize impacts of service disruptions.
- Require contractors to comply with utility owner notice requirements for planned outages.
- Coordinate with utility owners to insure owner contingency plans for management of any potential utility service disruptions during construction are accommodated.
- If inadvertent damage to utilities occurs during construction, the appropriate utility provider would be contacted immediately to restore service, Contractors would also be required to take immediate measures to assure public safety and protect property.

- If settlement-induced damage requires emergency repairs to utilities, coordinate with the public and transit agencies to mitigate the effects of any delays caused by the repairs.
- Provide traffic revision equipment and personnel as required during utility relocations.
- Conduct construction activities during off-peak hours, whenever possible, to lessen traffic effects.
- Provide protective measures such as pipe and conduit support systems, trench sheeting, and shoring during construction to minimize or avoid potential damage to exposed utilities and remaining pavement structure.
- Use construction techniques to avoid or minimize vibration effects on utilities. Such techniques may include drilled shafts in lieu of driven piles.
- Coordinate with SCL to provide a safety watch to minimize the interruption of power to customers and to speed up power restoration in the event of accidental interruption of power caused by project construction.
- Coordinate construction-related mitigation with other construction projects in the vicinity, to minimize utility and traffic disruptions.

Utility owner standards (along with other guidelines listed in Section 2.2) would be used for utilities that would need to be relocated. Existing piping, conduits, buried cable, and buried utilities that encroach on areas required for construction would be removed and relocated, within the existing right-of-way, wherever feasible.

The lead agencies will work with utility providers to coordinate the planned schedule, sequencing, and areas of outages. These issues will need to be coordinated as part of preliminary and final design.

Hazardous materials may be encountered during construction. Asbestos-cement pipe may be encountered in water line construction, in some SCL transite conduits, and in insulation around steam lines. See Appendix Q, Hazardous Materials Discipline Report, for additional information regarding mitigation of hazardous materials encountered during construction.

Appendix I, Section 106: Historic, Cultural, and Archaeological Resources Discipline Report, discusses potential archaeological resources and mitigation within that discipline's study area. The mitigation measures identified in Appendix I would be implemented for utility construction that may occur prior to roadway construction to ensure that archaeological resources are either avoided or addressed appropriately during utility construction.

Depending on the type of structure or earthwork, specific construction methods may need to be employed to minimize the transportation of hazardous material or

contaminated media. To prevent migration of contaminants in shallow groundwater, controlled-density fill or trench dams may be installed at intervals along utility runs where contamination is suspected. See Appendix Q, Hazardous Materials Discipline Report, for further information.

### 6.2.3 Construction Risks and Ground Improvement Methods

Tunneling is planned to be undertaken with best-available tunneling technology to minimize ground settlement. The ground improvement methods discussed below would be used prior to or during tunneling activities to protect existing structures on the surface and underground utilities from any potential ground subsidence and to strengthen the ground mass so that it can better accommodate the construction of the tunnel.

Ground improvement would likely be performed along the tunnel alignment to stabilize soft soils around the tunnel and mitigate potential ground loss. Ground improvements would be needed more extensively for the construction of the south portal and tunnel where the predominant soils are fill material. The area south of Marion Street, primarily between S. King Street and Marion Street, is more vulnerable to ground settlement than the north portal area because of the soil types found there and the relatively shallow depth of the tunnel. However, certain locations in the north portal area may also need ground improvements.

The minimization of ground settlement risks posed by tunnel work, such as sinkholes in streets or damage to utility conveyance facilities, is a primary design goal of tunnel construction. Ground improvements, such as those described throughout this section, would also be used as advance mitigation to prevent damage to utilities from ground settlement prior to tunnel boring. Before ground improvement takes place, care would be taken to ensure that grout does not enter utility pipes, trenches, vaults, areaways, and basements.

Although extensive planning and design measures are being undertaken to prevent subsidence, some unanticipated settlement events could occur. If unanticipated settlement occurs, emergency measures would be necessary to repair damage or to minimize further settlement. These measures could include lane and/or sidewalk closures or access to basements of adjacent buildings. Refer to Appendix P, Earth Discipline Report, for a more detailed discussion of ground improvements and potential effects.

#### Permeation Grouting

Permeation grouting is a ground improvement process in which a grout fluid is injected (by permeation) into the pore spaces of the soil to displace the air and/or water occupying the natural pore spaces. The fluid can be either a cement grout or a chemical grout, depending on project requirements and restrictions, soil

permeability, material availability, and the availability of specialized equipment and skilled local labor.

The permeation grouting process is limited to granular soils with a sufficiently high permeability to allow the fluid to penetrate the soil pore spaces. These permeability restrictions vary depending on the type of grout used, with ordinary Portland cement grout used for coarser materials, and microfine cement used for finer-grained sands with a lower permeability. For high-permeability materials, it may be necessary to adjust the cement grout fluid's viscosity, injection pressure, or setting time to limit the penetration distance. For finer-grained sands and coarse silts, chemical grouts, such as sodium silicate, are normally used because they have a lower viscosity than cement grouts and can penetrate smaller voids. In clay-type soils, both cement grout and chemical grout have limited application because soil permeability is too low to allow fluid penetration into the pore spaces without fracturing the ground and forming isolated lenses of grout.

Grout is placed through small-diameter pipes inserted from the surface and from pits or shafts adjacent to the grouted area or, in certain instances, from the tunnel face. In the latter scenario, the TBM must be appropriately equipped with drills and valves, and the tunnel drive must stop long enough to drill and insert the grout placement pipes, inject grout, and allow time for the grout to set. This method has been used successfully in situations where tunnels have been built under potentially sensitive or important structures.

### Compaction Grouting

Compaction grouting is a process that injects a highly viscous grout into the soil mass. It does not penetrate the pores as with permeation grouting, but instead forms a grouted "bulb" within the soil mass, displacing the natural soil and consolidating and condensing it in the process. Because of the nonpenetration of the grout into the soil mass, a single bulb has a limited volume and area of soil improvement. However, multiple bulbs can be placed adjacent to one another to achieve the desired results of ground improvement using this technique. It is especially useful in loose, granular soils that compact easily and quickly.

Compaction grouting would involve injection of grout above the tunnel crown as the TBM advances forward longitudinally. The grout densifies the soil profile overlying the tunnel's crown and it replaces some of the lost ground, thereby preventing potential settlement (or sinkholes) from propagating upward to the surface.

### Compensation Grouting

Compensation grouting would be performed to mitigate ground loss during tunneling beneath the structures where settlement is expected or detected during construction of the bored tunnel. Compensation grouting is a particular type of

ground improvement in which grout is injected into the ground beneath the foundations of existing structures, and grouted bulbs are formed beneath the foundations. The grout displaces the soil, and in the process, has the potential to uplift a foundation to recover displacement from ground movements associated with tunneling beneath the structure. Placement of grout using these methods is usually optional and only used if monitoring of a structure's foundation detects vertical displacement. However, because the actual behavior of the footing is unknown prior to construction, common practice is to install injection pipes appropriately to inject a bulb beneath a foundation. If no movement is detected, no grout is placed, although the pipes are in place if required. If movement is detected, the preinstalled pipes are used to inject sufficient grout to maintain the vertical position of the foundation prior to construction. Injection would continue as long as vertical movement was detected.

The key to effective compensation grouting is to carefully monitor both the structure and any ground movements to optimize the timing and quantities of grout to be injected. Through reuse of preinstalled grout placement pipes, grout can be injected before, during, and after the tunnel drive.

### Ground Freezing

Artificial ground freezing is a process by which heat is extracted from a water-saturated soil mass, temporarily converting the interstitial pore water to ice, resulting in a consolidated soil mass as long as it remains frozen. The heat extraction is accomplished by installing freeze pipes into the soil mass to be frozen and then circulating a refrigerant fluid to extract the heat. Under normal conditions, a saline solution with a freezing point below that of pure water is used. Liquid nitrogen can be used for saline groundwater conditions, when groundwater is moving under a slight hydraulic gradient, or where a "quick freeze" is desired. This expedites the freezing process but substantially increases the cost. The freeze can be maintained as long as the temporary foundation support is required.

Ground freezing is applicable to all soil types but is potentially problematic in some soils. Because water expands as it freezes, free water must be allowed to escape from the pore space as the ice forms or ice lenses will form and result in ground heave. In coarse- to fine-grained granular soils, this is usually not an issue because soil permeability is high enough to allow free water to escape. As soils become finer grained in the silt sizes, the permeability is low enough that free water cannot easily escape, and in some cases, capillary action can attract free water to the ice crystals. Either of these phenomena results in the formation of ice lenses that result in ground heave. In clays, free water cannot escape, but capillary action is reduced. Depending on the natural water content of the clay, some heave potential still exists due to ice formation and expansion. There is a

slight risk that any water-carrying buried utilities (such as water and sewer lines) could also freeze if they are within the zone of formation of the frozen ground block. Although ground freezing has not been ruled out as a ground improvement method, it is not among the most likely methods to be used. If it is used, it would be used in very limited areas.

### **Underpinning**

Underpinning is a traditional structural modification process by which the foundations of an existing structure are temporarily (sometimes permanently) structurally supported by alternative support elements. The objective is to maintain the structural integrity and vertical position of the existing structure while excavating for a new structure.

Typical underpinning methods include temporary timber cribbing beneath existing foundations, ground improvement with grout or ground freezing beneath the existing foundations, or new structural elements such as pin piles (or micropiling) beneath the existing foundations. The selection of an appropriate underpinning solution is a function of the size (weight) and geometry of the structure to be temporarily supported, the work space available, the site-specific ground and groundwater conditions, the availability of specialty equipment and labor locally, the duration for which supplemental foundation support is required, and the cost and schedule to construct the underpinning scheme.

Care should be taken to maintain access to utilities before, during, and after construction activities.

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## Chapter 7 CUMULATIVE EFFECTS

Cumulative effects, as defined by the Council on Environmental Quality (CEQ), are “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 actions” (CEQ Regulation 1508.7). Included in the consideration of cumulative effects in this chapter are transportation projects, land use and development planning projects, and planned upgrades to local utility infrastructure. Attachment A provides more detailed information on cumulative effects.

### 7.1 Current Public Services and Utilities Trends

Public services and utilities have evolved over time to adapt to the city’s growth and new development demands. There have also been ongoing improvements in operations and technology that have resulted in the types of facilities and services that exist today. In the mid-1800s, many of the public services were just being established. Early day schools (1861), law enforcement (1861), mail service (1852), and fire suppression (1883) were initiated during this period. Public utilities began to appear somewhat later near the turn of the 20<sup>th</sup> century, with water and sewer installations in 1889, steam in 1893, and electricity in 1911.

As the population grew, so did the number and types of public services and utilities being provided by both the public sector and private companies. Newer technologies have resulted in additional utility services such as fiber-optic cable for communications and other electronic systems, cable TV systems, and high-speed Internet access.

In the past few decades, there have been a number of private acquisitions and mergers of utilities or services such as natural gas, solid waste collection, and telecommunication companies. This trend is likely to continue because company growth is accomplished by acquiring other companies, and expanding into new service areas, and establishing new customer bases.

Services provided through local government and supported by taxes have been hard hit by the recent economic downturn, and many governmental services have seen cutbacks in staffing and operations and maintenance activities. This situation is likely to continue into the near future.

## 7.2 Effects From Other Roadway Elements of the Program

### 7.2.1 Alaskan Way Surface Street Improvements – S. King to Pike Streets

The Alaskan Way surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), transitioning to four lanes between Marion and Pike Streets. Generally the new Alaskan Way surface street would be located on the east side of the right-of-way where the viaduct is located today. The new street would include new sidewalks, bicycle lanes, parking and loading zones, and signalized pedestrian crossings at cross streets.

Once completed, the new Alaskan Way surface street would provide efficient movement of traffic along Seattle's central waterfront. The street would have more capacity than the existing Alaskan Way surface street, which would likely result in improved LOS and benefits to public service providers. During construction, traffic conditions could worsen, resulting in delays for public service providers. These effects could be mitigated by coordinating with public service providers to develop contingency plans in advance of construction. These mitigation measures should be coordinated with utility relocations planned for the Elliott Bay Seawall Project and the Alaskan Way Promenade/Public Space due to the proximity of the three projects.

During construction, utilities would need to be relocated. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

### 7.2.2 Elliott/Western Connector – Pike Street to Battery Street

The new roadway connecting Alaskan Way to Elliott and Western Avenues (in the area between Pike and Battery Streets) would be four lanes wide and would provide a grade-separated crossing of the BNSF mainline railroad tracks. The new roadway would include bicycle and pedestrian facilities. The Lenora Street pedestrian bridge is expected to remain as it is today. Where the bridge terminates on its east side, modifications would be made to provide an at-grade pedestrian crossing on Elliott Avenue.

The new connection would offer new access opportunities and benefits to public service providers. During construction, traffic conditions could worsen, resulting in delays for public service providers. These effects could be mitigated by coordinating with public service providers to develop contingency plans in advance of construction.

During construction, utilities would need to be relocated. The effects of utility relocations can be mitigated by coordinating project planning and design with the

utility purveyors, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

### 7.2.3 Mercer West Project – Fifth Avenue N. to Elliott Avenue

Mercer Street would be restriped and signalized between Fifth Avenue N. and Second Avenue W. to create a two-way street with turn pockets. These improvements also include the restriping and resignalization necessary to convert Roy Street to two-way operations from Fifth Avenue N. to Queen Anne Avenue N.

These improvements would improve circulation routes and access opportunities, resulting in benefits to public service providers. During construction, traffic conditions could worsen, resulting in delays for public service providers. These effects could be mitigated by coordinating with public service providers to develop contingency plans in advance of construction.

Because no utilities would need to be relocated, no effects on utilities in this area are expected from this project.

## 7.3 Effects From Non-Roadway Elements of the Program

### 7.3.1 Elliott Bay Seawall Project

The Elliott Bay Seawall needs to be rebuilt to protect the shoreline along Elliott Bay, including Alaskan Way. It is at risk of failure due to seismic and storm events. The seawall currently extends from S. Washington Street in the south to Bay Street in the north, a distance of about 8,000 feet. The Elliott Bay Seawall Project limits extend from S. Washington Street in the south to Pine Street in the north (also known as the central seawall).

Replacing the Elliott Bay Seawall would not likely have any long-term effects on public services and utilities. However, the new seawall would be less vulnerable to failure during a seismic event than the existing seawall, which would otherwise result in substantial disruptive effects on public services and utilities.

During construction, traffic conditions could worsen, resulting in delays for public service providers, including emergency services. These effects could be mitigated by coordinating with public service providers to develop contingency plans in advance of construction.

During construction, utilities located on or near the seawall would need to be relocated. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access. These mitigation measures should be coordinated with utility relocations planned for the Alaskan

Way surface street improvements and the Alaskan Way Promenade/Public Space due to the proximity of the three projects.

Mitigation measures for the Elliott Bay Seawall Project will be determined during the environmental review process specific to that project.

### 7.3.2 Alaskan Way Promenade/Public Space

A new expanded waterfront promenade and public space would be provided to the west of the new Alaskan Way surface street, between S. King Street and Pike Street. Between Marion and Pike Streets, this space would be approximately 70 to 80 feet wide. This public space will be designed at a later date. Access to the piers would be provided by service driveways. Other potential open space sites include a triangular space north of Pike Street and east of Alaskan Way and parcels created by the removal of the viaduct between Lenora and Battery Streets.

A new waterfront promenade would likely attract human activity, which might result in a slight increase in the need for law enforcement, fire suppression, and emergency medical services. Mitigation measures for the new promenade will be determined during the environmental review process specific to that project.

During construction, utilities beneath the promenade would need to be relocated. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access. These mitigation measures should be coordinated with utility relocations planned for Alaskan Way surface street improvements and the Elliott Bay Seawall Project due to the proximity of the three projects.

### 7.3.3 First Avenue Streetcar Evaluation

The First Avenue streetcar is currently planned to run between S. Jackson Street and Republican Street along First Avenue and would include an extension to the South Lake Union streetcar line. The maintenance base would likely be either at the extension of the South Lake Union line or at a new maintenance base that would be built as part of the First Hill streetcar line.

The First Avenue streetcar would operate within the First Avenue right-of-way, which could result in additional delays for public service providers using First Avenue. Mitigation measures for the new First Avenue streetcar will be determined during the environmental review process specific to that project.

The First Avenue streetcar would require additional electricity. Transit service providers routinely evaluate their energy needs and coordinate with their energy utility, so this increase would be unlikely to result in an adverse effect on utilities. The presence of a streetcar would likely be an added constraint to future utility

maintenance within the First Avenue right-of-way. Potential constraints include stray current and utility access.

During construction, utilities would need to be relocated, and new overhead trolley wire for electric trolley buses would need to be added. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

#### 7.3.4 Transit Enhancements

A variety of transit enhancements would be provided to support planned transportation improvements associated with the Program and accommodate future demand. These enhancements include (1) the Delridge RapidRide line, (2) additional service hours on the West Seattle and Ballard RapidRide lines, (3) peak-hour express routes added to South Lake Union and Uptown, (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, (5) transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue, and (6) simplification of the electric trolley system. RapidRide transit along the Aurora Avenue corridor would also be provided.

Enhanced transit service could reduce some traffic congestion, resulting in a decrease in emergency vehicle response times, as well as improving public service delivery and utility relocation efforts.

Enhanced transit service could require more electricity. Transit service providers routinely evaluate their energy needs and coordinate with their energy utility, so this increase would be unlikely to adversely affect utilities.

Simplification of the electric trolley system would require the relocation of some utilities and the addition of new overhead transit wire. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and providing for maintenance and repair access.

### 7.4 Cumulative Effects of the Project and Other Program Elements

#### 7.4.1 Public Services

The Bored Tunnel Alternative and other Program elements would affect future traffic patterns. Consequently, these changes may affect existing public service access and vehicle routes. Moreover, cumulative effects could include lane closures as a result of multiple projects under construction at the same time (including utility relocations), which may result in longer emergency response times and travel time delays for other public service vehicles. Lane closures and

traffic delays from multiple projects in the same or adjacent areas of the city could result in difficulties in determining efficient routes for these services.

In addition, overlapping construction schedules for utility relocations could result in temporary disruptions to water services necessary to support fire suppression in the study area. For the potential cumulative effect of multiple utility relocations, emergency response providers will be notified of construction plans and schedules in advance to reduce the effects of service disruptions.

#### **7.4.2 Utilities**

In general, cumulative effects on utilities would result from overlapping construction schedules among the planned actions by increasing the risk and frequency of service disruption. Potential utility outages would affect business and residential customers as well as public services. Services to customers could be temporarily disconnected each time a utility line is relocated. Multiple relocations of utilities could affect the local economy by increasing the risk of frequent and/or accidental loss of service to retail and commercial businesses, including the movement of freight.

The utility construction sequencing for the bored tunnel would be a major undertaking in and of itself. If construction of the bored tunnel overlaps with construction of other proposed actions, the multiple utility relocations would require utility providers to secure permitting, skilled personnel, and specialized equipment in large quantities and to commit to completing relocation work at an accelerated pace. The overall cumulative effect could be substantial due to the complexity of the relocations, the critical nature of the utility facilities in downtown Seattle, the estimated cost of the relocations, and the possibility of encountering schedule delays and temporary service disruptions. However, the cumulative effects stemming from multiple utility relocations occurring at the same time could be reduced by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

Potential cumulative benefits of these projects would be realized through the upgrade of the utility infrastructure to the latest standards versus the continuing risk of losing the existing viaduct structure as a utility corridor in the event of a natural disaster, such as another earthquake of the magnitude of the Nisqually earthquake of 2001 or larger.

### **7.5 Cumulative Effects of the Project, Other Program Elements, and Other Actions**

The existing environment in downtown Seattle today is a result of cumulative effects from decades of projects. Each project adds its environmental effects to

those that preceded it, and the cumulative result is the world as we know it. The environment that will exist in Seattle in 2030 will, similarly, be a result of all projects constructed to date and all projects constructed between today and 2030, which includes the entire Alaskan Way Viaduct and Seawall Replacement Program, including the S. Holgate Street to S. King Street Viaduct Replacement Project and other Moving Forward projects.

Cumulative effects of other past, present, and foreseeable actions combined with the Program may add to the effects on public services and utilities discussed in this discipline report. The project team considered 39 projects (shown in the project-specific cumulative effects matrix in Attachment A) for potential activities that could have a cumulative effect on public services and utilities in Seattle. The detailed evaluation of cumulative effects is provided in Attachment A and summarized here.

The effects from these projects will combine to alter future traffic patterns, which may result in travel time delays for public service vehicles. Increased development could lead to increased demand for public services. However, it is expected that as part of the environmental review for these projects, appropriate mitigation measures will be identified to reduce these combined effects.

During construction of these projects, utilities may need to be relocated. The effects of utility relocations can be mitigated by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

Through careful planning and coordination, the 2030 environment will be able to accommodate the cumulative effects resulting from the upcoming decades of project implementation.

The following is a summary of the key development projects relating to cumulative effects:

- SR 519 Intermodal Access Project, Phase 2
- I-5 Improvements
- Sound Transit University Link Light Rail Project

### 7.5.1 Public Services

The Bored Tunnel Alternative and the Program, together with other planned projects that may cause major roadway changes, would affect future traffic patterns. Consequently, these changes may affect existing public service access and vehicle routes. Moreover, cumulative effects could include lane closures as a result of multiple projects under construction at the same time (including utility relocations), which may result in longer emergency response times and travel

time delays for other public service vehicles. Lane closures and traffic delays from multiple projects in the same or adjacent areas of the city could result in difficulties in determining efficient routes for these services. Furthermore, if not properly mitigated, the combined effect of increased development associated with the planned actions in the study area could be an increased demand for public services. However, as other planned actions are subject to a separate environmental review, it is expected that mitigation measures would be implemented to reduce these combined effects.

In addition, overlapping construction schedules for utility relocations could result in temporary disruptions to water services necessary to support fire suppression in the study area. For the potential cumulative effect of multiple utility relocations, emergency response providers will be notified of construction plans and schedules in advance to reduce the effects of service disruptions.

If the construction of the I-5 improvements and the Bored Tunnel Alternative coincide, vehicle travel would be extremely constrained in and around the downtown core, which could result in additional response time and travel time delays for fire, police, and emergency service vehicles.

Operation of the University Link Light Rail Project could reduce some of the traffic congestion, resulting in a decrease in emergency vehicle response times, as well as improving public service delivery and utility relocation efforts.

The cumulative effect of the SR 519 Intermodal Access Project, Phase 2 in conjunction with the Bored Tunnel Alternative and other Program elements would be a benefit to public services, because these projects would result in smoother connections in both east-west and north-south directions.

In combination, the effects of the development projects occurring concurrently with the Bored Tunnel Alternative could include traffic disruptions and lane closures, which could result in additional response time difficulties and travel time delays for emergency and other public service vehicles at select locations in the study area. If not properly mitigated, lane closures as a result of multiple projects under construction concurrently could result in substantial effects on response times and travel time delays for police, fire, and emergency medical services. However, it is expected that SDOT, with assistance from WSDOT, will oversee the development of such projects and approvals for lane closures in such a way as to reduce construction effects. The effect of increased response times will need to be specifically addressed with the affected emergency response agencies, and specific means and methods to mitigate the impacts will need to be implemented.

If construction of the Bored Tunnel Alternative overlaps with construction of other planned actions, construction and demolition activities would generate solid waste

that could contribute to cumulative effects on solid waste management facilities. Mitigation measures would be implemented to reduce these effects, such as upfront coordination during planning and design with the solid waste management providers. In addition, as other major planned actions are subject to separate environmental review, it is anticipated that mitigation measures applied to these planned actions would reduce the overall combined effects.

### 7.5.2 Utilities

In general, cumulative effects on utilities would result from overlapping construction schedules among the planned actions by increasing the risk and frequency of service disruption or potential damage to existing infrastructure. Potential utility outages would affect business and residential customers as well as public services. Services to customers could be temporarily disconnected each time a utility line is relocated. Multiple relocations of utilities could affect the local economy by increasing the risk of frequent and/or accidental loss of service to retail and commercial businesses.

The utility construction sequencing for the bored tunnel would be a major undertaking in and of itself. If construction of the Bored Tunnel Alternative overlaps with construction of other proposed actions, the multiple utility relocations would require utility providers to secure permitting, skilled personnel, and specialized equipment in large quantities and to commit to completing relocation work at an accelerated pace. The overall cumulative effect could be substantial due to the complexity of the relocations, the critical nature of the utility facilities in downtown Seattle, the estimated cost of the relocations, and the possibility of encountering schedule delays and temporary service disruptions. However, the cumulative effects stemming from multiple utility relocations occurring at the same time could be reduced by coordinating project planning and design with the utility providers, implementing a consolidated utility relocation plan to avoid when possible or minimize disruption of services, and making allowances for maintenance and repair access.

Potential cumulative benefits of these projects would be realized through the upgrade of the utility infrastructure to the latest standards versus the continuing risk of losing the existing viaduct structure as a utility corridor in the event of a natural disaster, such as another earthquake of the magnitude of the Nisqually earthquake of 2001 or larger.

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**ATTACHMENT A**

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**Cumulative Effects Analysis**

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## CUMULATIVE EFFECTS ANALYSIS

This cumulative effects analysis follows *Guidance on Preparing Cumulative Impact Analyses*, published by Washington State Department of Transportation (WSDOT) in February 2008. The guidance document was developed jointly by WSDOT, Federal Highway Administration (FHWA) – Washington Division, and U.S. Environmental Protection Agency – Region 10. The guidance can be used for FHWA’s National Environmental Policy Act (NEPA) compliance (Code of Federal Regulations, Title 23, Part 771) and fulfillment of Washington State Environmental Policy Act (SEPA) requirements for evaluation of cumulative effects (Washington Administrative Code, Section 197-11-792).

The approach provided in the WSDOT guidance calls for early consideration of cumulative impacts while direct and indirect effects are being identified, preferably as part of the scoping process. For analysis, the guidance recommends the use of environmental documents such as discipline reports, as well as other relevant information such as local comprehensive plans, zoning, recent building permits, and interviews with local government. The guidance also advocates a partnership approach among agencies that includes early collaboration and integrated planning activities.

The guidance established eight steps to serve as guidelines for identifying and assessing cumulative impacts. These eight steps have been used in the following cumulative effects evaluation for the Bored Tunnel Alternative of the Alaskan Way Viaduct Replacement Project (the project). A matrix that identifies projects with the potential for cumulative effects with this project and an assessment of likely contributions to cumulative effects is also included.

### **Step 1. Identify the resource that may have cumulative impacts to consider in the analysis**

Public services and utilities

### **Step 2. Define the study area and timeframe for the affected resource**

The south and north boundaries of the study area for public services and utilities are approximately S. Atlantic Street and Roy Street, respectively. In general, public services and utilities within three to five blocks of the existing viaduct or facilities proposed as part of the Bored Tunnel Alternative are identified as being within the study area for potential construction or operational effects. There are exceptions to this rule; some facilities (such as hospital emergency rooms) are located outside the study area but are included in the analysis because they offer critical services to the study area.

The timeframe for the cumulative effects analysis is 1850 (the time of significant European settlement) to 2030. Before construction, the affected environment discussion is in the present. The timeframe for construction-related (temporary) impacts is the approximately 5.5-year construction duration for the Bored Tunnel Alternative (2011–2017). After construction, the timeframe for operational impacts is from the year of opening (2015) to the design year of the project (2030).

### **Step 3. Describe the current health and historical context for each affected resource**

#### **Public Services**

The historical context for this resource is a legacy of public service to the community. Since the mid-1800s, public services such as police, fire, mail, and schools have been established. Later, other services such as emergency medical and solid waste disposal were provided by the City. These services have expanded to serve both a larger service area and a larger population. Several of the area's public services such as Medic One are recognized nationally for their excellence.

The affected environment for public services includes the following services, which have historically been provided by governmental agencies or private companies and are adequate to meet current demand:

- Fire suppression
- Public schools and transportation
- Solid waste collection, disposal, and recycling
- Postal services
- Law enforcement services
- Emergency medical services (including emergency technical rescue)
- Disaster preparedness

#### **Utilities**

Utilities have served the area since the late 1800s and expanded as needed to serve the urban development. Seattle has a large number of utility providers, particularly in the telecommunications area. It also has a steam utility that is fairly rare in the Northwest. Today there is a full range of utilities serving the project area.

The affected environment for utilities includes the following utilities, which utilities have historically been owned, operated, and maintained by governmental agencies or private companies and are adequate to meet current demand:

- Electrical power
- Water
- Sanitary sewer and storm drainage, and a combined sewer conveyance system and outfalls
- Natural gas
- Steam
- Petroleum
- Telecommunications

#### **Step 4. Identify the direct and indirect impacts that may contribute to a cumulative impact**

##### **Operational Effects**

For public services and utilities, operational effects are considered to be the increase in operational requirements of the affected public service providers and utility providers after construction.

##### *Public Services Operational Effects*

Operational effects likely to affect public services that may contribute to cumulative impacts are listed below:

- Fire suppression services: risk of spill of hazardous materials or fires due to accidents, natural events, or human-caused events; potential increase in response time for an underground tunnel.
- Law enforcement services: potential increase in response time for an underground tunnel.
- Emergency medical services: potential increase in response time for an underground tunnel.
- Disaster preparedness: potential increase in response time for an underground tunnel.
- School bus routes through the corridor and to the waterfront: potential increase in travel time for some routes within the study area.
- Solid waste collection, disposal, and recycling: potential changes in traffic patterns and travel times within the study area.
- Postal services: potential changes in traffic patterns and travel times within the study area.

##### *Utilities Operational Effects*

Operational effects likely to affect utilities that may contribute to cumulative impacts are listed below:

- Water: new utility infrastructure would require more maintenance. The bored tunnel fire suppression system would increase demand for water.
- Telecommunications: new utility infrastructure would require more maintenance.
- Electrical power: increase in operational electrical power consumption and infrastructure would require more capacity and maintenance.
- Sanitary, storm drainage, combined sewer conveyance system and outfalls: new utility infrastructure would require more maintenance.

##### **Construction Effects**

Construction effects for public services and utilities are the effects that would affect public service providers or utility providers over a relatively short period during construction, such as travel delays due to temporary lane closures, detours, or construction-related congestion, or temporary utility relocations.

### *Public Services Construction Effects*

Construction effects are anticipated for all public service providers, predominantly because of traffic delays during construction and increased difficulty in accessing waterfront sites. The following sources of construction-related congestion may affect response or service times for public services and may contribute to cumulative effects:

- Increased traffic volumes on surface streets.
- Limited open lanes for the existing viaduct and Alaskan Way surface street.

### *Utilities Construction Effects*

Construction effects are anticipated for all utilities during construction because relocation or protection would be required during construction. Such construction effects, which may contribute to cumulative effects, could include the need for the following additional work:

- Field observation/inspection if utilities are constructed by the project.
- Utility relocations if such relocations are not included in the construction documents.
- Temporary utility shutoffs.
- Specialized tasks such as connections to existing utility systems.
- Emergency repairs, if needed, due to unforeseeable circumstances during construction.

### **Step 5. Identify other historic, current, or reasonably foreseeable actions that may affect resources**

The project team considered 39 projects (shown in the matrix at the end of this attachment) for potential activities that could have a cumulative effect on public services and utilities within or near the study area. Nineteen of these projects were identified as having the potential for cumulative effects on public services and utilities.

### **Step 6. Assess potential cumulative impacts to the resource; determine the magnitude and significance**

The projects listed below are expected to result in minimal effects that would be localized and temporary. These projects would be occurring at the same time and in the vicinity of the Bored Tunnel Alternative. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers (as noted above) if not properly mitigated.

- **A1.** Alaskan Way Surface Street Improvements – S. King Street to Pike Street
- **A2.** Elliott/Western Connector – Pike Street to Battery Street
- **A3.** Mercer West Project – Mercer Street becomes two-way from Fifth Avenue N. to Elliott Avenue, and Roy Street becomes two-way from Aurora Avenue to Queen Anne Avenue N.
- **B1.** Elliott Bay Seawall Project
- **B2.** Alaskan Way Promenade/Public Space

- **B3.** Transit Enhancements – (1) Delridge RapidRide, (2) additional service hours on the West Seattle and Ballard RapidRide lines, (3) peak hour express routes added to South Lake Union and Uptown, (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, (5) transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue, and (6) simplification of the electric trolley system.
- **B4.** First Avenue Streetcar Evaluation
- **C1.** S. Holgate Street to S. King Street Viaduct Replacement Project
- **E1.** Gull Industries on First Avenue S.
- **E2.** North Parking Lot Development at Qwest Field
- **E3.** Seattle Center Master Plan (EIS) (Century 21 Master Plan)
- **E4.** Bill and Melinda Gates Foundation Campus Master Plan
- **E5.** South Lake Union Redevelopment
- **E7.** Seattle Aquarium and Waterfront Park
- **E8.** Seattle Combined Sewer System Upgrades
- **F1.** Bridging the Gap Projects
- **H3.** RapidRide
- **I3.** Other Transit Improvements

#### **Public Services**

#### **Traffic Patterns**

- The project and the Alaskan Way Viaduct and Seawall Replacement Program (the Program), together with other planned projects that may cause major roadway changes, would affect future traffic patterns. Consequently, these changes may affect existing public service access and vehicle routes.
- Cumulative effects could include lane closures as a result of multiple projects under construction at the same time (including utility relocations), which may result in longer emergency response times and travel time delays for public service vehicles.

#### **Increased Demand for Public Services**

- The combined effect of increased development under the planned actions in the study area could be an increased demand for public services.

#### **Effects on Fire Suppression**

- Overlapping construction schedules for utility relocations could result in temporary disruptions to water services necessary to support fire suppression in the study area.

#### **Effects on Solid Waste**

- If construction of the project overlaps with construction of other planned actions, construction and demolition activities would generate solid waste that could contribute to cumulative effects on solid waste management facilities.

## **Utilities**

### **Overlapping Construction Schedules**

- Overlapping construction schedules among the planned actions may increase the risk and frequency of service disruption.

### **Step 7. Report the results**

See discussion in the matrix below.

### **Step 8. Assess and discuss potential mitigation issues for all adverse impacts**

#### **Public Services**

The combined effect of increased development under the planned actions in the study area could be an increased demand for public services. However, as other planned actions are subject to a separate environmental review, it is expected that mitigation measures for those actions would be implemented to reduce these combined effects.

For the potential cumulative effect of multiple utility relocations on public service providers, emergency response providers will be notified of construction plans and schedules in advance to reduce the effects of service disruptions.

Multiple projects under construction concurrently could result in substantial effects on response times and travel time delays for police, fire, and emergency medical services. However, the Seattle Department of Transportation (SDOT) will oversee the development of such projects and approvals for lane closures in such a way as to reduce construction effects.

Mitigation measures for increased solid waste demand would be implemented to reduce these effects, such as upfront coordination with the solid waste management providers during planning and design. In addition, as other major planned actions are subject to separate environmental review, it is anticipated that mitigation measures implemented for these planned actions would reduce the overall combined effects.

#### **Utilities**

The overall cumulative effect could be substantial due to the complexity of the relocations, the critical nature of the utility facilities in downtown Seattle, the estimated cost of the relocations, and the possibility of encountering schedule delays and temporary service disruptions. However, the cumulative effects stemming from multiple utility relocations occurring at the same time could be reduced by coordinating with the utility providers during project planning and design, implementing a consolidated utility relocation plan to minimize disruption of services, and making allowances for maintenance and repair access.

The following matrix identifies project-specific potential cumulative effects.

## PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX

PROJECT	POTENTIAL CUMULATIVE EFFECTS
<b>A. Roadway Elements</b>	
<b>A1.</b> Alaskan Way Surface Street Improvements – S. King Street to Pike Street	Minimal effect, localized and temporary. The Alaskan Way surface street improvements would be occurring at the same time as the demolition of the existing viaduct. Cumulatively, there would be a lot of simultaneous construction activity along the waterfront as viaduct demolition and reconstruction of the Alaskan Way surface street would occur at the same time. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>A2.</b> Elliott/Western Connector – Pike Street to Battery Street	Minimal effect, localized and temporary. Construction of the Elliott/Western Connector would be occurring at the same time as the demolition of the existing viaduct. Cumulatively, there would be a lot of simultaneous construction activity near the south portal of the Battery Street Tunnel as the Battery Street Tunnel is being backfilled with viaduct demolition debris during the simultaneous demolition and reconstruction of the Elliott/Western Connector. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>A3.</b> Mercer West Project – Mercer Street becomes two-way from Fifth Avenue N. to Elliott Avenue, and Roy Street becomes two-way from Aurora Avenue to Queen Anne Avenue N.	Minimal effect, localized and temporary. Construction of the Mercer Street improvements would be occurring at the same time as the construction activities on Aurora Avenue. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>B. Non-Roadway Elements</b>	
<b>B1.</b> Elliott Bay Seawall Project	Minimal effect, localized and temporary. The Elliott Bay Seawall Project would be occurring at the same time as the demolition of the existing viaduct. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>B2.</b> Alaskan Way Promenade/Public Space	Minimal effect, localized and temporary. Construction of the Alaskan Way Promenade/Public Space would be occurring at the same time as the demolition of the existing viaduct. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>B3.</b> Transit Enhancements - 1) Delridge RapidRide 2) Additional service hours on West Seattle and Ballard RapidRide lines 3) Peak hour express routes added to South Lake Union and Uptown 4) Local bus changes to several West Seattle and northwest Seattle routes 5) Transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue 6) Simplification of the electric trolley system	Minimal and temporary effect. Utility work would be required for construction of the Delridge RapidRide line, but this corridor lies outside the study area. The buses would not be electrified, but increased service hours could increase demand for natural gas. The transit enhancements would be occurring at the same time as the numerous other construction activities associated with the Program. Modifying the trolley network would require work on the overhead trolley wire. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.

## PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
<b>B4.</b> First Avenue Streetcar Evaluation	Minimal and temporary effect. The First Avenue streetcar would operate within the First Avenue right-of-way, which could result in additional delays for public service providers using First Avenue. Construction of the First Avenue streetcar would occur at the same time as numerous other construction activities associated with the Program. The First Avenue streetcar would require installation of overhead trolley wire and would require additional electricity. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<i>C. Projects under Construction</i>	
<b>C1.</b> S. Holgate Street to S. King Street Viaduct Replacement Project	Minimal effect, localized and temporary. Construction of the S. Holgate Street to S. King Street Viaduct Replacement Project would be occurring at the same time as construction of the south portal of the bored tunnel. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>C2.</b> Transportation Improvements to Minimize Traffic Effects During Construction	No cumulative effect: outside study area.
<i>D. Completed Projects</i>	
<b>D1.</b> SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)	No cumulative effect: outside timeframe for the study.
<b>D2.</b> S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)	No cumulative effect: outside timeframe for the study.
<i>E. Seattle Planned Urban Development</i>	
<b>E1.</b> Gull Industries on First Avenue S.	Minimal effect, localized and temporary. Construction of the Gull Industries project would be occurring at the same time as construction of the south portal of the bored tunnel. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>E2.</b> North Parking Lot Development at Qwest Field	Minimal effect, localized and temporary. Construction related to the North Parking Lot Development would be occurring at the same time as construction of the south portal of the bored tunnel. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>E3.</b> Seattle Center Master Plan (EIS) (Century 21 Master Plan)	Minimal effect, localized and temporary. Construction at Seattle Center would be occurring at the same time as construction activities along Aurora Avenue. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>E4.</b> Bill and Melinda Gates Foundation Campus Master Plan	Minimal effect, localized and temporary. Construction of the Gates Foundation Campus would be occurring at the same time as construction activities along Aurora Avenue. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.

## PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
<b>E5.</b> South Lake Union Redevelopment	Minimal effect, localized and temporary. Construction throughout South Lake Union would be occurring at the same time as construction activities along Aurora Avenue. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>E6.</b> U.S. Coast Guard Integrated Support Command	No cumulative effect: outside study area.
<b>E7.</b> Seattle Aquarium and Waterfront Park	Minimal effect, localized and temporary. Construction at the Seattle Aquarium and Waterfront Park would be occurring at the same time as the demolition of the existing viaduct. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>E8.</b> Seattle Combined Sewer System Upgrades	Minimal effect, localized and temporary. Construction of the Combined Sewer System Upgrades would be occurring at the same time as numerous activities associated with the Program. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<i>F. Local Roadway Improvements</i>	
<b>F1.</b> Bridging the Gap Projects	Minimal and temporary effect. Construction of the Bridging the Gap Projects would occur at the same time as construction of the south portal of the bored tunnel. However, the duration of the construction activity would be brief. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>F2.</b> S. Spokane Street Viaduct Widening	No cumulative effect: outside study area.
<b>F3.</b> SR 99/East Marginal Way Grade Separation	No cumulative effect: outside study area.
<b>F4.</b> Mercer East Project from Dexter Avenue N. to I-5	No cumulative effect: outside timeframe for the study.
<i>G. Regional Roadway Improvements</i>	
<b>G1.</b> I-5 Improvements	No cumulative effect: outside study area.
<b>G2.</b> SR 520 Bridge Replacement and HOV Program	No cumulative effect: outside study area.
<b>G3.</b> I-405 Corridor Program	No cumulative effect: outside study area.
<b>G4.</b> I-90 Two-Way Transit and HOV Operations Stages 1 and 2	No cumulative effect: outside study area.
<i>H. Transit Improvements</i>	
<b>H1.</b> First Hill Streetcar	No cumulative effect: outside study area.
<b>H2.</b> Sound Transit University Link Light Rail Project	No cumulative effect: outside study area.
<b>H3.</b> RapidRide	Minimal and temporary effect. Utility work would be required for the RapidRide construction, which would be occurring at the same time as numerous other construction activities associated with the Program. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<b>H4.</b> Sound Transit North Link Light Rail	No cumulative effect: outside study area.

## PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
<b>H5.</b> Sound Transit East Link Light Rail	No cumulative effect: outside study area.
<b>H6.</b> Washington State Ferries Seattle Terminal Improvements	No cumulative effect: outside timeframe for the study (construction of this project will already have been completed, so there will be no public services or utility conflicts)
<i>I. Transportation Network Assumptions</i>	
<b>I1.</b> HOV Definition Changes to 3+ Throughout the Puget Sound Region	No cumulative effect: outside study area.
<b>I2.</b> Sound Transit Phases 1 and 2	No cumulative effect: outside study area.
<b>I3.</b> Other Transit Improvements	Minimal and temporary effect. Utility work required for the Fourth Avenue bus island construction would be occurring at the same time as construction of the south portal of the bored tunnel. Concurrent construction activity could result in delays for public service providers and disruptions for utility customers if not properly mitigated.
<i>J. Completed but Relevant Projects</i>	
<b>J1.</b> Sound Transit Central Link Light Rail (including the Sea-Tac Airport extension)	No cumulative effect: outside timeframe for the study (construction of this project will already have been completed, so there will be no public services or utility conflicts).
<b>J2.</b> South Lake Union Streetcar	No cumulative effect: outside timeframe for the study (construction of this project will already have been completed, so there will be no public services or utility conflicts).
<b>F5.</b> SR 519 Intermodal Access Project, Phase 2	This project was completed earlier in 2010 and contributes to a beneficial cumulative effect to public services with smoother connections in both the north-south and east-west directions. There would be no adverse cumulative effects on utilities since this project is completed..