Denny Substation Project

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared for Seattle City Light
March 27, 2014

Photo: Kenneth Lu

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City of Seattle
Edward B. Murray, Mayor

Seattle City Light
Jorge Carrasco, General Manager and CEO

March 27, 2014

To Interested Parties, Agencies and Organizations:

Enclosed is the Draft Environmental Impact Statement (Draft EIS) for the Seattle City Light (City Light) proposed Denny Substation Project.

This Draft EIS addresses construction and operation of a new electrical substation, distribution network, and transmission line, and the addition of electrical equipment (a series inductor) at the existing City Light Broad Street Substation/Annex. Key environmental elements covered in the Draft EIS are Aesthetics, Transportation, Noise, and Environmental Health. Land Use and Housing, Air Quality (including Greenhouse Gases), Historic and Cultural Resources, Hazardous Materials, Energy and Natural Resources, Water Resources and Utilities are also analyzed.

City Light requests comments on the Draft EIS from the public, agencies and organizations throughout the public comment period beginning March 27, 2014 and ending April 26, 2014. To be considered for preparation of the Final EIS, all comments must be postmarked or Emailed by midnight April 26, 2014. Written comments should be addressed to Ms. Kathleen Fendt, Sr. Environmental Analyst, Seattle City Light, P. O. Box 34023 Seattle, WA 98124-4023 or via Email at: SCL_dennysub@seattle.gov (Attn: Kathleen Fendt).

An open house and public hearing on the Draft EIS will be held on the evening of April 16, 2014 in the Bertha Landes Room of Seattle City Hall, located at 600 4th Avenue, Seattle, WA. Additional information on the hearing and open house are available on the project website at http://www.seattle.gov/light/dennysub and in the Fact Sheet contained within this Draft EIS.

Following the Draft EIS, a Final EIS will be prepared that addresses written comments received during the comment period and the public testimony received during the public hearing.

Thank you for your interest in the proposed Denny Substation Project. We welcome your comments.

Sincerely,

Lynn Best
Director of Environmental Affairs and Real Estate

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Hearing Impaired use the Washington Relay Service (7-1-1)
www.seattle.gov/light
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FACT SHEET

Name of Proposal

Denny Substation Project

Proponent

Seattle City Light

Project Location

The project includes four major components, all of which would be within the city limits of Seattle, Washington.

The proposed Denny Substation would be located in Seattle's South Lake Union and Cascade neighborhoods, between East John Street, Minor Avenue North, Denny Way, and Yale Avenue North on one or more City Light-owned parcels.

The proposed transmission line would extend between the proposed substation and the existing Massachusetts Substation in the South of Downtown (SODO) neighborhood.

New equipment would be installed adjacent to either the existing Broad Street Substation or Annex, in the Broad Street right-of-way.

The proposed electrical distribution system improvements would be installed in the South Lake Union neighborhood.

Project Description

City Light proposes to construct a new electrical substation on Denny Way; construct a new high-voltage transmission line connecting the new substation to the existing Massachusetts Substation in the SODO neighborhood; install an inductor at the existing Broad Street Substation; and construct new underground electrical distribution system improvements to expand network service to the South Lake Union neighborhood. The purpose of the project is to provide more reliable electrical service for the north downtown area of Seattle while meeting growth in electrical demand.

This Draft Environmental Impact Statement (EIS) evaluates alternatives for developing the Denny Substation and installing a transmission line, and options for installing an inductor at Broad Street Substation. The Denny Substation alternatives represent three different site configurations involving three adjacent parcels of land. Each alternative has different exterior treatments, screen wall shapes, and site amenities. There are two general types of site use proposed: two alternatives (Substation Alternative 2 [SA2] and Substation Alternative 3 [SA3]) would vacate Pontius Avenue North between Denny Way and John Street, and one (Substation Alternative 1 [SA1]) would not. The transmission line alternatives are all primarily underground along three different routes. Transmission Line Alternative 1 (TL1) and Transmission Line Alternative 3 (TL3) would use surface streets. Transmission Line Alternative 2 (TL2) would use the Downtown Seattle Transit Tunnel (DSTT) to traverse the majority of downtown Seattle, and surface streets for the rest of the alignment. The options for the Broad Street Substation inductor are two different locations at the same existing substation facility. The EIS also considers a No Action Alternative as required by the State Environmental Policy Act (SEPA). Alternatives evaluated in the Draft EIS include the following:

Summary of Alternatives and Options

Alternative Name	Description
No Action Alternative	Under the No Action Alternative, no substation would be constructed and no new transmission line to the proposed project site would be installed. No new network service would be available for the South Lake Union area (north of Denny Way). The Broad Street inductor would, however, be installed along with a second inductor needed for the regional power grid.
Substation Alternative 1 (SA1): No Street Vacation	The substation under SA1 would be a two-level structure with one level below grade. The substation would occupy only one of the three parcels at the site. No vacation of Pontius Avenue North would be necessary, and no public benefit to compensate for the loss of that street would be required. The two remaining parcels would not have an above-grade use related to the substation. These parcels would either be used by City Light for meeting another electric utility need or identified as surplus and dedicated to another public use or private development.
Substation Alternative 2 (SA2): Street Vacation Design 1	SA2 would be a one-level structure occupying two of the three site parcels. It would have a larger aboveground footprint than SA1 and require a street vacation of the block of Pontius Avenue North, north of Denny Way. The site design would provide opportunities for public access and use of portions of the substation site outside the facility on the north, west, and east sides. The parcel not used for the substation would be available for other City uses or could be made available for private development.
Substation Alternative 3 (SA3): Street Vacation Design 2 – Preferred Alternative	As with SA2, SA3 would also be a one-level structure occupying two of the three site parcels but would be different in design from SA2. SA3 would also require a street vacation of the block of Pontius Avenue North, north of Denny Way. The facility design would also provide opportunities for public access and use surrounding the substation perimeter and allow public access on an elevated walkway area along the south, east, and west elevations of the substation. The parcel not used for the substation would be available for other City uses or could be made available for private development.
Transmission Line Alternative 1 (TL1): East Edge Downtown Route	TL1 would be a downtown underground transmission line route, running generally along the eastern edge of the Central Business District. The line would likely be overhead on poles at its south end.
Transmission Line Alternative 2 (TL2): Downtown Seattle Transit Tunnel (DSTT)	TL2 would be a transmission line route running primarily underground and through the DSTT. As with TL1, it would likely be an overhead line on poles at its south end.
Transmission Line Alternative 3 (TL3): I-5 East Route	TL3 would be a transmission line route running primarily underground within and along the east side of the I-5 right-of-way, also likely to be overhead on poles at its south end.
Broad Street Substation Inductor Options	The inductor and associated equipment would be located on the Broad Street Substation site with two on-site options. One option would be located on the northwest side of the Broad Street Substation Annex in a closed portion of Broad Street, west of Taylor Avenue North. The second option would be located on the northwest corner of the Broad Street Substation in a closed portion of Broad Street, east of Taylor Avenue North. The two options are referred to as BI1 and BI2.

Construction Timing for the Project

For purposes of this EIS, construction timing for the project is anticipated to follow the approximate proposed schedule described herein. The project components would be constructed primarily over a period of approximately 6 years, as follows:

1. Phase 1 Build-out of the network distribution system would be first, beginning in late 2014 and being completed in late 2016.
2. The network distribution system in the Future Build-out area of South Lake Union would be installed as needed thereafter, driven primarily by customer request.
3. Construction of the Denny Substation would take 18 to 24 months, depending on the alternative chosen. Substation construction is expected to begin in mid-2015, and the substation would be placed in service (energized) in late 2016, with limited construction continuing into early 2017.
4. Construction of the Broad Street Substation inductor facilities would take 6 to 12 months to construct and would likely occur in 2016.
5. Construction of the transmission line to the Massachusetts Substation would likely begin in late 2018 and be complete at the end of 2020.

State Environmental Policy Act (SEPA) Lead Agency

Seattle City Light

SEPA Responsible Official

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Governmental Actions

The project requires review and approval under the requirements of the Seattle Municipal Code and other applicable regulations. The approvals that are anticipated to be applied for are shown below.

Required Permits & Approvals

	Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System
City of Seattle									
Seattle Design Commission Review and Recommendations, with final approval from City Council	X	X	X	X	X	X	X	X	X
Street Vacation (Pontius Avenue North) from SDOT		X	X						
Street Vacation (Broad Street) from SDOT							X	X	
Master Use Permit (Type V Council Land Use Action, including any waivers of use or development standards) from City Council	X	X	X				X	X	
Major Public Project Noise Variance from DPD	X	X	X	X	X	X	X	X	X
Street Improvement Permit from SDOT	X	X	X	X	X	X	X	X	X
Utility Major Permit from SPU	X	X	X	X	X	X	X	X	X
Grading and Drainage Permit from DPD	X	X	X				X	X	
Building Permit from DPD	X	X	X				X	X	
Shoring Permit from DPD	X	X	X				X	X	
WSDOT									
Utility Franchise and/or Air Rights Approval				X	X	X			
Washington State Department of Ecology									
National Pollutant Discharge Elimination System – Construction Stormwater General Permit	X	X	X	X	X	X			X
King County									
King County Wastewater Treatment Division Industrial Discharge Permit	X	X	X						
King County Department of Transportation Approval to use DSTT					X				
Sound Transit									
Sound Transit Approval to use DSTT					X				

SDOT = Seattle Department of Transportation; DPD = Department of Planning and Development; SPU = Seattle Public Utilities; WSDOT = Washington State Department of Transportation; DSTT = Downtown Seattle Transit Tunnel

Authors and Principal Contributors

This Draft EIS has been prepared under the direction of Seattle City Light, in consultation with other City of Seattle departments and other agencies, including King County Department of Transportation and Sound Transit.

Research and analysis were provided by:

- Environmental Science Associates (ESA) – Alternatives development; analysis of aesthetics, noise, air, electric and magnetic fields (EMF), land use and housing, cultural resources, utilities, and energy and natural resources; EIS document coordination and production.
- Enertech Consultants – EMF measurements and modeling
- Dr. Asher Sheppard – Expert review: EMF and potential health effects
- Heffron Transportation, Inc. – Transportation analysis
- Herrera Environmental Consultants – Analysis of water resources and hazardous materials
- Rosen Goldberg Der and Lewitz, Inc. – Noise modeling report
- VIA Architecture – Visual simulations for aesthetics analysis

Date of Issue

March 27, 2014

End of Comment Period

All comments must be postmarked or emailed on or before midnight, April 26, 2014.

Commenting on the Draft EIS

Individuals may comment on the Draft EIS by emailing or mailing written comments to:

Kathleen G. Fendt, AICP
Senior Environmental Analyst
Seattle City Light
P.O. Box 34023
700 5th Avenue, Suite 3200
Seattle, WA 98124-4023
Email: SCL_dennysub@seattle.gov, Attn: Kathleen Fendt

Commenters should include "Denny Substation" in the subject line of the email or letter.

Individuals may also provide comments at the public hearing to be held from 7:00 p.m. to 9:00 p.m. on April 16, 2014. An open house will precede the public hearing from 6:00 p.m. to 7:00 p.m. The public hearing/open house will be held at:

The Bertha Knight Landes Room
Seattle City Hall
600 4th Avenue, 2nd Floor
Seattle, WA 98104

Availability of the Draft EIS

Copies of the Draft EIS and/or Notices of Availability have been distributed to agencies, tribal governments, and organizations on the Distribution List in Chapter 16.

The Draft EIS may be viewed online and/or downloaded from the project website: http://www.seattle.gov/light/dennysub/.

Copies of the Draft EIS are also available for review at the following locations:

- Downtown Seattle Public Library, 1000 4th Avenue, Seattle, WA, 98104
- International District/Chinatown Library Branch, 713 8th Avenue South, Seattle, WA, 98104
- Capitol Hill Library Branch, 425 Harvard Avenue East, Seattle, WA, 98102
- Seattle Department of Planning and Development, Public Resource Center, 700 5th Avenue (20th floor), Seattle, WA, 98104

Copies are available to purchase for cost of reproduction by contacting the project hotline at (206) 257-2142.

Availability of Background Materials

The Draft EIS includes appendices with information that is important to help understand the EIS analysis.

The consultant developed technical discipline reports for transportation, noise, air quality and greenhouse gas, and historic and cultural resources to document some of the underlying analysis for the Draft EIS. These discipline reports are available at the same locations as the Draft EIS listed above.

Other background materials developed specifically for this project and used by the consultant are available on the website listed above.

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ACRONYMS AND GLOSSARY

ADA	Americans with Disabilities Act
ADT	average daily traffic
A/E	architectural/engineering
aMW	Average megawatts - the amount of electricity produced by the continuous production of one megawatt over a period of one year or specified time period.
AWV	Alaskan Way Viaduct
bgs	below the ground surface
BMPs	best management practices
BNSF	BNSF Railway Company (formerly the Burlington Northern Santa Fe Railway Company)
BPA	Bonneville Power Administration
BSCI	Broad System Capacity Improvements
BTEX	benzene, toluene, ethylbenzene, and xylenes
capacitor bank	A device to store an electrical charge. In the field of electric power transmission and distribution, capacitors are devices used for power factor correction and voltage regulation. Power factor correction improves the capability to deliver useful power (real power) to loads and voltage regulation helps to maintain constant service voltage.
CBD	Central Business District
CH4	methane
City	City of Seattle
City Council	Seattle City Council
City Light	Seattle City Light
CO	carbon monoxide
CO2	carbon dioxide
CO_2e	carbon dioxide equivalents
County	King County
CPTED	Crime Prevention Through Environmental Design
CSECP	Construction Stormwater and Erosion Control Plan
CSO	combined sewer overflow

DAHP	Washington State Department of Archaeology and Historic Preservation
dB	decibels - a logarithmic loudness scale with 0 dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain
dBA	A-weighted decibels – a method of frequency weighting for noise analysis addressing the fact that the typical human ear is not equally sensitive to all frequencies of the audible sound spectrum (sound is measured using an electronic filter that deemphasizes the frequencies below 1,000 hertz (Hz) and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range).
distribution feeders	Voltage lines used to distribute electric power from a substation to consumers or to smaller substations.
distribution riser	A distribution riser is where a distribution voltage circuit transitions from an underground configuration (typically within a concrete duct) to an overhead configuration (typically supported by cross-arms on a wooden pole). The shielded distribution conductors are located together along one side of the wooden pole within a protective sleeve at ground level and continue vertically up the pole to a point where they separate to connect into an overhead conductor configuration. Other electrical equipment, such as disconnects or fuses, may also be present on a distribution riser pole.
DMC	Downtown Mixed Commercial zoning designation
DN-BR	Denny-Broad Transmission Cable
DNL	Day-night average sound level – the energy average of the A-weighted sound levels occurring during a 24-hour period, accounting for the greater sensitivity of most people to nighttime noise by weighting nighttime noise levels by adding 10 dBA to noise between 10:00 p.m. and 7:00 a.m.
DPD	Seattle Department of Planning and Development
Draft EIS	Draft Environmental Impact Statement
DSTT	Downtown Seattle Transit Tunnel
duct bank	Two or more conduits (or ducts) routed together in a common excavation, often within a concrete encasement.
E3 busway	A dedicated bus route in south Seattle providing access between the DSTT, I-90, and the SODO area.
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
electrical distribution network	A network of overhead and/or underground conductors that carry electricity from an electricity transmission system to consumers.
electrical impedance	The opposition that an electrical circuit presents to a current when a voltage is applied, similar to resistance.
EMF	electric and magnetic fields
EP-DN	Seattle City Light's East Pine-Denny transmission line

FAR	Floor area ratio- the ratio of the total floor area of a building to the total land area of the building site.
FHWA	Federal Highway Administration
fluvial	Of or relating to a river or stream, or produced by the action of a river or stream (deposits or landforms).
freeze plug, freeze pit	Refers to a method of freezing the insulating oil in an underground transmission line to allow the line to be cut, such as to allow splicing the line. The work area needed to create a freeze plug is called a freeze pit.
FTA	Federal Transit Administration
fugitive dust	Particulate matter which is or can be suspended into the atmosphere as a result of mechanical, explosive, or windblown suspension of geologic, organic, synthetic, or dissolved solids, and does not include non-geologic particulate matter emitted directly by internal and external combustion processes.
G	Gauss – a unit of measurement of the density of a magnetic field
GHG	greenhouse gases
GIS	Gas-insulated switchgear - an assemblage of switching and interrupting devices and associated control, instrumentation, metering, protective and regulating devices co-located in a sealed metal envelope filled, commonly, with SF6 gas (the GIS being used to control, protect and isolate the components).
grounding bank	A specialty type of transformer intended primarily to provide a neutral point in an ungrounded electrical circuit. In the event of a ground fault, the grounding transformer provides a means of detection so that system protection is initiated to isolate the fault from the healthy part of the electrical system (by circuit breaker operation).
GWP	global warming potential
HFCs	hydrofluorocarbons
horizontal screening	Refers to a design option under consideration to partially screen views into the Denny Substation yard from the upper floors of adjacent buildings, using an open, horizontal louvre-type structure, which would not be a complete structural roof.
HPFF	high pressure, fluid filled
HVAC	heating, ventilation, and air conditioning
Hz	Hertz
I-5	Interstate-5
I-90	Interstate-90
I-405	Interstate-405
I-937	Initiative 937 (Energy independence Act)

inductor, series inductor	An inductor is an electrical component, usually a wire coil that resists changes in electric current passing through it, acting somewhat like a valve in a pipe (when a current flows through it, energy is stored temporarily in a field in the coil). Series inductors are used to control and balance electrical load traveling through the regional grid.
IRP	Integrated Resource Plan
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hours
lacustrine	Of or relating to a lake or pond.
LEED	Leadership in Energy and Environmental Design
Leq	Equivalent sound level - the constant sound level that would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).
Lmax	Instantaneous maximum noise level –the loudest noise level measured during the measurement period of interest.
Lx	The sound level equaled or exceeded x percent of a specified sound level (L50 represents the median sound level, i.e. the noise level exceeded 50 percent of the time).
mG	milligauss - one millionth of a gauss, a measurement of the density of a magnetic field
MHz	megahertz
MMT	million metric tons
$MMTCO_2e$	million gross metric tons of CO_2e
MSATs	mobile source air toxics
MTCA	Model Toxics Control Act
MUP	Master Use Permit
MW	megawatt
MWhr	megawatt-hour
N2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
network service area	An area served by a type of electrical distribution system that provides high reliability by using multiple transmission sources (in Seattle, network service areas must be designated by ordinance and customers of the service pay premium rates).
NIEHS	National Institute of Environmental Health Sciences
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen

NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OHP	Office of Historic Preservation
P1	Parcel 1
P2	Parcel 2
P3	Parcel 3
Pacific Northwest Transmission Grid	The power transmission system that serves the Pacific Northwest.
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	perchloroethene
PFCs	perfluorocarbons
PM	particulate matter
$PM_{2.5}$	fine particulate matter
PM_{10}	coarse particulate matter
PPV	peak particle velocity
precast girder	A metal beam used in construction that is cast in its final shape before positioning.
PSCAA	Puget Sound Clean Air Agency
PSE	Puget Sound Energy
radial distribution system	The simplest type of distribution system, with only one power source for a group of customers (it is the cheapest to build, and is widely used in sparsely populated areas).
RCW	Revised Code of Washington
RECs	Renewable Energy Credits
REI	Recreation Equipment, Inc.
RPZ	restricted parking zone
SA1	Substation Alternative 1
SA2	Substation Alternative 2
SA3	Substation Alternative 3
SA3a	Substation Alternative 3 without overhead screening
SCCA	Seattle Cancer Care Alliance
SDOT	Seattle Department of Transportation
SEPA	State Environmental Policy Act
series inductor	See inductor

service levels	Refers to measures of system reliability, such as the number and hours of power interruption considered acceptable within a specified time period
sf	square feet
SF6	sulfur hexafluoride
SHPO	State Historic Preservation Office
sight distance triangles	Refers to the clear distance needed at driveways to allow a driver exiting a facility to see approaching pedestrians and vehicles before entering the sidewalk and roadway.
SIP	State Implementation Plan
SLU	South Lake Union
SM	Seattle Mixed zoning designation
SM/R	Seattle Mixed/Residential zoning designation
SMC	Seattle Municipal Code
SODO	South of Downtown neighborhood
SO_2	sulfur dioxide
SPU	Seattle Public Utilities
SR	State Route
stationary source	A fixed, non-mobile source of air pollution, usually found at industrial or commercial facilities.
street vacation	Relinquishment of public right-of-way to adjacent property owner(s)
substation	A facility in which transformers are located that change transmission voltages to distribution voltage.
switchgear	An assemblage of switching and interrupting devices and associated control, instrumentation, metering, protective and regulating devices to control, protect and isolate electrical equipment.
SWPPP	Stormwater Pollution Prevention Plan
T	Tesla
TDR	transferable development rights
Tier 1	A set of vehicle standards established by amendment to the Clean Air Act specifically to restrict emissions over time - between 1994 and 1997 - and aimed at reducing emissions of carbon monoxide, oxides of nitrogen, particulate matter, formaldehyde, and non-methane organic gases or non-methane hydrocarbons (Tier 1 applied to vehicles defined as “light duty”, which included passenger cars, light light-duty and heavy duty trucks).
TL1	Transmission Line Alternative 1
TL2	Transmission Line Alternative 2
TL3	Transmission Line Alternative 3
TPH	total petroleum hydrocarbons

TPH-D	diesel-range petroleum hydrocarbons
TPH-G	gasoline-range petroleum hydrocarbons
TPH-O	oil-range petroleum hydrocarbons
transformer	A device used to change the voltage of an alternating current in one circuit to a different voltage in a second circuit, or to partially isolate two circuits from each other. Transformers consist of two or more coils of conducting material, such as wire, wrapped around a core (often made of iron). The magnetic field produced by an alternating current in one coil induces a similar current in the other coils. If there are fewer turns on the coil that carries the source of the power than there are on a second coil, the second coil will provide the same power but at a higher voltage. This is called a step-up transformer. If there are fewer turns on the second coil than on the source coil, the outgoing power will have a lower voltage. This is called a step-down transformer.
transmission	The bulk transfer of electrical energy, from generating power plants to electrical substations located near demand centers.
transmission circuit	A conductor used to transport electricity from generating stations to substations or between substations.
transmission line	The towers, insulators, conductors, and other equipment used to transmit electrical power at high voltage to electric distribution facilities (substation) and from generating facilities.
transmission line splicing	The act of cutting into an existing transmission line to add a new connection to that line or extend the line.
underground vaults	Chambers placed at regular intervals along an underground transmission or distribution line to allow access to the line for installation and maintenance of the line.
U.S. EPA	U.S. Environmental Protection Agency
UST	underground storage tank
VdB	vibration velocity level
vertical screen wall	The perimeter wall surrounding a substation designed to limit views of the interior of the facility. A screen wall is provided primarily for aesthetic reasons but also is designed to provide security and safety by preventing entry by unauthorized persons. A vertical screen wall may allow some views into the facility from outside, may have some semitransparent areas, and may have portions of the wall that are not strictly vertical.
V/m	Volts per meter
VOC	volatile organic compound
WAC	Washington Administrative Code
WHR	Washington Heritage Register
WSDOT	Washington State Department of Transportation
XLPE	cross-linked polyethylene

Chapter 1: SUMMARY

1.1 Introduction

Seattle City Light (City Light), as the State Environmental Policy Act (SEPA) lead agency for the Denny Substation Project, has prepared this SEPA Draft Environmental Impact Statement (EIS) for the project, consistent with Seattle Municipal Code (SMC) 25.05 and Washington Administrative Code (WAC) 197-11.

The Denny Substation Project is a proposal to construct:

- a new electrical substation on Denny Way in the Cascade area of Seattle's South Lake Union neighborhood;
- a new high-voltage transmission line to connect the new substation to the existing Massachusetts Substation in the South of Downtown (SODO) neighborhood; and
- a new electrical network distribution system to serve the South Lake Union area.

City Light also proposes to construct a new inductor at the Broad Street Substation to help balance the regional transmission system. For purposes of this environmental review, installation of this new inductor is incorporated as part of the Denny Substation Project.

Chapter 2 provides a detailed description of the project (including the Broad Street Substation inductor) and proposed alternatives.

The proposed action addresses all regulatory and other decisions necessary to accomplish the project.

This Draft EIS documents the analyses of potential impacts. It identifies both potential construction (short term) and operational (long term) impacts of the project. It also addresses potential direct and indirect impacts. Where impacts would be significant, other nearby projects have been considered and cumulative impacts have been identified. The following elements of the environment are addressed in this Draft EIS:

What are impacts?
Impacts are the effects or consequences of actions. Environmental impacts are effects upon the elements of the environment listed in Seattle Municipal Code (SMC) 25.05.444.

What does significant impact mean?
Significant, as used in the State Environmental Policy Act (SEPA), means a reasonable likelihood of more than a moderate adverse impact on environmental quality. See SMC 25.05.794 for additional information on how this determination is made.

- Aesthetics (including light and glare)
- Noise
- Environmental Health - Electric and Magnetic Fields
- Environmental Health - Hazardous Materials
- Transportation
- Land Use and Housing
- Historic and Cultural Resources
- Air Quality and Greenhouse Gases
- Utilities
- Water Resources
- Energy and Natural Resources

1.2 Major Conclusions of this EIS

The project is not expected to have any unavoidable significant adverse impacts. The potential significant adverse impacts identified through this Draft EIS analysis were found to be avoidable either through design measures already included in the project or mitigation measures that could be implemented by City Light. In particular, some of the impacts on noise and transportation were found to be potentially significant unless mitigation measures identified in the EIS were implemented. Otherwise, the project would have some adverse impacts (referred to as minor or moderate in this EIS) that would not be significant based on the City of Seattle (City) SEPA policies (see SMC Chapter 25.05).

SEPA requires that when there are gaps in relevant information or scientific uncertainty concerning significant impacts, the EIS must make it clear that such information is lacking or that uncertainty exists. The areas of uncertainty for the Denny Substation Project with regard to potential impacts include:

1. City Light has proposed Transmission Line Alternative 2 (TL2) as a route through the Downtown Seattle Transit Tunnel (DSTT), which is managed by Sound Transit and the King County Department of Transportation. Sound Transit raised a number of technical issues related to the feasibility of constructing the transmission line, several of which would require detailed engineered design to resolve. The issues pertain to the structural design of the tunnel, clearances for trains, and other concerns that are discussed in the EIS. It is not possible to demonstrate with certainty that all of these issues can be resolved though design because the necessary level of engineering detail would only be developed for a preferred alternative. Therefore, the Draft EIS has been prepared on the assumption that these issues would have to be resolved to Sound Transit's and King County's satisfaction before this alternative would be feasible.

   These issues are not considered controversial. Although it is an area where there may be differences of opinion among experts at Sound Transit and City Light, City Light and Sound Transit have been communicating on the issues and would continue to work together should TL2 become the preferred transmission line alternative, which at present it is not.

2. The potential health effects from electric and magnetic fields (EMF) have been an area of controversy and scientific inquiry for several decades. There is substantial agreement among experts that there are no confirmed adverse health impacts from the types of EMF exposure that the Denny Substation project would generate. Scientific evidence does remain inconclusive on one topic: possible increased risk of childhood leukemia in homes with stronger magnetic fields. This issue is discussed in further detail in the EIS.

The following sections summarize the findings for each of the four components of the proposed project. See Chapter 14, Impact Summary Tables, for additional detail about likely impacts by alternative and project component.

1.2.1 Substation Alternatives

This section describes the impacts related to the construction and operation of the Denny Substation. Impacts related to other project components are discussed in subsequent sections.

There are three substation alternatives (referred to as Substation Alternative 1 [SA1], Substation Alternative 2 [SA2], and Substation Alternative 3 [SA3]) that would all have similar impacts, with the primary differences between them being the shape of the project (aesthetics), vacation of a street (transportation), duration of construction (noise, air, and transportation), and volumes of excavation (hazardous materials and transportation). Major conclusions are organized by element of the environment below. Each element corresponds to a specific chapter in this Draft EIS, and is listed below in the same order as the chapters. Unless otherwise noted, impacts would be the same for all substation alternatives.

Aesthetics – The Denny Substation would change the visual character of the former (and now vacant) Greyhound bus maintenance facility site in the Cascade area of the South Lake Union neighborhood. While the project would place an assembly of large-scale electrical equipment on one or two vacant lots in an area largely surrounded by residential and commercial buildings, the equipment would be screened from viewers from most perspectives, except for areas designed to provide views of the substation interior to the public. The screen wall, although large in footprint, would be similar in height to adjacent buildings (far shorter than the zoning of the site would allow) and would be architecturally treated to provide visual interest. Some neighbors would see over the screen wall into the substation from upper floors of adjacent buildings.

None of the substation alternatives would adversely affect any public views protected under SEPA. While the project would affect views from adjacent properties, the City's SEPA policy is premised on a finding that it is "impractical to protect private views through project-specific review"; therefore, the City has not adopted policies to protect private views other than those embodied in height and bulk controls in the Land Use Code. Because this is a City-owned project, the effects on urban design are evaluated by the Seattle Design Commission.

Buildings in the vicinity typically have street level uses that provide visual interest along public streets (however, the zoning code does not require such uses on streets adjacent to the substation site). To address streetscape character under any substation alternative, City Light, through an open, public design process with the Seattle Design Commission, is designing the substation to fit into the existing urban setting by incorporating features that reduce the potential monotony of a screen wall, such as by varying surface materials, modulating or sculpting the shape of the wall, incorporating artwork and lighting, and providing landscape plantings. The features that would result from this project would be improvements to the existing streetscape adjacent to the substation. For the alternatives that would require a street vacation, additional features, including a large public open space, would result in additional benefits to the visual and pedestrian environment. Light and glare impacts could be controlled through design to eliminate adverse effects on the street or neighboring properties. The project also would not adversely affect any designated Seattle Landmarks, protected view points, protected scenic routes, or protected view corridors.

Noise – Under SA1 and SA2, operating the substation would result in a minor noise impact at the adjacent David Colwell building, with noise levels from the substation exceeding noise levels established by the Seattle Noise Control Ordinance by up to 1 A-weighted decibel (dBA). The primary sources contributing to noise levels at the David Colwell building would be the 26-kilovolt (kV) air-handling equipment in the substation maintenance building and the backup generator, which would be used during emergencies and also run for short periods on a regular basis to ensure it remains in working order. To abate that impact, City Light would employ one or more mitigation measures so that, at a minimum, the project would comply with Seattle Noise regulations. SA3, which has a different arrangement of the predominant noise sources located within the substation yard and added shielding effects of the perimeter wall, would not have the same impact. During construction of any of the substation alternatives, noise would increase over existing conditions for approximately 18 to 24 months. Construction noise would be typical of large developments that occur throughout the city and would comply with applicable requirements for construction noise. Nighttime construction would have the potential to result in sleep interference if conducted near residential receptors. This significant noise impact would be avoided with a mitigation measure that limits certain construction activities within 500 feet of residential receptors. Vibration levels from impact equipment would exceed human annoyance thresholds and result in a moderate impact during nighttime hours.

Environmental Health - Electric and Magnetic Fields – The topic of electric and magnetic fields (EMF) is included in this Draft EIS to address potential concerns by the public on the potential health effects of exposure to power-frequency EMF. This Draft EIS also addresses the topic of electromagnetic interference (EMI) and potential interactions with the functioning of implanted medical devices such as cardiac pacemakers.

The project would increase EMF within the substation site and in localized areas near the substation site above underground transmission and distribution lines (as well as along the transmission route). EMF from the project is not expected to adversely affect human health.

There is substantial agreement among experts that there are no confirmed adverse health impacts from power-frequency EMF exposure. Scientific evidence does remain inconclusive on one topic: possible increased risk of childhood leukemia in homes with stronger magnetic fields.

EMI with implanted medical devices (such as cardiac pacemakers) can be a concern in environments where EMF occurs at much higher levels than has been calculated for the Denny Substation site. EMI is addressed by occupational exposure guidelines, and limits provided by manufacturers of the devices. The project will not result in EMF that could possibly result in interference with implanted medical devices in any area where the public could be exposed. For discussion of potential impacts on electronic equipment within the Downtown Seattle Transit Tunnel (DSTT), see Section 1.2.2 Transmission Line Alternatives below.

Environmental Health - Hazardous Materials – A previous remediation project on one parcel of the proposed substation site (remediated to the Model Toxics Control Act [MTCA] Level A standard) has removed a great deal of pre-existing contaminated soil and groundwater. Because of its deep basement, construction of SA1 could encounter and result in the removal of more residual soil and groundwater contamination on the site than under SA2 or SA3. Contaminated media (e.g., soils, groundwater) encountered during construction, which could have the potential to migrate along buried utilities, would be removed during construction. Construction of any the alternatives at the substation site would use equipment fueled by hazardous materials such as diesel fuel and oil. Any accidental spills of such materials on-site would be immediately cleaned up. City construction contracts require the use of appropriately maintained equipment, do not allow fueling on-site, and include cleanup protocols specifically to address any accidents. Operation of the substation would require use of hazardous substances such as oil and propane, which carries risk of fire. The design and operation of the facility would incorporate best management practices for managing these risks and is not expected to pose any risk to people or property adjacent to the site.

Transportation – With mitigation, the Denny Substation would not significantly affect transportation to or through the project vicinity. Construction of the substation would cause temporary disruptions to street circulation. The largest impact would occur when Denny Way, a major arterial and designated truck route, would be fully or partly closed for approximately 4 to 6 weeks for the initial transmission line construction needed to power the substation. All street closures would be coordinated with the Seattle Department of Transportation (SDOT) to minimize traffic disruption in such a way as to avoid significant adverse impacts to transportation.

Under two of the substation alternatives (SA2 and SA3), Pontius Avenue North would be permanently closed and incorporated into the project site. Pontius Avenue North is a minor collector street that carries low traffic volumes at present and provides access to a parking lot (Parcel 1) and The Brewster apartment building. With either of these alternatives, pedestrian access between John Street and Denny Way would be maintained and the existing pedestrian access at both ends of The Brewster apartment building would be retained. The vacation of Pontius Avenue North would cause an impact on vehicular access to The Brewster, but that building has vehicular access to another door at Minor Avenue North, and a loading zone would be added on John Street near The Brewster's east entrance. Parking lost by the street vacation would not be replaced. Based on the availability of public transit in the area, availability of off-street parking, and City policies encouraging increased use of alternative transportation modes, particularly in higher density areas such as the Downtown and South Lake Union Urban Centers, this reduction in parking would be a minor to moderate impact. The small amount of traffic that travels Pontius Avenue North can be accommodated by nearby streets; therefore, the street vacation would not adversely affect traffic circulation.

Land Use and Housing – The Denny Substation is not expected to adversely impact land use or housing. There are no uses, buildings, or businesses that would be displaced, and the substation would not impact the viability of existing land uses. The substation would support provision of reliable network distribution system service to businesses in the area, consistent with the City's adopted land use policies. Adopted land use policies for the South Lake Union neighborhood, which includes the Cascade area, call for creating an active pedestrian environment on public streets. Operation of the Denny Substation would require only a small number of workers to be present at the site on an intermittent basis; therefore, it would not create much pedestrian activity. However, provision of public open space adjacent to the substation could stimulate a more active pedestrian environment than currently exists. SA1 would have the lowest potential for creating an active pedestrian environment because it would not have public open space areas. SA2 and SA3 would provide a substantial new open space designed to create an inviting and active community gathering area to offset the loss of Pontius Avenue North. Although the substation site would be a large utility facility that would contrast with other uses in the area, with the design features described above under the Aesthetics conclusions, the substation is not expected to adversely impact adjacent residents (many of whom reside in low-income eligible housing) or commercial tenants, nor hinder new housing, commercial, or other development in the vicinity.

Historic and Cultural Resources – No impacts are expected to archaeological (underground) cultural resources based on review of geotechnical information and archaeological research on past discoveries, and because of past disturbance of the majority of the substation site. If resources were identified during construction, they would be treated appropriately according to an Inadvertent Discovery Plan. There are no designated historical properties that would be adversely affected by substation construction.

Air Quality and Greenhouse Gas – The Denny Substation would not generate a significant amount of any air pollutant. City Light would offset any operational greenhouse gas emissions, including those from expected use of sulfur hexafluoride (SF_6), under its zero net emission policy.

Utilities – City Light is coordinating with all affected utilities in the project vicinity to ensure that the project would not have an adverse impact on utilities during or after construction. All utility conflicts that have been identified can be avoided or replaced during construction to avoid significant impacts to utilities or utility services.

Water Resources – Construction stormwater would be managed in compliance with regulations prior to discharge to City or County combined sewer systems and would not create adverse impacts to downstream waterbodies. Stormwater from the completed Denny Substation would comply with City requirements and would not have an adverse impact on water quality in adjacent water bodies.

Energy and Natural Resources – Construction of the Denny Substation would consume a modest amount of energy and natural resources. Operation of the substation would result in a negligible increase in energy or natural resource consumption.

1.2.2 Transmission Line Alternatives

To help support network service from the new substation, City Light would add a new transmission line to feed the facility after construction is completed. City Light is considering three alternatives for the transmission line (referred to as Transmission Line Alternative 1 [TL1], Transmission Line Alternative 2 [TL2], and Transmission Line Alternative 3 [TL3]).

The impacts of the transmission line alternatives would occur primarily during construction. After the transmission line is installed (primarily underground), it would have few, if any, operational impacts. The discussion below summarizes the construction-related impacts (transportation, noise, historic and cultural resources, environmental health relating to hazardous materials, and utilities), and the operational impacts (utilities and environmental health relating to electric and magnetic fields). Other elements of the environment (aesthetics, air quality and greenhouse gases (GHG), land use and housing, water resources, and energy and natural resources) would have only minor impacts from construction of the transmission line.

Transmission Line Alternatives 1 and 3 (TL1 and TL3)

Impacts resulting from either TL1 or TL3 would be similar because these project alternatives both consist of installing underground electrical lines and equipment primarily in public rights-of-way. The impacts would vary depending on the traffic volumes of the affected roadways and the types of adjacent land uses, but the impacts from in-street construction would primarily be short term and not cause any significant impacts if mitigation is provided.

Installation of TL1 and TL3 would require excavation in streets; protection, and in some cases, relocation of utilities; and pavement restoration. The alternatives would require temporary lane closures affecting all modes of transportation, and all street work would be coordinated with SDOT and other transportation agencies to minimize traffic disruption. Temporary construction impacts, including noise, air quality, and traffic impacts and potential discovery of hazardous materials during excavation, could last approximately 5 weeks per city block in any given location and would be typical of street projects that occur throughout the city on a regular basis. Excavation under any of the alternatives could encounter cultural resources in the form of artifacts. Any cultural artifacts discovered would be evaluated by an archaeologist and treated according to an Inadvertent Discovery Plan.

Construction would occur primarily during the day but would occasionally occur at night to avoid creating major traffic backups on Interstate 5 (I-5) or major arterials. Where nighttime work is necessary, such as near freeway on- and off-ramps, City Light would obtain a noise variance from the City. City Light would minimize the number of nights of work, notify nearby tenants and property owners in advance of any nighttime work, and require contractors to use ambient-sensitive broadband backup alarms during nighttime work. To avoid the potential for significant noise impacts from nighttime work near noise-sensitive uses, City Light may be required to limit nighttime use of concrete breakers and other impact equipment or employ other measures as determined in the variance process.

All alternatives (TL1, TL2, and TL3) would require crossing rail yards in the SODO area, either overhead or underground. Construction through the rail yards would require coordination with the BNSF Railway Company and Sound Transit to minimize interruption of rail traffic. If overhead transmission lines were used, the construction impacts to rail traffic would be less than if underground lines were used.

TL1 and TL3 would also pass under the Interstate 90 (I-90) off-ramps and would potentially affect I-5. Regardless of which transmission alternative is chosen, careful coordination with the Washington State Department of Transportation (WSDOT), including obtaining permits, would be required. TL1 would avoid crossing I-5, while running underground roughly parallel to the freeway on its west side through much of downtown then through the Chinatown/International District on 5th Avenue South to South Dearborn Street. However, TL1 would require trenching along 6th Avenue where it serves as part of the I-5 on-ramp and off-ramp system, and could disrupt freeway traffic. Construction would need to be scheduled to avoid peak hours in order to mitigate this potentially significant impact. TL3 would cross I-5 in two locations: underground at South Dearborn Street and within the existing overpass bridge at Boren Avenue, neither of which would require closure of lanes on I-5. TL3 would require construction near the James Street off-ramp from I-5.

Either TL1 or TL3 would intersect a known archaeological site on 6th Avenue South, a former refuse deposit site that has not been formally evaulated for eligibility for archaelogical significance by the State Department of Archaeology and Historic Preservation.

There would be minor operational impacts on utility maintenance and installation in city streets because the duct banks would present an additional utility for other utilities to work around. Overhead lines would have few conflicts with other utilities because most other utilities are underground. City Light will continue coordinating with affected utility agencies to ensure no adverse impacts occur to utilities during or after construction. Magnetic fields from TL1 or TL3 are not expected to affect utilities or other facilities.

Transmission Line Alternative 2 (TL2)

TL2 would travel through the DSTT for slightly more than half of its length and would exit the south end of the DSTT and be attached above ground to the I-90 ramps, requiring approval from WSDOT for this component. Construction impacts would be the same as those described for TL1 and TL3, except that there would be fewer impacts to surface streets (because less of the construction would be located within street rights-of-way). Potential impacts to cultural resources or from noise or hazardous materials would be similar to TL1 and TL3, except that these are not expected in the DSTT. There would also be no crossings of I-5 and no impacts on I-5 freeway ramps.

However, the DSTT was not designed to incorporate extraneous utilities, and it now appears that installation of TL2 would pose significant engineering challenges that would be difficult to resolve. Sound Transit has informed City Light that trenching for the transmission line in the tunnel stations (anything more than 1 foot in depth) could compromise the structural integrity of the cut-and-cover portions of the DSTT. However, more than 1 foot of depth would be required in order to splice transmission line segments. Sound Transit also raised long-term safety and operational issues that City Light would need to address before Sound Transit would allow use of the tunnel for the transmission line. Because City Light has not completed full engineering on any of the transmission line alternatives, City Light has not addressed these structural concerns at this time, but recognizes that they are fundamental constructability issues that must be addressed before the tunnel could be used. For the purposes of this analysis, City Light has chosen to examine only the impacts that would occur assuming that these constructability issues were addressed to the satisfaction of Sound Transit and King County.

In addition to the constructability issues related to cutting into the floor of the tunnel, construction impacts to transit would be significant without mitigation. Certain aspects of TL2 construction (transmission line splicing in particular) would require temporary closure of the tunnel for up to 8 hours at a time, which could be scheduled on weekends. City Light would coordinate with Sound Transit and

Metro in order to plan portions of construction at night when the DSTT is closed. Closure of the DSTT would require rerouting transit service during those periods. Rerouting of transit to surface streets would have a moderate impact on transit users. The increase in the number of downtown buses on surface streets would have minor impacts on weekend roadway traffic operations.

There is potential for EMI in the DSTT. However, power-frequency EMF such as from electrical distribution and transmission lines, is not found to cause EMI with equipment operating at much higher radio or microwave frequencies, as can be found in the tunnel. City Light has determined there would not be operational impacts to other equipment within the DSTT, provided City Light engineers review all potentially affected equipment and design the transmission line accordingly.

Operation of TL2 is not expected to have any adverse operational impacts except for minor impacts on utility maintenance, as described above for TL1 and TL3.

1.2.3 Broad Street Substation Inductor Options

During the time the Denny Substation is being constructed, City Light would construct a new inductor at the existing Broad Street Substation to help balance the regional transmission system. City Light is considering two options for locating the new equipment (referred to as Broad Street Substation Inductor Option 1 [BI1] and Broad Street Substation Inductor Option 2 [BI2]).

Construction and operation of the Broad Street Substation inductor would have only minor adverse impacts to any element of the environment because it would be a small expansion of the Broad Street Substation.

It is possible that basement construction under either option could have an impact on an archaeological resource thought to extend into the project area: a retaining wall that was covered during prior regrading of the area. Cultural resources would be treated appropriately according to a Monitoring and Treatment Plan. Construction would likely encounter hazardous materials in the soil, which would be removed.

The Broad Street Substation inductor options would have no adverse operational environmental health related to hazardous materials or EMF, land use, energy, water resources, utilities, or transportation impacts. The facility would not change the character of the area. If BI1 is selected, a portion of an existing art installation fence at the Broad Street Substation Annex would be relocated or replaced in coordination with the City Arts Commission. If BI2 is selected, the inductor would add to the array of electrical equipment on the west side of the substation building and would require extending the security wall and fence to enclose the new facilities. The placement of the inductor in either location would not have an adverse impact on the visual context of the historic structures at the Broad Street Substation on Taylor Avenue North.

The inductor is not expected to produce any noticeable noise, and there would be only minor air pollutant or GHG releases from construction and operation. As with all its facilities, City Light would offset any operational releases of GHG consistent with its zero net emissions policy.

1.2.4 Distribution System

Construction of the various components of the Denny Substation Project would first begin with installation of distribution lines. Installation would continue while the Denny Substation and transmission line are being built. The distribution lines would deliver electric power from the Denny Substation to residential and commercial customers in South Lake Union at appropriate voltages. City

Light has identified two areas for installing the distribution lines: the Phase 1 Build-out area and the Future Build-out area.

Impacts from construction of the distribution system in the Phase 1 Build-out and Future Build-out areas would be similar to the transmission line alternatives, with the primary impacts occurring during construction in street rights-of-way. Construction would require more excavation than the new transmission line due to greater length of duct bank installation compared to the transmission line. Overall, construction of the Phase 1 Build-out area would take approximately 24 months to complete, with construction on any given block taking about 2 months to complete. The distribution system would primarily consist of installing underground electrical lines and equipment in public rights-of-way. The distribution system is not expected to have any significant operational aesthetic, noise, environmental health related to hazardous materials or EMF, land use, air quality, GHG, energy, transportation, water, utilities, or cultural and historic resource impacts because it would be installed underground.

After construction of the Phase 1 Build-out area, the distribution system would continue to be extended as new development in the South Lake Union area requests network distribution service ("Future Build-Out"). As such, minor construction-related impacts would continue intermittently into the future for that work.

1.2.5 Combination of Impacts from Denny Substation Project Components

The Denny Substation Project is composed of several components, each of which would only cause minor to moderate impacts once mitigation measures specified in this Draft EIS are implemented. Under SEPA, an EIS is required to examine whether numerous minor impacts could in combination result in a significant impact. Assuming mitigation measures are implemented, the combined impacts from various components of the project are not expected to result in significant impacts for the following reasons.

Aesthetics – The substation, the potential overhead lines in SODO, and the Broad Street Substation inductor would be separated by substantial distances, and would not affect the same neighborhoods. Other components would not have any visual impacts.

Noise – Construction noise from building the project components would be most concentrated at the substation site. Phase 1 Build-out of the distribution system would occur near the substation and the construction schedules for these two components would overlap from mid-2015 through 2016. However, most of the impacts would be sufficiently far away that they would not affect the substation area. The transmission line would be constructed after the substation is complete, and except for the northern end would be sufficiently far away that construction noise would not affect the substation area. The Broad Street Substation inductor site is also sufficiently far away that construction noise would not affect the substation area.

Environmental Health - EMF – EMF associated with the various project components would not overlap except where they connect to the substation. Although there would be an increase in EMF within this area, it is not expected to adversely affect human health.

Environmental Health - Hazardous Materials – Hazardous materials encountered during construction would be removed and treated, thus reducing risks in any affected areas.

Transportation – Moderate transportation impacts are expected during construction of the project components but would be physically and temporally separated such that impacts would not overlap. Operational impacts would be separated by substantial distances, and would not affect the same neighborhoods.

Land Use and Housing – None of the project components individually is expected to affect surrounding land use or housing over the long term. Short-term impacts from the combination of the two components in closest proximity, the substation and the distribution system, would still not be of sufficient duration to affect land use over the long term. Other components are not close enough to each other to have any combined effect on land use.

Historic and Cultural Resources – The project could encounter a series of archaeological resources located underground. However, the likelihood of discovery is low. With specified mitigation, any discoveries would be treated appropriately.

Air Quality and GHG – The analysis examined the combined volumes of construction-related air emissions and found that the impacts would not be significant. Operational impacts are very small, and any GHG impacts would be offset by City Light.

Utilities – The substation, transmission lines, distribution system, and the Broad Street Substation inductor would be physically separated. Therefore, any construction-related impacts would be unlikely to affect utilities in the same area more than once. City Light and SDOT would coordinate to help ensure that repeat street work would be minimized. Operational impacts, which would be limited to duct banks potentially hindering future utility construction or replacement, would be minimized by designing and installing duct banks such that other utilities have adequate room to work around them.

Water – Although construction of some project components would occur simultaneously, most of the impacts would be sufficiently isolated from each other that they would not combine to impact water quality. Once each component is completed, it would not have any adverse water quality impacts that could combine with those of another component.

Energy – Consumption of energy from construction of all project components would not be significant, and energy consumption for operation would be even smaller.

Chapter 2: DESCRIPTION OF PROJECT AND ALTERNATIVES

As described in Chapter 1 Summary, Seattle City Light's (City Light's) Denny Substation Project is a proposal that includes the following components:

1. Construct a new electrical substation on Denny Way in the Cascade area of Seattle's South Lake Union neighborhood;
2. Construct a new high-voltage transmission line to connect the new substation to the existing Massachusetts Substation in the South of Downtown (SODO) neighborhood; and
3. Construct a new electrical network distribution system to serve the South Lake Union area.

City Light also proposes to construct a new inductor at the Broad Street Substation to help balance the regional transmission system. For purposes of this environmental review, installation of this new inductor is incorporated as part of the Denny Substation Project.

This chapter describes the Environmental Impact Statement (EIS) project components, provides details of the three substation alternatives, three transmission line alternatives, two inductor options, and the distribution system, and describes the No Action Alternative as required by the State Environmental Policy Act (SEPA). Figure 2-1 is a map showing the locations of the project components, including the alternative alignments for the transmission lines.

The purpose and need for the project are discussed in this chapter, as well as project alternatives initially considered but not pursued. Basic information about electrical power generation, transmission, and distribution is also provided for project context.

2.1 Purpose and Need for Proposal

The proposed project is intended to meet a number of needs. The objectives are to provide more reliable electrical service for the South Lake Union and Denny Triangle areas as soon as possible by extending network distribution system service, including the development of a new electrical substation to support the expanded network distribution system, and provide for increasing electrical load in keeping with planned economic development. Such efforts would, in turn, also provide more reliable electrical service to the Uptown neighborhood and the northern part of Seattle's Central Business District (CBD). The project is also expected to provide added capacity to serve existing distribution systems in the Denny Triangle and First Hill areas and to create options for meeting existing and future system capacity needs. Furthermore, the project will help implement regional transmission line system improvements to regulate power flow. (See Appendix A, Neighborhood Map, for key neighborhoods where project work would occur.)

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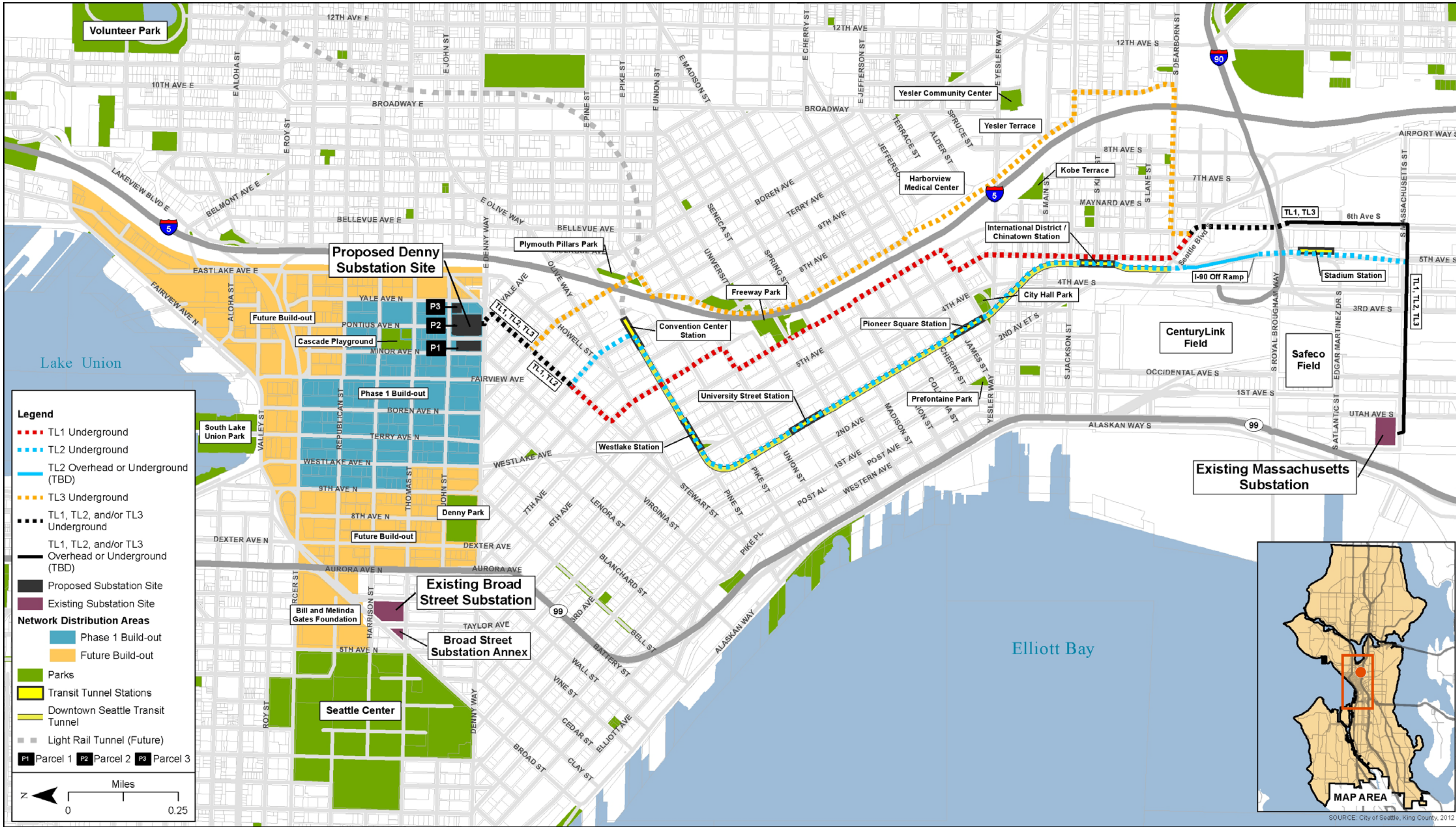
Figure 2-1. Proposed Denny Substation Project Components



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According to a report prepared by City Light in January 2012, the South Lake Union area of Seattle has been experiencing rapid redevelopment over the past 15 years (City Light, 2012). In 2003, the Seattle City Council (City Council) adopted Resolution Number 30635, which directed the Department of Planning and Development to expand its efforts to address the specialized needs of biotech development throughout the city. In 2004, the Seattle Comprehensive Plan listed the South Lake Union area as one of five urban centers (City of Seattle, 2005). This designation is intended to lead to creation of a high-density urban area where low-density commercial and industrial development would be replaced with multistory residential and commercial development, providing high-tech/professional jobs, increasing the tax base, and adding retail services and housing in the city center. Pursuant to these goals, the City has been upgrading transportation, road, and water management infrastructure in South Lake Union.

South Lake Union's Rapid Growth

Between 2002 and 2004, real estate projections and estimates of the economic potential through 2020 were developed for the north downtown area (as described in the Initial Business Case for Serving Load in North Downtown Seattle prepared by City Light; City Light, 2012). These projections included square footage of real estate development segregated by biotech, office, and retail/residential categories; job creation projections; and revenue generation. At the end of 2010 these projections were re-evaluated. The analysis concluded that growth through 2010 exceeded its forecasted estimates for construction, job creation, and revenue generation, while the national, state, and local economies declined (City Light, 2012).

Based on these planning goals, redevelopment is expected to result in a high electrical load density approaching that of the CBD, where network distribution is already in place. According to the City Light report, in early 2000, the South Lake Union and north downtown area had an electrical load density in the range of 10 to 25 megawatts (MW)/square mile. In 2010, the electrical load density was 75 MW/square mile. As development occurs, City Light expects electrical load density in South Lake Union and north downtown to increase to 150–200 MW/square mile (City Light, 2012). By comparison, the CBD load density is currently 200–300 MW/square mile.

City Light has a systemwide objective to not exceed an average customer outage duration of 70 minutes per year. Currently, the South Lake Union/north downtown area experiences an annual average system outage of 94 minutes per year. This exceeds the desired reliability goals for high electrical load density areas such as the CBD, where outages are rare (City Light, 2012).

City Light considered how best to serve the emerging high load density and provide system flexibility to accommodate planned and unplanned outages, and determined the need to convert the existing overhead and underground radial distribution system to an underground network distribution system (see Section 2.2, Electrical Power Basics, for more information on types of electrical distribution) (Quanta Technology, 2011).[1] This conclusion was based in part on findings that the reliability and flexibility from a network distribution system is especially important to the types of power customers anticipated in the area.

[1] City Light typically serves lower electrical load density areas with a looped radial distribution system, and, as exemplified in the CBD, serves high electrical load density areas with an underground network distribution system.

City Light further determined that both the expanded and existing network distribution systems in the project vicinity would require a new substation designed to function as both a distribution station and a transmission station. A new network distribution system and substation system would provide the needed capacity and flexibility to manage load growth in other nearby urban centers, and also alleviate existing electrical system congestion between the Broad Street, Canal, University, and East Pine substations (see Figure 2-2). A network distribution system is considered by City Light to be the most operationally viable system to provide the required electrical power reliability in this service area. By alleviating electrical system congestion, the anticipated growth in the South Lake Union and Denny Triangle areas of Seattle would avoid negatively affecting other neighborhoods.

In addition to a new substation, City Light's analysis determined that a new (third) transmission line would be needed to provide reliable power to the new network area and First Hill network. Distribution requirements include an ultimate capacity of 225 MW of power at 13.8 kilovolts (kV) and an ultimate capacity of 180 MW of power at 26 kV (City Light, 2012). To deliver the required power to the Denny Substation when it is first energized, the existing 115-kV transmission line running adjacent to the proposed substation site would be split into two lines. In the near future, a new 230-kV transmission line would need to be constructed from the Massachusetts Substation in the SODO area to the new Denny Substation. A new transmission line would help meet the distribution load requirements and contribute to system reliability by providing more than one source of power to the network.

Figure 2-2. Seattle City Light Substations[1]

[1]Substation types are described in Section 2.2, Electrical Power Basics
Source: Quanta Technology, LLC, 2011; City of Seattle,

City Light also determined the need to install new inductors both inside the proposed Denny Substation and adjacent to the existing Broad Street Substation in order to comply with the terms of their agreement with the Bonneville Power Administration (BPA) and Puget Sound Energy (PSE) (BPA et al., 2012). Inductors regulate the flow of electricity along a transmission line. At the Broad Street Substation, the inductors would assist with the overall transmission system balance by helping control the electrical impedance[2] down particular lines and prevent overloading. Increasing impedance reduces the flow of electrical current within a circuit, which has the effect of rerouting electrical current to other circuits. These improvements would increase the reliability of City Light's electric transmission grid.

[2] Electrical impedance is the measure of the total opposition that a circuit or part of a circuit presents to electric current.

The new substation would both distribute electrical power to the South Lake Union area and transmit power to other City Light substations to alleviate electrical system congestion and accommodate expected growth. The proposed Denny Substation would initially be served by the existing transmission line that connects the Broad Street and East Pine Substations (shown in Figure 2-2), which runs through the proposed site. During construction of the proposed Denny Substation, this underground transmission line would be split into two lines that terminate at the Denny Substation site. This line would be reconfigured into two lines to provide the initial power for the facility, thereby allowing the substation to provide network service to some customers after initial energization. After the transmission line is cut, one existing line would extend west and connect Denny Substation to the existing Broad Street Substation, and one existing line would extend east and connect Denny Substation to the existing East Pine Substation, providing two separate transmission circuits to power the new substation.

Based on current planning assumptions, by 2020 City Light would construct a new transmission line from the new Denny Substation to the existing Massachusetts Substation in the SODO neighborhood to reliably power the proposed substation from three transmission circuits. The new transmission line would be installed primarily underground, within road rights-of-way.

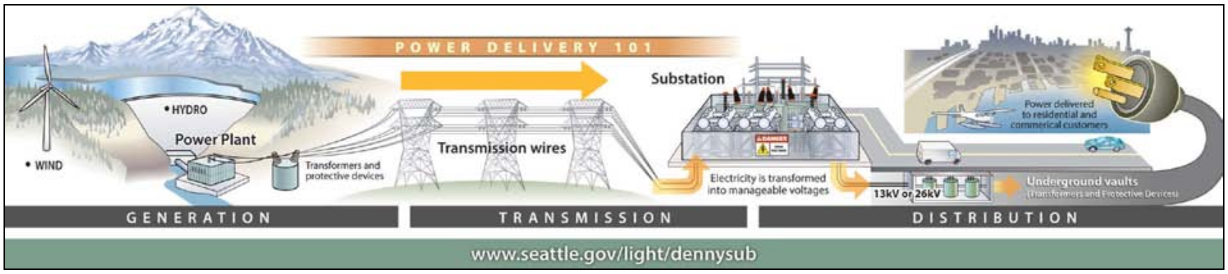
The substation would contain transformers and associated equipment (e.g., switchgear, grounding bank, and inductors). The interior of the substation would be developed in phases. As loads expand over time, equipment would be added to the substation to maintain reliable electrical service, but the outer footprint of the substation would remain the same.

The project would install a new underground network distribution system in the South Lake Union area. The network distribution system service area extending out from the new substation would be developed in phases, with a first set of new conduits and cables installed within street rights-of-way through the neighborhood adjacent to and surrounding the substation (referred to as the Phase 1 Build-out area) and then with connections to be constructed within street rights-of-way as needed in the future (referred to as the Future Build-out area). The schedule of this future construction will be determined by the pace of private development. Figure 2-1 shows the substation site and the network distribution areas. Network improvements within the Denny Triangle area of City Light’s existing Downtown Network Service Area are planned in 2014 as a separate project. Bolstering network distribution system service to this area is required in the very near term, whether or not the Denny Substation is completed as planned.

2.2 Electrical Power Basics

City Light is the municipal power utility serving the city of Seattle and surrounding communities. City Light’s service area is approximately 131 square miles, has a population of approximately 750,000, and includes approximately 398,000 electrical customers. It has the responsibility to generate (or procure), transmit, and distribute electricity to its customers. This is accomplished through a generation, transmission, and distribution system (Figure 2-3).

Figure 2-3. Generation, Transmission, Distribution System



Source: City Light, 2013

Power generation refers to the production of electrical energy from another form of energy, such as the potential energy from falling water in a hydroelectric facility. Power generation comes from City Light's resource portfolio that includes City-owned energy-generation resources, long-term purchase contracts, and conservation programs.

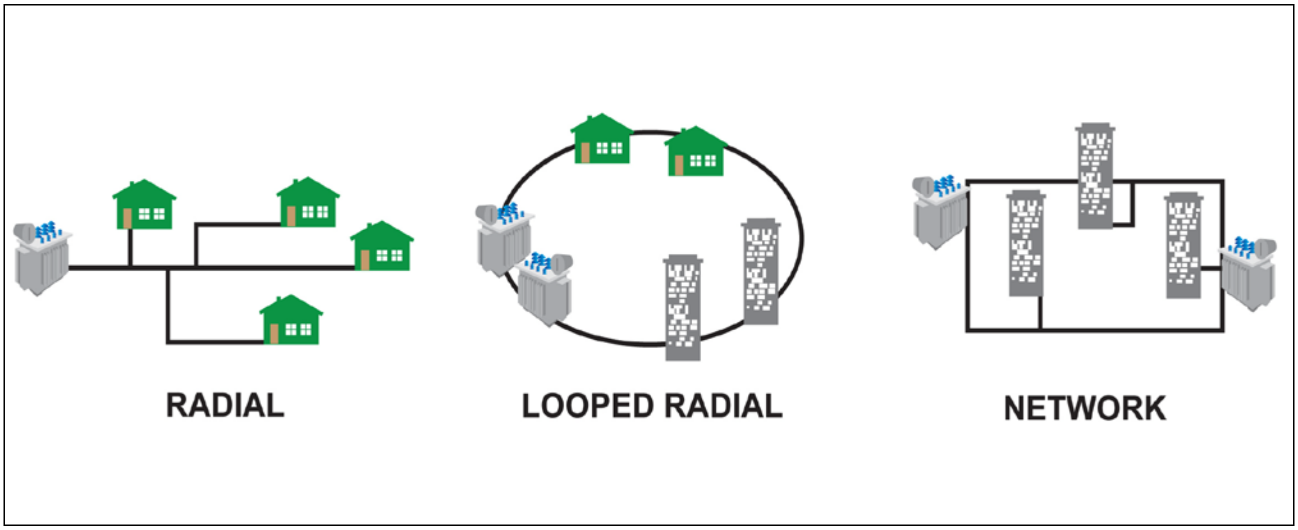
Transmission refers to the bulk transmission of power from a generation facility or substation to another substation. Nearly all of City Light's electricity is generated outside of the Seattle city limits. Electricity is transmitted from its point of generation over long distances by high-voltage transmission lines. Transmitting electricity at high voltage reduces the amount of energy that is lost through inefficiencies (resistance). Transmission lines are interconnected, forming power grids. City Light is part of the transmission power grid known as the Western Interconnection. City Light owns transmission facilities, but depends on BPA and other utilities for most of the electric transmission outside its service area. City Light's transmission system operates at nominal voltages of 115 kilovolts (kV), 230 kV, or 480 kV.

A distribution system originates at a distribution substation and includes the lines, poles or conduits and vaults, transformers, and other equipment needed to deliver electric power to customers at required voltages. Commercial and residential customers do not use electricity at high voltage. Commercial and residential electrical service must be delivered at 120 volts or 240 volts. The distribution system lowers voltages to these required levels and delivers power to customers (U.S. Department of Labor, 2013).

There are several types of distribution systems (Figure 2-4): radial, looped radial, and network. A radial distribution system is the simplest and is typically used in sparsely populated areas. It has only one power source for a group of customers. A power failure, short-circuit, or a downed power line would interrupt power in the entire system and must be fixed before power can be restored.

A loop system, or looped radial system, loops through the service area and returns to the original point. The loop is usually tied into an alternate power source. By placing switches in strategic locations, the utility can supply power to the customer from either direction. If one source of power fails, switches can be thrown (automatically or manually), and power can be fed to customers from the other source. The loop system provides better continuity of service than the radial system, with only short interruptions for switching. In the event of power failures due to faults on the line, the utility has only to find the fault and switch around it to restore service. The fault itself can then be repaired with a minimum of customer interruptions. This is the type of distribution system that is most typical in City Light's service area outside of the Downtown, First Hill, and University District Network Service Areas.

Figure 2-4. Distribution System Types



A network system, which is the type of system used to supply City Light customers in downtown Seattle, is the most complicated and consists of interlocking loop systems. A given customer can be supplied from two, three, or more different power supplies. The advantage of such systems is added reliability. Network systems are expensive to install and for this reason are usually used only in high-load density areas like downtown Seattle.

Substations are an integral part of the electrical distribution system. There are two main types of substations: (1) transmission substations, which reduce voltage for continued transmission, and (2) distribution substations, which reduce voltages to primary system levels for delivery to transformers found on utility poles and underground vaults throughout Seattle. These transformers lower voltages again to the service levels that are used by commercial and residential customers. The transmission substations' equipment must also regulate the power flow on the transmission system so that operation of the system is optimized for the region, via the Western Interconnection to the Pacific Northwest Transmission Grid. Substations can function as both transmission and distribution stations, and both types serve as power control valves.

City Light owns approximately 657 circuit miles of transmission line service, 15 transmission and distribution substations (13 within the Seattle city limits) (Figure 2-2), and approximately 2,500 miles of electric distribution lines. City Light's system has three 230-/115-kV transmission substations and 14 distribution substations (including the Massachusetts and East Pine substations) that provide 26-kV looped radial and 13-kV and 26-kV network service. Downtown Seattle and portions of the University District and First Hill are served by 13-kV network service from five substations. Most of the rest of the service area is served by 26-kV looped radial systems.

2.3 Action Alternatives

This section describes the various substation and transmission line alternatives and Broad Street Substation inductor options, as well as the components of the project that are the same regardless of the alternatives. The three action alternatives listed below for the substation are conceptually the same as those provided and discussed during the SEPA scoping period in 2012:

- **Substation Alternative 1 (SA1): No Street Vacation** – SA1 would not vacate Pontius Avenue North.
- **Substation Alternative 2 (SA2): Street Vacation Design 1** – SA2 would vacate Pontius Avenue North and include public benefit features to compensate for street vacation. See the detailed description of this alternative below for information on features that have changed since scoping.
- **Substation Alternative 3 (SA3): Street Vacation Design 2** – SA3 would also vacate Pontius Avenue North and include public benefit features but employ a different design and structural form than SA2.

The substation would include an initial phase of equipment installation that will meet current and near future power needs. Over a period of approximately 20 years after energization of the substation, additional equipment would be added as power demand grows. Unless otherwise noted, the analysis considers the full build-out condition of the substation.

What is a street vacation?

The term *street vacation* refers to the process whereby a property owner petitions the City Council to acquire adjacent street right-of-way for use other than as a public street. Public right-of-way is any property where the City has a right to use the land for street purposes whether or not the right-of-way has ever been improved.

This Draft EIS also evaluates the following three alternatives for transmission line routes, which follow different routes through downtown Seattle, and the same general corridor in the South of Downtown (SODO) area:

- **Transmission Line Alternative 1 (TL1): East Edge Downtown Route** – TL1 would run underground through downtown Seattle, generally along the eastern edge of the CBD.
- **Transmission Line Alternative 2 (TL2): Downtown Seattle Transit Tunnel (DSTT)** – TL2 would run underneath city streets at its north end and through the DSTT. This alternative is not preferred by City Light, as described in the text of this chapter.
- **Transmission Alternative 3 (TL3): Interstate 5 (I-5) East Route** – TL3 would run underground adjacent and east of I-5, through the eastern edge of the Pike/Pine, First Hill, and Chinatown/International District neighborhoods.

This Draft EIS evaluates the following two options for installing inductors at the Broad Street Substation:

- **Broad Street Substation Inductor Option 1 (BI1): North of the Annex** – BI1 would locate equipment on the northwest side of the Broad Street Substation Annex in a closed portion of Broad Street, west of Taylor Avenue North.
- **Broad Street Substation Inductor Option 2 (BI2): North of the Substation** – BI2 would locate equipment on the northwest corner of the Broad Street Substation in a closed portion of Broad Street, east of Taylor Avenue North.

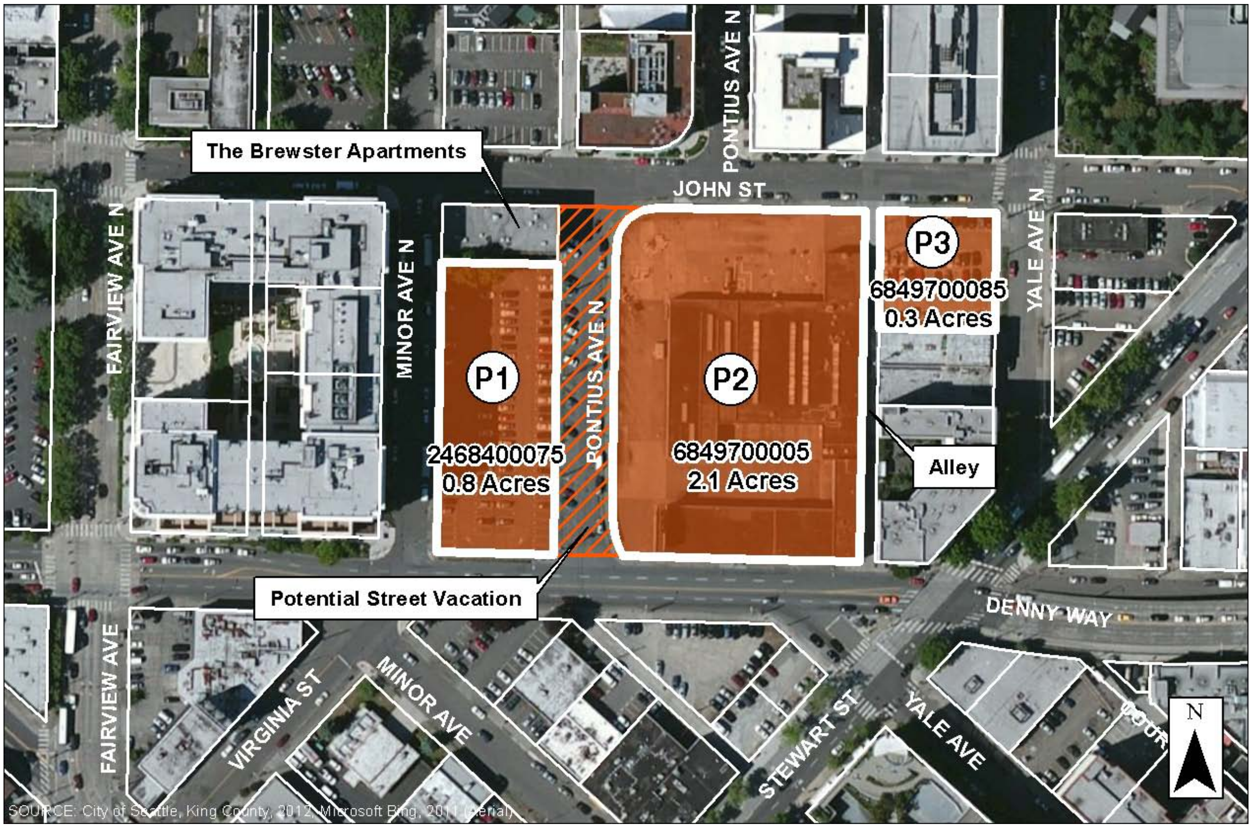
Because the project would require street excavation and in some cases utility line replacement or relocation, some utility lines may be upgraded with this project, if requested and paid for by the utility provider. For example, the water main in Pontius Avenue North would be upgraded when the distribution system is being installed.

2.3.1 Substation Alternatives

Substation design details presented in this section are conceptual and intended to help assess environmental impacts associated with each alternative. City Light has designated SA3 as its Preferred Alternative based on its ease of operation, its flexibility for installing future equipment, its ability to provide enhanced pedestrian experience, and the opportunities this alternative presents for public benefits associated with a street vacation, as well as public feedback received during scoping. City Light has also studied two screen wall heights and the possibility of overhead screening on the substation, which would obscure views into the substation yard from upper level windows in adjacent development). City Light prefers a design without overhead screening and with lower wall heights. The reasons for this preference are discussed under the section entitled Design Features Common to All Alternatives, below.

All three of the substation designs would be constructed on a portion of the 3.2 acres of City Light property in the Cascade area of the South Lake Union neighborhood. The proposed substation site consists of three parcels (Parcels 1, 2, and 3, referred to as P1, P2, and P3, respectively, on figures) located between Denny Way and John Street and between Yale Avenue North and Minor Avenue North. Parcels 1 and 2 are bisected by Pontius Avenue North, and Parcels 2 and 3 are separated by a public alley. The proposed site is shown in Figure 2-5, which also includes parcel number and size for each parcel.

Figure 2-5. Proposed Denny Substation Site



The substation alternatives represent three different site configurations, each with different exterior treatments, screen wall shapes, and associated amenities. There are two general types of site use proposed: two of the three alternatives described below (SA2 and SA3) would vacate Pontius Avenue North between Denny Way and John Street and one (SA1) would not. A street vacation would require provision of public benefit features in exchange for the vacation, which the project would provide. The street vacation proposed for SA2 and SA3 would still retain pedestrian access to the adjacent building (The Brewster apartments) from Pontius Avenue North, and would not change vehicular access to The Brewster from other adjacent streets. Vehicular access for solid waste storage and pickup for The Brewster would be shifted to Minor Avenue North.

Connecting to the Existing Transmission Line in Denny Way and John Street

Two new vaults would be installed to intercept the existing East Pine/Broad Street transmission line: one at the southeast corner of the proposed substation site on Denny Way and one at the northwest corner of the site on John Street. City Light would install "freeze pits" to freeze the oil that insulates the transmission lines, thus allowing them to be cut. The line would be extended from each freeze pit to the new substation through a trench. The temporary closure of Denny Way for this process would be one of the most substantial traffic impacts of the project.

Design Features Common to All Alternatives

All three of the substation alternatives include underground distribution and transmission around the substation (e.g., no overhead lines in or out of the site). These distribution and transmission lines would extend from the substation on all sides. As described in Section 2.1, Purpose and Need for Proposal, the proposed Denny Substation would be initially connected to the electrical transmission system via the existing East Pine-Broad Street 115-kV underground transmission line.

This one line would be split into two separate circuits. The line would then be redesignated into two lines: (1) East Pine-Denny (EP-DN) and (2) Denny-Broad (DN-BR). Connection to the East Pine-Broad Street transmission line would occur with the substation construction.

All necessary duct installation for future transmission and distribution lines in streets adjacent to the substation would be constructed with the substation, so that streets would not need to be disturbed again in the future. The installation of a ground grid would be required beneath the Denny Substation. A ground grid is a system, or grid, of connected metal grounding rods that transfer electric current to the ground. This type of grid is required for proper equipment operation and personnel safety. The ground grid is necessary to maintain reliable performance of the substation during electrical faults, as well as to protect people who are in and near the facility. The grid would be installed at a minimum depth of 24 inches below the finished grade of the substation. The spacing and exact placement of the ground grid will be determined during final design, after the completion of site-specific soil testing and computer analysis. The grid would extend approximately 3 feet beyond the perimeter screen wall for proper protection.

The existing alley between Parcels 2 and 3 would be expanded and improved to meet minimum City standards, and would include lighting and other security features. The facility design would accommodate pedestrian movement around the site and maintain pedestrian connectivity through the area for the neighborhood once the project is complete.

The design of the substation alternatives is driven by the requirement to house specific equipment with space for maintenance crews and vehicles to install, access, and maintain the equipment. The substation alternatives would provide a screen wall around the substation yard, buildings, and equipment. Each of the three alternatives would have the same equipment, and the footprints of each would allow for installation of the equipment as discussed in Section 2.1. The substation interior of each alternative would be built out in a phased fashion over the life of the substation.

Since the initial substation concept designs were developed, City Light has evaluated a variety of full or partial overhead screening treatments from the engineering perspective and found this type of facility covering to be unsatisfactory. Specifically, City Light determined that even partial overhead screening would carry risks to critical substation equipment because there is a potential risk of widespread damage to substation equipment if the screening should fail. In the unlikely event of a fire or similar equipment failure within the substation, the structural integrity of overhead screening might be compromised, which could cause the screening to fall into the substation. This type of screening failure could lead to a larger scale of equipment damage than that caused just by the underlying event (such as fire). Additional equipment damage due to failed overhead screening could also lead to higher repair costs and longer time to get the substation fully back on line with service restored to customers. With very high electrical service reliability being a key objective of the project, even though the likelihood of equipment failure events would be very low, the higher potential impact on cost and reliability leads City Light to prefer that any alternative chosen would have no overhead screening, along with the lower wall heights described below.

However, understanding the importance of fitting the substation into the neighborhood, in lieu of partial overhead screening, other design treatments within the substation are being considered through the design process. These include internal lighting of the site and equipment that provides visual interest at night, as well as color schemes that could be applied to the equipment for day and night interest.

Regardless of technical issues and preferences, this Draft EIS does evaluate partial overhead screening across the top of the substation and compares the impacts of that type of design to options with no overhead screening. Full overhead horizontal screening (something more similar to a roof) is not evaluated in this Draft EIS. Although it was initially considered for the substation, it was not pursued due to the reasons discussed in Section 2.5.5, Structural Roof for Denny Substation.

For each alternative, two maximum screen wall heights are shown in Table 2-1, which provides a comparison of all three substation alternatives. Because design of the substation is in its early stage, the dimensions provided are approximate. The height of the screen wall for any of the substation alternatives is, in part, dependent on whether partial overhead screening would be provided or not. The lower screen wall height is the height necessary to screen the tallest equipment that could be seen from ground level, without an overhead screen structure. The lower walls could accommodate overhead screening over portions of the site where there is shorter equipment. Either the taller or the lower screen wall height for any alternative could be built without any overhead screening. If overhead screening were provided and extends above the height of the tallest equipment in the yard, the higher wall heights refer to height at the tallest point of the screen wall. This varies by alternative because of different overhead screen support systems envisioned for each alternative.

Table 2-1. Substation Alternatives Comparison

	Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)
Approximate construction duration	24 months	18 months	18 months
Approximate footprint of substation yard	63,500 square feet	95,250 square feet	111,500 square feet
Approximate volume of excavation	63,600 cy	24,700 cy	25,700 cy
Likely size of shell spaces (available for public benefit)	None	7,320 sf	7,320 sf
Likely size of control room	5,390 sf	5,390 sf	5,390 sf
Likely size of maintenance building	1,360 sf	1,360 sf	1,360 sf
Total interior substation area	127,000 sf (interior of yard at two levels)	95,250 sf (interior of yard)	111,500 sf (interior of yard)
Approximate screen wall height at tallest point above adjacent street level *with* full or partial overhead screening for tallest equipment	49 feet (NW corner)	48 feet (NW corner)	40 feet (SE corner)
Approximate screen wall height at tallest point above adjacent street level *without* overhead screening for tallest equipment	44 feet (NW corner)	43 feet (NW corner)	35 feet (SE corner)
City Light-owned parcels developed with substation	P2	P1 and P2	P1 and P2
Area of street right-of-way proposed to be vacated and incorporated into the project site	None	22,090 sf	22,090 sf
Approximate area of proposed public open space (available as a public benefit feature for street vacation)	Not applicable	28,000 sf	31,000 sf

NW = northwest; P1 = Parcel 1; P2 = Parcel 2; SE = southeast; sf = square feet; cy = cubic yards

Landscaping Features Common to All Alternatives

Landscaping on the substation site would be provided for each of the substation alternatives and would meet, at a minimum, all City code requirements. Each substation alternative would include streetscape improvements (e.g., sidewalks, curbs) around the site that meet the City design standards. Pedestrian access along Denny Way, John Street, and Minor Avenue North would be maintained. On the substation site, the landscape materials selected would be drought-tolerant, low-maintenance plants or hardscape treatment, such as paved walks or gathering areas.

For SA1, which would not vacate Pontius Avenue North, the alley would be widened and improved to meet at least the minimum City design standards, and would include lighting and other security features.

For the three substation alternatives, landscaping in public areas on-site and along adjacent street frontages would be consistent with Crime Prevention through Environmental Design (CPTED) principles to maximize the safety and security of the facility and members of the general public who might be around the edges of the facility or within open space areas. Examples of CPTED principles include maintaining sight visibility into all open areas, avoiding any tree canopy overhang into the facility that may facilitate trespass onto the property, and limiting the height of vegetation in vehicular and pedestrian sight distance triangles. Security concerns and landscaping requirements would be coordinated among City departments as final design is achieved. Also, street trees would be planted along John Street and Denny Way with each substation alternative; the trees would be planted starting approximately 30 feet from the corner of Denny Way and John Street and extend along the substation site. This would exclude a clear zone for the substation service entrance. Street trees along Minor Avenue North would be limited by the potential for tree roots to interfere with the underground duct banks. Trees would be located to avoid conflict with existing and proposed utilities and duct banks. With minimal soil cover over major transmission lines, plantings may be limited to shrubs and groundcover in a few locations. City Light would coordinate with the Seattle Department of Transportation (SDOT) and Seattle Public Utilities (SPU) on tree selection and placement as the landscape design is finalized.

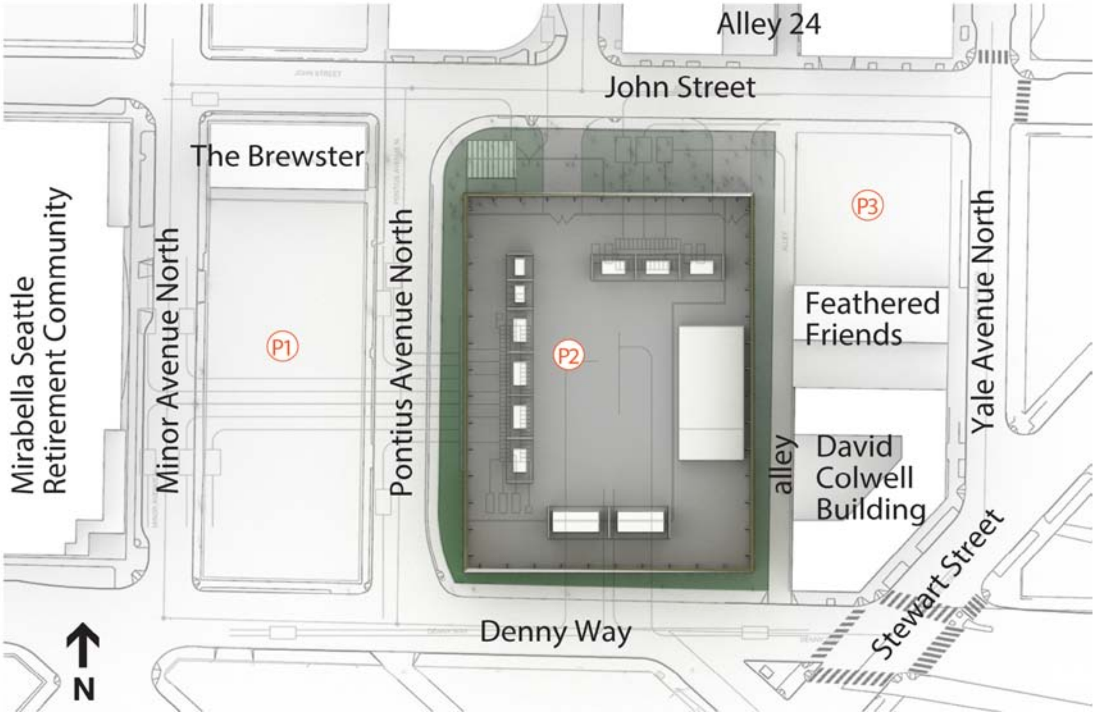
Substation Alternative 1 (SA1)

The substation under SA1 would be a two-level structure with one level below grade. The substation would occupy a single parcel (Parcel 2) at the site (Figures 2-6 and 2-7). No vacation of Pontius Avenue North would be necessary and, therefore, no public benefit to compensate for the loss of that street would be required. The two remaining parcels (Parcels 1 and 3) would not have an above-grade use related to the substation. These parcels would either be used by City Light or identified as surplus and dedicated to another public use or private development. Under any of these scenarios, City Light would retain easements or other property rights for access to maintain the distribution lines running through Parcel 1 and through the alley on the east side of Parcel 2. Figures 2-6 and 2-7 show the substation concept without overhead screening. As discussed above under the heading Design Features Common to All Alternatives, overhead screening poses risks to the equipment, and the greatest risk is in the area where the transformers would be located. As described earlier, for purposes of this analysis, it is assumed that partial overhead screening could be extended over other components in SA1, similar to the partial screen described below for SA3. Figure 2-7 indicates the high and lower screen wall heights evaluated for the Draft EIS.

Substation Interior

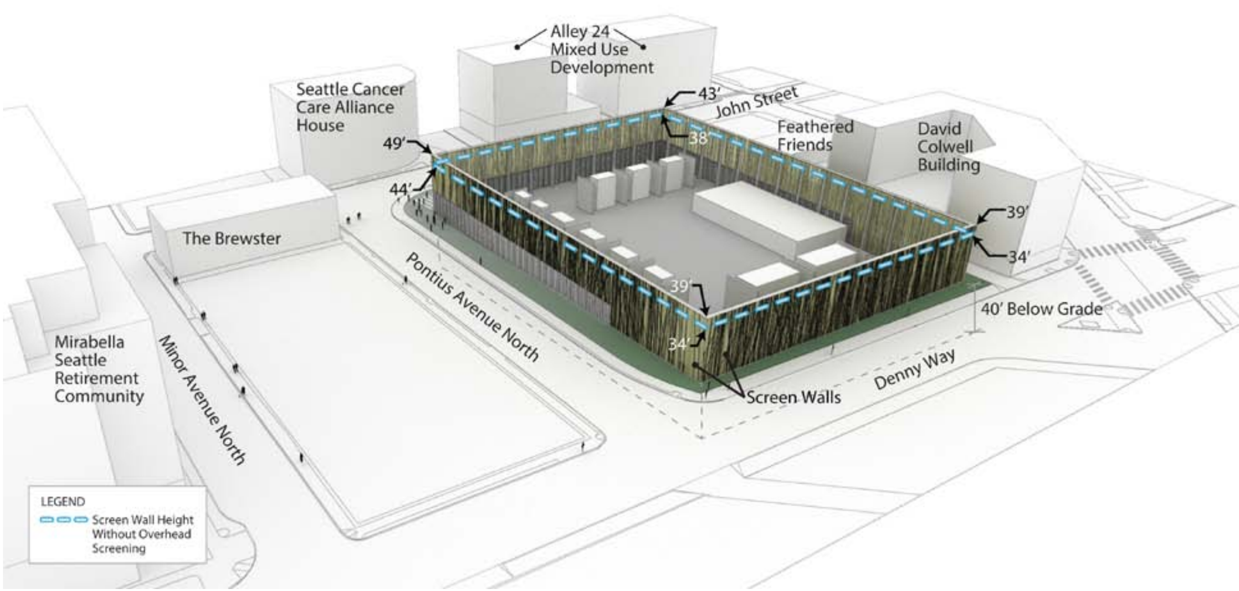
Transformers would be at grade within SA1, which would consist of an approximately 5,390-square-foot, air-conditioned control building; an approximately 1,360-square-foot, air-conditioned maintenance building; a back-up generator for emergency control building operations; and a series inductor. A second series inductor would be installed at a later date, as needed. The control building would contain a battery room to power and maintain a communications equipment room, critical substation control and protection systems in case of a power failure, a mechanical building, and crew facilities (which could include lockers, restroom, and break room).

Figure 2-6. Substation Alternative 1 (SA1) – Plan View



Source: NBBJ, 2013

Figure 2-7. Substation Alternative 1 (SA1) – Oblique View



Source: NBBJ, 2013

SA1 would also incorporate a 40-foot below-grade structure, essentially a basement (which would be designed to withstand and manage seepage from groundwater over time), and which would house gas-insulated switchgear (GIS) equipment and distribution switchgear. This basement structure would consist of a poured-in-place concrete base. Portions of the basement would contain service doors and ventilation louvers. The ‘roof’ of the basement would consist of a precast concrete girder system within a concrete slab, with an integrated waterproofing system. The precast girders would be similar to those found in standard bridge girders.

In order to install additional equipment over time (future phases of electrical build-out), a temporary crane would be brought in (likely by truck) and used to place or remove equipment through an access hatch located near the intersection of John Street and Pontius Avenue North.

SA1 poses operations and management costs and risks that are not present in the other substation alternatives. Because of the greater difficulty accessing the facility to place or remove equipment, SA1 may cost more to operate than the other two substation alternatives. The lower level would be below the groundwater level in the underlying soil and thus would require water management. SA1 would also require additional mechanical equipment for ventilation. Reliance on these mechanical groundwater and ventilation systems poses the risk of system failures that could cause the substation to shut down temporarily.

Substation Exterior

As is the case with all substation alternatives, the SA1 design reviewed in the Draft EIS is conceptual, so that the materials used are assumptions that could change in final design and the dimensions shown are approximate. The SA1 substation structure would be set back farther than Seattle Municipal Code allows outright from the property line along John Street to accommodate equipment staging for placing or moving equipment, an access drive with secured entry, and an areaway connecting to the basement. A zoning waiver for the extra setback would be required. The facility’s exterior screen walls could consist of poured-in-place concrete at the base and an assembly of translucent glass or other solid screen material above. The screen assembly would provide an opportunity for City Light to incorporate art into the facility. From a distance, the screen would effectively appear opaque. Because the substation site slopes approximately 12 feet from southeast to northwest, the screen wall would be highest at the northwest corner.

The height of the screen wall around the perimeter of the facility’s exterior would be approximately 44 feet above adjacent street level at its highest point (the northwest corner) without an overhead screen, or approximately 49 feet with a partial overhead screen. The SA1 structure’s heights with and without overhead screening are shown on Figure 2-7. If used, the overhead screen would allow views into the substation facility from nearby buildings taller than the substation, some of which would be filtered by the screening. Some vantage points would still have unobstructed views into the substation.

Landscaping

The landscape surrounding SA1 would consist primarily of streetscape planting consistent with City standards. Pedestrian improvements are proposed in the alley to meet minimum City standards. The proposed planting surrounding the substation would include drought-tolerant trees, shrubs, and groundcovers to the extent feasible.

Substation Alternative 2 (SA2)

SA2 would be a one-level structure located on two of the three site parcels (Parcels 1 and 2). It would have a larger footprint than SA1 and require vacation of Pontius Avenue North (Figures 2-8 and 2-9). However, in extending the facility onto more than one parcel, the site design would provide opportunities for public access and use of portions of the substation site outside the facility on the north, west, and east sides, with the west side being the largest public use area. These areas around the perimeter of the substation could be used to provide some or all of the public benefit required for the street vacation approval. Parcel 3 would not be necessary for the substation once it begins operating. This parcel could either be used by City Light to meet another facility need or identified as surplus and dedicated to another public use or private development. Figures 2-8 and 2-9 show the alternative without horizontal screening. Similar to the other alternatives, a partial screen could be provided over a portion of the substation.

Substation Interior

SA2 would house all of the same equipment and facilities described earlier for SA1, but equipment would be at-grade, at approximately the same elevation as the entry gate on the north side of the substation. This facility design would eliminate the complexity of ‘basement’ operations and maintenance and also make future equipment installation easier as compared to SA1.

Substation Exterior

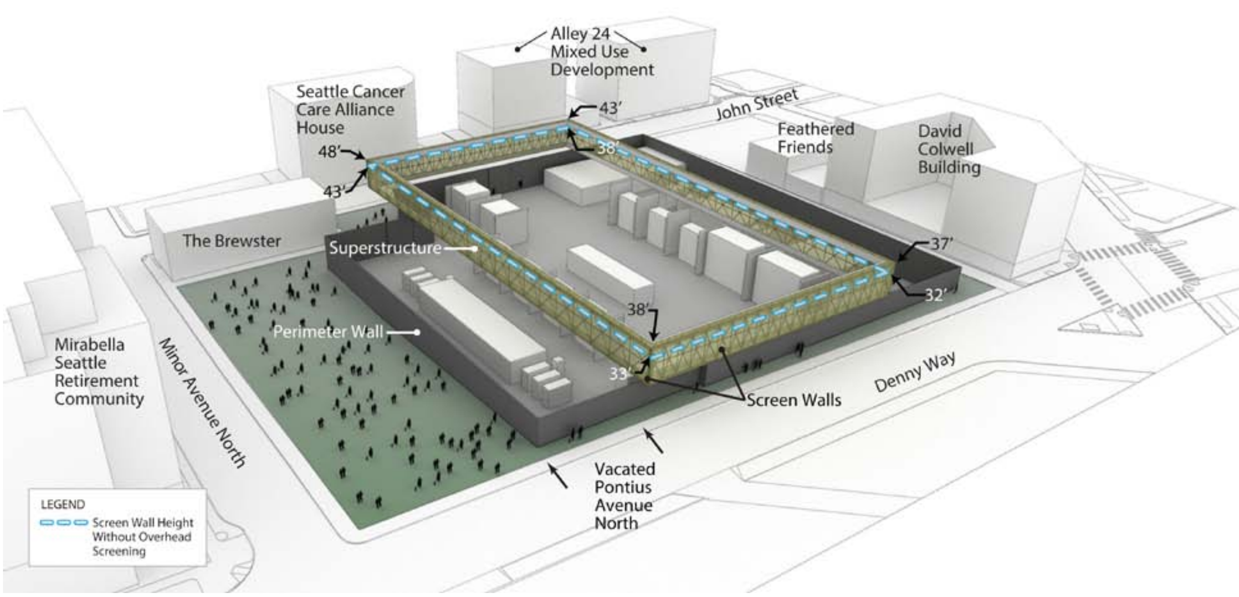
The structure would be set back significantly farther than Seattle Municipal Code allows outright from the property lines along John Street and Minor Avenue North, thus requiring a zoning waiver for the extra setbacks, with the intent to allocate accessible open space along these streets for public benefit features. The edge of the site bordered by Denny Way would also be set back to provide landscape plantings. With the vacation of Pontius Avenue North, the north-south pedestrian movements through the block would be moved onto the open space areas of the site and to the alley between Parcels 2 and 3. SA2 could also accommodate shell spaces at the southeast and southwest exterior corners as public benefits that SA1 would not need to provide. The shell spaces could be used for a learning center or community space. City Light is considering the feasibility of these amenities.

The exterior walls of SA2 would consist of two structures: a 20-foot-tall perimeter screen wall height composed of poured-in-place concrete and a superstructure placed above the perimeter screen wall, which would screen the transformer equipment with a translucent wall assembly (see Figure 2-9). This design, with a recessed upper level, is intended to lessen the bulk and scale of the facility. The screen walls (top and bottom) around the perimeter of SA2 would be approximately 43 feet above adjacent street level at its highest point (the northwest corner) without an overhead screen, or 48 feet with a partial overhead screen. The SA2 structure’s heights with and without overhead screening are shown on Figure 2-9.

Figure 2-8. Substation Alternative 2 (SA2) – Plan View

Source: NBBJ, 2013

Figure 2-9. Substation Alternative 2 (SA2) – Oblique View



Source: NBBJ, 2013

Street Vacation

The street vacation of Pontius Avenue North under SA2 would require discretionary legislative approval from the City Council. Under State and City policies, approval of a right-of-way vacation must achieve a long-term benefit to the general public beyond the benefits of mitigation for impacts. Consistent with City criteria for the approval of street vacations, proposed improvements are intended to provide long-term public benefits. The public benefits associated with the street vacation for the Denny Substation would focus on improvements on and surrounding the site. At the current stage of design, the following features have been identified as public benefits that could be incorporated into the final design of SA2:

- Public open space
- Playground area
- Skate park
- Dog park
- P-patch community garden
- Shell spaces
- Sculpture garden
- Wi-Fi connectivity
- Bicycle amenities
- Electric vehicle charging
- Alley lighting and other security features, pedestrian improvements, and paving enhancements

The design and programming of open space would support adopted community plans and integrate community preferences into the final design. It would be flexible enough to serve a variety of programmed uses and community needs. The Seattle Design Commission will be providing guidance on whether these amenities provide adequate public benefit as part of their recommendation to the City Council as to whether the vacation of Pontius Avenue North should be approved.

The overhead electrical lines and poles that are located on the west side of Pontius Avenue North would be removed as part of the street vacation. Electricity would be provided by the underground 13.8 kV network service instead.

Landscaping

Landscaping and site features for SA2 would support opportunities for City Light to provide public benefit features that would be required as mitigation for the Pontius Avenue North vacation. Public art at the substation site could be included in the SA2 design either as part of the screen structure or in the open space. Open space to the west of the substation could provide for informal recreation and gathering in the form of lawns, planted areas, or plaza areas. The spaces could also be designed to accommodate specific programmed uses, such as an off-leash dog park. The open space along John Street could consist of seating, trees, planting, or paving and this area could also be designed to reinforce the connection to Cascade Playground to the north (see Figure 2-1). The site's open space could be suitable for large and small group gatherings. Landscaping in the existing alley would be designed to be similar in character to the alley north of the site across John Street and could include a swale for stormwater. The landscape would also include buffer planting around the substation to help screen the substation from pedestrians and adjacent residences. The plantings adjacent to The Brewster apartments, as well as elsewhere around the site, would include trees and other vegetation.

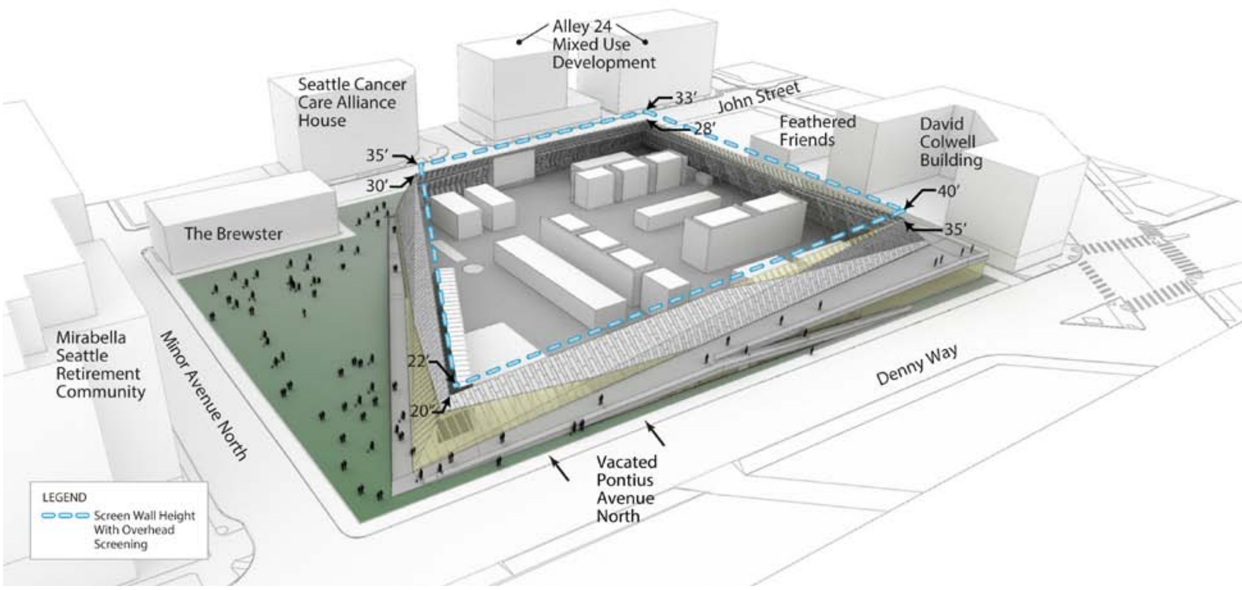
Substation Alternative 3 (SA3) – City Light's Preferred Alternative

As with SA2, SA3 would also be a one-level structure located on two of the three project site's parcels (Parcels 1 and 2) and require a street vacation of Pontius Avenue North, but this alternative would be different in design and layout from SA2 (Figures 2-10 and 2-11). As with SA2, the facility's conceptual design provides public benefit opportunities that would be needed for a street vacation. Similar to SA2, Parcel 3 would not be needed for substation facilities and could either be used by City Light for meeting another facility need or identified as surplus and dedicated to another public use or private development. As described earlier, City Light considers SA3, with no overhead screening and the lower screen walls around the perimeter, its preferred alternative.

Figure 2-10. Substation Alternative 3 (SA3) – Plan View

Source: NBBJ, 2013

Figure 2-11. Substation Alternative 3 (SA3) – Oblique View



Source: NBBJ, 2013

Substation Interior

SA3 would house all of the same equipment, facilities, and amenities described for SA2. Like SA2, equipment would be at-grade, eliminating the complexity of 'basement' operations and maintenance presented by SA1, and allows easier access for vehicles within the facility.

Substation Exterior

Similar to SA2, SA3 would require a zoning waiver for the extra setbacks along John Street and Minor Avenue North. The setbacks would accommodate more open space adjacent to The Brewster apartment building northwest of the substation compared to SA2 and leave accessible open space for public benefit features. As with the other substation alternatives, the substation service access drive would be located along John Street. The exterior corners of the screen wall area could accommodate the same shell spaces described for SA2.

The exterior of the substation structure would be a terraced configuration that would lessen the bulk and scale of the structure. An elevated pedestrian pathway would proceed along the Denny Way edge of the site and continue north along the alley at the east edge of Parcel 1, potentially providing views into the substation as well as the surrounding area. The pathway would also provide a north-south pedestrian connection between the public sidewalks on Denny Way and John Street.

The sloped enclosure of the substation or screen walls is envisioned to be composed of glass panels and metal cladding.

The height of the screen walls around SA3 would be approximately 35 feet above adjacent street level at its highest point (the southeast corner) without an overhead screen, or 40 feet with an overhead screen. Figures 2-10 and 2-11 show the facility without overhead screening.

Street Vacation

As with SA2, the vacation of Pontius Avenue North under SA3 would require discretionary legislative approval from the City Council. Because SA3 is the preferred alternative, a draft application for street vacation has been prepared for this alternative. See Appendix B, Pontius Avenue North Street Vacation Petition – Public Benefits Matrix for more information.

The SA3 design would afford access to open space consisting of paved walkways connecting the corner of Denny Way and Minor Avenue North to the intersection of John Street and Pontius Avenue North, north of the substation. The walkway would serve as a through-block connection, replacing the pedestrian function the sidewalks currently provide in the section of Pontius Avenue North proposed for vacation. The open space areas could be maintained by City Light or possibly by Seattle Parks and Recreation; City Light is coordinating with Seattle Parks and Recreation on this question.

Additionally, an elevated walkway along the west side of the substation would provide an accessible route to assist in the grade differential between Denny Way and John Street. The elevated walkway would be built according to design standards, with necessary pedestrian safety and accessibility features, including guardrails, handrails, security lighting, and other features.

The southern and eastern edges of the project site would contain elevated pedestrian walkways along Denny Way and through the alley. By elevating the walkway, the design would include a unique feature that would afford views to the interior of the substation yard that could be enhanced with art features. In addition, the elevated walkway could contain outdoor seating that facilitates a pedestrian-friendly experience. The substation under SA3 may also be designed with shell space, which is currently conceptualized as approximately 7,320 square feet of space (which could provide public benefits to offset vacation of Pontius Avenue North) located at the southeastern and southwestern exterior corners of the structure.

Like SA2, the overhead electrical lines on the west side of Pontius Avenue North would be removed as part of the street vacation. Electricity would be provided by the underground 13.8 kV network service instead.

Landscaping

The landscape of SA3 would comprise a series of open spaces around the site and elevated walkways with a connection between Denny Way and John Street. The walkways would be designed with paving, planting, and seating, and would provide at-grade pedestrian access across the site.

The main open space to the west of the substation could provide opportunities for informal recreation and gathering in the form of lawn, planting, or plaza areas. The spaces could also be designed to accommodate specific programmed uses, such as an off-leash dog park, community gardens, public art, or other park use. The open space along John Street could consist of seating, bicycle racks, shade trees, accent planting, or paving. This area could also be designed to reinforce the connection to Cascade Playground to the north (see Figure 2-1). The open space could be suitable for large and small group gatherings to support educational opportunities for learning about the substation, the history of the site, or other topics. Like SA2, landscaping in the existing alley would be designed to be similar to the alley north of the site.

The landscape would also include plantings around the substation and the elevated walkways to add visual interest along the edges and to help screen the substation from pedestrians and adjacent residences. The plantings adjacent to The Brewster apartments, as well as elsewhere around the site, could include trees and other vegetation.

2.3.2 Transmission Line Alternatives

In keeping with City Light's operational criteria, which require a minimum of three transmission sources for each substation, the project would construct a new transmission line to connect the Denny Substation to the existing Massachusetts Substation (see Figure 2-1). The same equipment would be installed for any of the routes. Each route would be underground along the majority of its length, and then likely overhead through the SODO area (Figure 2-1). However, more detailed design efforts may indicate a need to place the line underground through at least a portion of the south end of the route; therefore, both underground and overhead lines are considered in this Draft EIS. No preferred transmission line alternative has been determined at this time.

The transmission line, which would incorporate the latest cross-link polymer (XLPE) technology available at the time, is anticipated to consist of three 4- to 6-inch-diameter insulated wires. For the underground line segment, each line would be installed in a separate polyvinyl chloride (PVC) or fiberglass conduit and frequently with spare conduit and communication conduit. The conduit travels within a concrete-encased duct bank that is approximately 2 feet by 4.5 feet, at a minimum of 3 feet deep. Duct bank installation would generally be by open trenching and would occur along the entire length of the transmission line route. It is expected that no more than three contiguous city blocks and two adjacent intersections in the same street would be under construction at any one time. Duct bank installation would take approximately 5 weeks at each one-block segment. Figure 2-12 shows a typical underground transmission line being installed underground along Mercer Street.

The overhead transmission line would be installed on steel utility poles that could be as tall as 150 feet and approximately 4 feet in diameter at the base. Installation of overhead circuits would start with pouring foundations for new steel utility poles. Pole locations would be determined based on site engineering, but locations would generally be based on tensioning needs for the wire (including where turns are needed along the route), obstacles underground where pole foundations would be proposed, and allowable structural heights, all while attempting to use as few poles as possible. Once the poles are in place, the transmission wire would be installed. The wire-stringing operation requires equipment at each end of the section being strung. Wire would be pulled between these "pulling sites" through pulleys at each structure. These pulling sites would be set up at various intervals along the right-of-way, typically one to three miles apart. Specific pulling sites would be determined close to the time the stringing activity takes place. City Light would notify property owners about the sites chosen at that time. Once the wire is strung, the stringing blocks would be removed and the wire clipped into its final hardware attachment. Figure 2-13 shows a typical overhead transmission line located on Mercer Street.

Figure 2-12. Installation of an Underground Transmission Line

Source: SDOT, 2010

Figure 2-13. Typical Overhead Transmission Line

Source: ESA, 2014

Electric vaults that measure approximately 10 feet high, 10 feet wide, and 20 to 25 feet long would also be placed underground along the transmission line. An estimated eight or nine vaults would be needed along the entire transmission line route. Installation of these vaults takes approximately 2 weeks. Figure 2-14 shows a typical electrical vault being installed in a downtown Seattle street.

Figure 2-14. Installation of a Typical Electrical Vault

Source: SDOT, 2010

Transmission Line Alternative 1 (TL1)

As shown in Figure 2-1, beginning at the proposed Denny Substation, TL1 would extend south from the substation below grade and cross under Denny Way to Yale Avenue. It would then proceed southwest on Stewart Street and turn southeast at 7th Avenue. It would jog west on Union Street and continue south along 6th Avenue to Jefferson Street, where it would jog again and proceed south on 5th Avenue to 5th Avenue South. At South Dearborn Street, the line would turn onto Seattle Boulevard South and then to 6th Avenue South. If the overhead line option is selected for the SODO area, the line would exit the ground at South Royal Brougham Way. It would proceed overhead on steel utility poles along 6th Avenue South, turn west on South Massachusetts Street, and connect at the Massachusetts Substation south of Utah Avenue South. If the underground line option is selected for SODO, the transmission lines would follow these same streets. (See Figure 2-1 for the proposed TL1 route.)

The line would generally be located within City rights-of-way. However, the line would cross Washington State Department of Transportation (WSDOT) right-of-way across I-90 on-/off-ramps along 6th Avenue South and BNSF Railway property in SODO. Construction would include trenching for the duct bank and excavation for vault installation. Disturbed areas would be returned to the preconstruction condition.

Transmission Line Alternative 2 (TL2)

TL2 would be underground and within the DSTT for approximately 53 percent of its length. Figure 2-1 shows the transmission line route, including where it is proposed through the DSTT and where it would likely be overhead at its southern end. As shown, TL2 would also extend south from the Denny Substation site and travel underground to Stewart Street via Yale Avenue. It would extend south on Stewart Street and turn onto 9th Avenue to the Convention Place Station, where it would enter the DSTT. The transmission line would continue through the tunnel south of the International District/Chinatown Station until the tunnel ends near the intersection of Seattle Boulevard South and South Dearborn Street. At this location, the line would continue aboveground affixed to the Interstate-90 (I-90) express lane overpass. This route segment would require approval from WSDOT. Near South Royal Brougham Way, the line would be placed in an underground duct bank extending to South Massachusetts Street. From there, it would either remain in an underground duct bank or exit the ground and run along steel utility poles to the Massachusetts Substation south of Utah Avenue South.

For the segment within the DSTT, conduit carrying the transmission line would attach to one side of the bored tunnel segments in three 4- to 6-inch-diameter conduits. At each transit station, the line would leave the side walls of the bored tunnel segments and transition underground into the space between the bus and train travel lanes, within a trench to accommodate electrical vaults.

On behalf of Sound Transit, LTK Engineering Services provided documentation to articulate that agency's concerns about use of the DSTT for the transmission line, information shared by Sound Transit with City Light (see Appendix C, Sound Transit Memorandum on Use of DSTT for Transmission Line Alternative 2). LTK identified four primary technical issues of concern that the design of the transmission line would need to address:

- The potential impact on the structural integrity of the stations from excavation into the floor of the tunnel for conduit and vaults
- Inadequate room for both transmission conduit and vehicle operations through the bored tunnel segments (assuming a 4-inch-diameter concrete encasement of each conduit would be required)

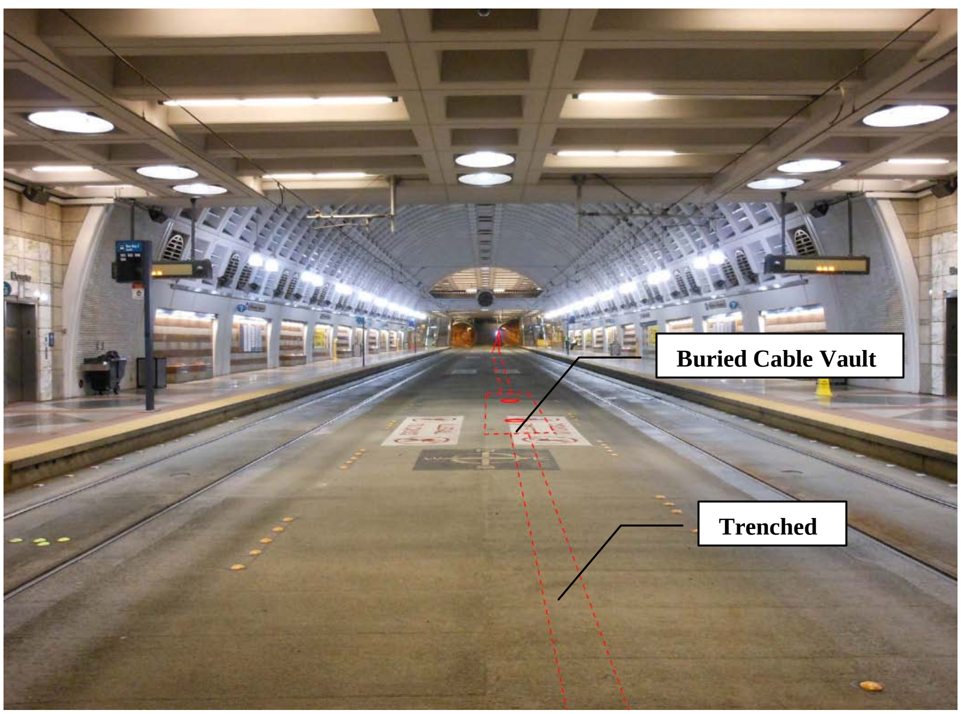
- Potential damage to rail infrastructure in the event of a transmission line fault
- Potential electromagnetic interference (EMI) with tunnel electrical systems and operations

LTK also raised concerns about City Light's potential need to access the transmission line for maintenance or emergency response, and additional Sound Transit maintenance work that might be triggered by co-location of the transmission line (especially EMI with tunnel equipment), all in the context of potential impacts to tunnel operations and transit availability. LTK noted serious concerns about impacts to transit service during required construction shutdowns and providing information regarding likely construction timing constraints. They also noted concerns about unknown life safety hazards to both transit riders and tunnel workers that could result from an electrical transmission line in the DSTT.

City Light began environmental analysis of TL2 in order to make a reasoned decision about whether to pursue this alternative route further, in light of its apparent technical challenges, and mindful of the detailed coordination needed with Sound Transit on maintenance and emergency response protocols.

During the environmental analysis of TL2, City Light continued discussions with Sound Transit and King County (the DSTT's owners and operators). These discussions have yielded substantial concerns on the part of both of these agencies about use of the DSTT for a transmission line. Sound Transit provided additional technical opinion about likely structural impacts that could arise from excavation into the tunnel floor for transmission cable, indicating that any excavation deeper than 12 inches would possibly compromise the structural integrity of the tunnel.

Figure 2-15. Transmission Line Alternative 2 (TL2) – Conceptual Configuration at Example Downtown Seattle Transit Station



Source: City Light, 2013

The subsequent chapters of this Draft EIS show the work that has been completed to address potential environmental impacts (as opposed to technical/structural impacts) of TL2. Because City Light has not completed full engineering on any of the transmission line alternatives, City Light has not addressed Sound Transit's structural concerns at this time, but recognizes that they are fundamental constructability issues that must be addressed before the tunnel could be used. For the purposes of this analysis, City Light has chosen to examine only the impacts that would occur assuming that these constructability issues were addressed to the satisfaction of Sound Transit.

Similarly, City Light recognizes that the potential for EMI during the operation of the transmission line would need to be addressed before the tunnel is used. City Light would hire an EMI specialist to determine approaches to minimize interference between DSTT equipment, systems and communications and the electric and magnetic fields produced by the transmission line. For the purposes of this analysis, City Light has chosen to examine only the impacts that would occur assuming that EMI issues were addressed to the satisfaction of Sound Transit.

Transmission Line Alternative 3 (TL3)

As shown in Figure 2-1, the TL3 route would begin at the proposed Denny Substation and extend south from the substation underground and cross under Denny Way to Yale Avenue. It would then proceed southwest along Stewart Street, turn southeast at Boren Avenue, and cross I-5 within the Boren Avenue overpass. TL3 would then turn west onto East Pike Street and south to Hubbell Place, with I-5 to the west. TL3 would continue along Hubbell Place past Seneca Street, where Hubbell becomes 7th Avenue. It would continue in the right-of-way to James Street.

At James Street, TL3 would cross the intersection and run underground along the east side of I-5 immediately east of the I-5 retaining wall. It would cross Yesler Way and continue south immediately east of the retaining wall. TL3 would then jog east on South Jackson Street and south on 10th Avenue South. At South Dearborn Street, TL3 would turn west and cross under I-5 in the South Dearborn Street right-of-way, then turn south on 6th Avenue South. As with TL1, the line would likely exit the ground south of South Royal Brougham Way and proceed overhead on steel utility poles along 6th Avenue South, then turn west on South Massachusetts Street and connect at the Massachusetts Substation west of Utah Avenue South. However, continuing the line underground could also be an option south of Royal Brougham Way.

TL3 would generally be located underground within City and WSDOT rights-of-way, although the precise location of the line within the rights-of-way has not been determined. Construction would include trenching for the duct bank and excavation for vault installation. Disturbed areas would be returned to the preconstruction condition.

2.3.3 Broad Street Substation Inductor Options

City Light proposes to install new equipment (called a series or line inductor) both inside the proposed Denny Substation and at the existing Broad Street Substation. Together, the two inductors would help balance the regional transmission system by controlling electrical impedance down particular lines to prevent overloading. The inductors are needed to regulate the flow of electricity through the regional power grid consistent with the agreement with BPA and PSE (BPA et al., 2012). At the Broad Street Substation, either the substation or the substation

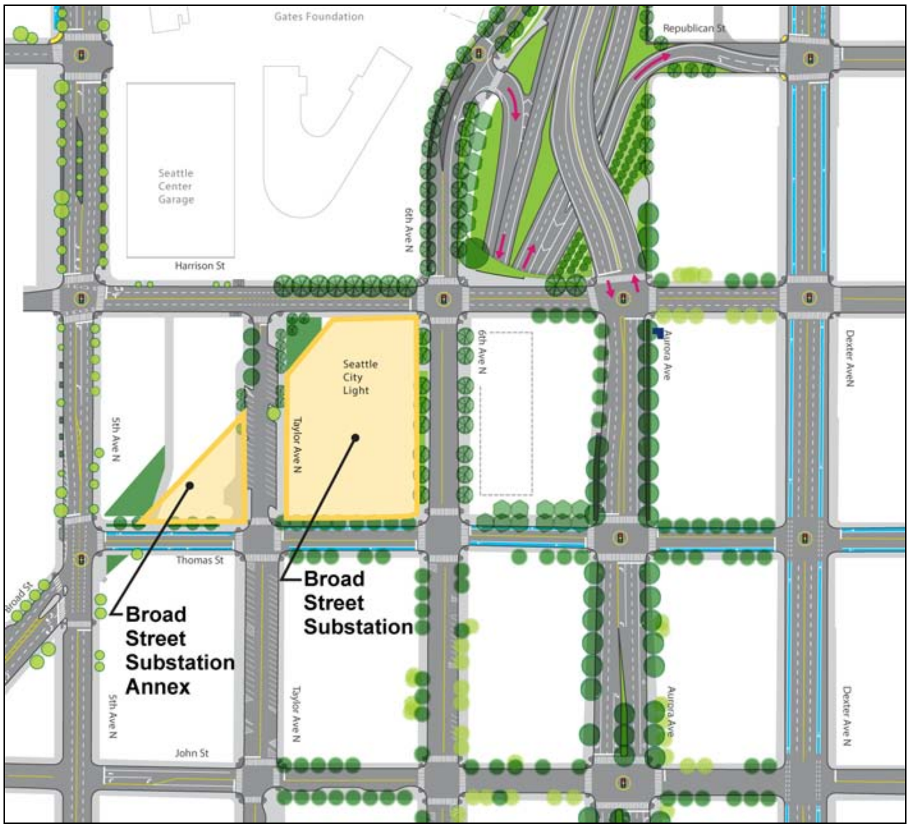
Series Inductor

An inductor is an electrical component, usually a wire coil that resists changes in electric current passing through it, acting somewhat like a valve in a pipe. When a current flows through it, energy is stored temporarily in a field in the coil. Series inductors are used to control and balance electrical load traveling through the regional grid.

annex would be expanded to accommodate the inductor, depending on the option.

Broad Street, in the area near the Broad Street Substation, is scheduled to be permanently closed as part of the construction of the new north portal for the Alaskan Way Viaduct Replacement Project being constructed by WSDOT. Figure 2-16 shows the location of the Substation and the Annex with Broad Street closed.

Figure 2-16. Broad Street Reconfigured near Substation and Annex



Source: SDOT, 2013

Under BI1, the proposed inductor and associated equipment would be installed in the closed portion of the Broad Street right-of-way north of the annex, west of Taylor Avenue North. Under BI2, the proposed inductor and associated equipment would be installed in the closed portion of the Broad Street right-of-way at the northwest corner of the Broad Street Substation, east of Taylor Avenue North and south of Harrison Street (Figure 2-17). Both options would require a portion of Broad Street to be vacated in order to accommodate the inductor and associated equipment, even though the street would already have been closed. For either BI1 or BI2, the security wall and fence would be expanded to enclose the new equipment, encompassing the hatched areas shown for each Option in Figure 2-17.

Figure 2-17. Broad Street Substation Inductor Options

Source: City Light, 2013

For either option, the series inductor would be accompanied by other electrical equipment (a capacitor bank and switchgear) that would be at ground surface and likely fed by existing overhead lines. The footprint of the new equipment is anticipated to be approximately 15 feet by 20 feet in size, with a maximum equipment height of approximately 17 feet. Equipment would also be installed underground, possibly within a basement approximately 50 feet long by 20 feet wide and 20 feet deep.

2.3.4 Distribution System

The Denny Substation would be designed for an ultimate capacity of no less than 40 distribution lines (feeders). Several feeders would be placed in a single duct bank. Although subject to change, the final configuration would likely include 10 duct banks: seven duct banks carrying feeders of up to 15 kV and three duct banks carrying feeders of up to 26 kV. The 10 duct banks would be built to the first vault in the street right-of-way along with the substation construction. However, not all of the feeders would be installed initially. With initial construction of the substation, twelve 13.8-kV feeders would exit west and north from the substation in five duct banks. Eventually, thirty 13.8-kV feeders would exit west, south, and north from the substation in seven duct banks, and ten 26-kV feeders would exit from the northeastern area of the substation in three duct banks. Since this Draft EIS has been published during early phases of the distribution system design, it is possible that the number of duct banks and feeders could change from what is described above. Any changes are expected to be minor and would not change the impact analysis substantially because the analysis assumes all streets in the South Lake Union network distribution area could potentially be affected eventually.

Figure 2-18 shows the existing downtown network service area, which would eventually be supported in part by the Denny Substation, as well as the network distribution area that would be served by this project. Future feeders would serve the First Hill area network distribution system. This Draft EIS describes the potential impacts of installing the distribution lines in the Phase 1 Build-out area and provides a programmatic assessment of potential impacts of installing the distribution lines in the Future Build-out area shown in Figure 2-1.

Distribution lines would be installed underground through trenching within City street rights-of-way. The distribution lines would run through concrete-encased duct banks that are 2 feet by 4.5 feet. City Light estimates that installation of distribution lines through a typical city block would take approximately 2 months. When in place, individual customers needing network reliability would have the option to connect to the new network distribution system.

2.3.5 Construction Timing for the Project

For purposes of this EIS, construction timing for the project is anticipated to follow the approximate schedule described herein. Initial construction of the Denny Substation would take approximately 18 to 24 months, depending on the alternative chosen. With its below-grade level, SA1 would likely take longer to construct (24 months) than the mostly at-grade SA2 and SA3 facilities. Substation construction is expected to begin in mid-2015, and the substation would be placed in service (energized) in late 2016, with limited construction continuing into early 2017. With any substation alternative, additional equipment would be added over time as needed, with full build-out of the substation projected by 2035. Construction of the Broad Street Substation inductor facilities would take approximately 6 to 12 months to construct and would likely occur in 2016. Construction of the transmission line to the Massachusetts Substation would likely begin in late 2018 and be complete at the end of 2020. Construction of the Phase 1 Build-out area of the network distribution system would begin in late 2014 and be completed in late 2016. The network distribution system in the Future Build-out area of South Lake Union would be installed as needed thereafter, and the rate of that installation would depend on the rate of development in the South Lake Union area.

Figure 2-18. Downtown Network Service Areas

2.4 No Action Alternative

SEPA requires that an EIS include a No Action Alternative to describe what would occur if the lead agency (City Light for this project) chose not to take action on the proposal discussed in the EIS. The No Action Alternative is intended to provide a baseline for comparison of the impacts from the proposed project. In the case of the Denny Substation project, City Light would have obligations to take some actions regardless of whether the substation would be built, in order to meet its obligations to provide reliable service to its customers, and to meet regional power obligations.

Under the No Action Alternative, no substation would be constructed and no new transmission line to the proposed project site would be installed. No new network service would be available for the South Lake Union area (north of Denny Way). The South Lake Union area would continue to be served by a looped radial electrical system operating at 26 kV.

Regardless of whether the new substation is built, a portion of the existing downtown network area south of Denny Way, referred to as the Broad System Capacity Improvements (BSCI) area, would require extensive system improvements to continue providing network service. Those improvements would include additional underground distribution lines from the Broad Street and Union Street substations to continue the existing 13.8-kV network service (the exact electrical configuration and specific location of these lines is not known). To power these new lines without a new substation, City Light would need to modify current operational standards and run existing substation equipment at higher than optimal levels. Equipment operating at these levels would have a significant risk of premature failure and/or permanent heat damage to power supply system components, with a significant chance of reduced reliability to customers. At the Broad Street Substation, the existing circuits exiting the facility already require a custom cooling system, and additional circuits to serve the BSCI area would make this engineered system more challenging to manage.

City Light's ability to reliably serve loads in the South Lake Union area and to provide reliable network service in the area south of Denny Way would be compromised, especially considering the land uses and densities north of Denny Way anticipated by the City's land use plans and zoning districts. Less reliable service would result in power disturbances and, without additional capacity in the near future, the possibility of power outages during the hot summer months. City Light could need to make other changes to its system to address these risks.

City Light would consider whether a portion of the Denny Substation site could still be used for one of the inductors required to be installed in accordance with an agreement with BPA and PSE (BPA et al., 2012). Installing an inductor at the Denny Substation site would likely require short-term work in the right-of-way to split the existing underground transmission line into two lines. The inductor at the Broad Street Substation would likely still be placed at one of the proposed locations discussed in Section 2.3, Action Alternatives (within the right-of-way of the closed portion of Broad Street).

In addition to considering whether one of the inductors should still be placed on the Denny Substation site, City Light could resume leasing Parcels 1 or 3 for public parking as they were used prior to the start of the remediation project.

Surplus Property Process

City Light engages in a structured review process to determine whether a property is considered surplus. City Light would determine whether there would be other City Light needs for a property. If no other needs were identified, City Light would next determine whether other City departments would be interested and able to purchase a property. If a property were determined to be surplus to City Light and other City department needs, it would likely be sold.

Meanwhile, City Light would conduct a surplus property review for the unused parcels. If the parcels were deemed to be surplus, some or all of the parcels would likely be sold and presumably developed by others as allowed by current zoning. This EIS does not cover any possible development of these parcels beyond discussion in Chapter 8, Land Use and Housing, of what would be allowed under current zoning for those properties.

2.5 Options Considered and Not Included

2.5.1 Substation Siting Criteria, Identification and Selection

In 2003, City Light started a process to identify and evaluate potential sites in the South Lake Union area for development of a new electrical substation.

City Light had recommended property purchase for a new substation in keeping with utility goals for meeting customer electrical needs and in anticipation of the City's land use plans. The high level goals were:

1. Meet the long-term energy delivery needs of the South Lake Union neighborhood and nearby areas.
2. Minimize cost and risk to ratepayers.
3. Make a necessary and positive contribution to meeting the City's stated land use goals and objectives.
4. Make electrical improvements that are responsive to and in keeping with community needs.
5. Meet the timeline necessary for new electrical infrastructure and respond quickly to growing electrical demand in keeping with planned economic development.

City Light identified and considered potential sites by applying the following criteria which are each described in more detail further below:

1. Physical Space Needs: Size to meet long-term electrical capacity targets for the facility;
2. Location: Proximity to South Lake Union electric load and existing transmission lines;
3. Urban Planning and Land Use Context: Current and planned or proposed land use including recent development or development plans by others;
4. Development Costs and Issues (including environmental conditions and constraints): Major issues having a large impact on development feasibility or cost; and
5. Timing and Schedule: Feasibility of purchase and development within the timeline needed.

In addition, City Light established principles to guide development of a substation that provided a second layer of criteria for considering the appropriateness of potential sites. These principles can be summarized as:

1. No net decrease in housing units
2. Respect (preserve) historic structures
3. Minimize impact on properties important to neighborhood planning initiatives
4. Minimize business displacement

5. Improve the pedestrian environment
6. Contribute to economic vitality of the neighborhood and city

Physical Space Needs – For equipment and operational needs, City Light determined that 60,000 to 70,000 square feet would be necessary for a substation site. A site within this size range would provide adequate space for the intended substation equipment, adequate area along the property perimeter for spacing distribution circuits sufficiently to dissipate heat and maintain maximum amperage or ampacity ratings, and adequate space on-site for circulation of utility vehicles, access to equipment and maintenance.

Location – The substation needed to be located within close proximity to the electric load in the South Lake Union area, and close to existing transmission to be optimize efficiency.

Urban Planning and Land Use Context – In applying principles listed above, City Light sought to find properties that avoided the removal of housing units and displacement of businesses, and included a viable means of preserving historic buildings. For each property being considered, City Light looked at the property's existing and proposed land use, pending development proposals, and zoning district being considered as part of the South Lake Union Rezone. City Light also conducted the same review for the area surrounding each property under consideration.

Development Costs and Issues (including environmental conditions and constraints) – City Light conducted preliminary environmental due-diligence and prepared draft land valuations based on readily known conditions to estimate the approximate cost to purchase and develop potential sites. This included costs of any environmental remediation and development of an electrical facility within an area with a relatively high water table.

The search for substation sites extended both north and south of Denny Way (Figure 2-19). During this evaluation period, the pace of redevelopment in the South Lake Union area began to increase. A number of the sites identified for a possible substation location were purchased and developed by others, which significantly narrowed the field of potentially suitable sites.

Timing and Schedule – The need for the project within the targeted 2015 to 2016 timeline winnowed the range of potential sites when considered together with other criteria. The rate of development meant that the risk of not meeting the schedule and working with a willing seller was rising.

In late 2009, City Light determined that the proposed Denny Substation site would meet all of the project objectives and selection criteria, and began land purchase negotiations with the Greyhound Bus Lines Real Estate Division. The property had been used as a bus maintenance facility for approximately 50 years. City Light believed that this site offered the best possibility for purchase and development for a substation within the timeline needed to provide for the power needs of the neighborhood and the city.

Figure 2-19. Substation Site Evaluation Area

2.5.2 Other Transmission Line Routes

During the scoping process, City Light presented three preliminary transmission line alternatives representing a range of costs, construction methods, and possible impacts. City Light stated a preference for building a transmission line west of I-5, if feasible, but during scoping also included a primarily overhead route on the east side of I-5, through Capitol Hill. After the close of the public scoping period, City Light decided not to proceed with the primarily overhead Capitol Hill route, and that option is not evaluated within this EIS. The decision to dismiss this route as an option to be considered for the proposed project was based on the viability of more direct options that appear to cause limited short-term construction impacts.

2.5.3 Transferring Load to Existing Substations

In order to serve the anticipated high-density and high-tech power customers in the South Lake Union area, City Light considered whether it would be possible to use other existing substations (see Figure 2-2) to serve the expected electricity load (load transfer), rather than building a new substation. City Light looked at three other substations in particular (Broad Street, Canal, and University) to determine if they would have additional capacity available and what capital improvements would be needed to use those substations to serve the South Lake Union area. Two substations in the vicinity of the proposed project were not considered in this analysis. The East Pine Substation was not considered because it is a different, smaller type of station. It was built primarily to serve an overhead distribution system of a different voltage than would be needed for the network areas associated with the Denny Substation Project and also includes a small First Hill network. It would need complete reconstruction to serve the service area. The Union Street Substation was not considered because it was already known to have limited capacity (it is densely packed with equipment serving an underground network in the downtown area). It would need substantial reconfiguration to serve another network distribution system area, which would involve installing larger equipment and revised and new circuits into and out of the substation, all of which would be extremely challenging for the enclosed, small facility.

For the three substations that were evaluated, the analysis showed that because of the existing loads already served, physical congestion at the sites (especially the Broad Street Substation with its annex), and greater than desirable distance from the service area for two of the substations (Canal and University), none of them would work in the long term to provide new network service in the South Lake Union area and maintain network service south of Denny Way.

Whether transferring loads to other stations would be technically feasible or not, a transfer of power would provide only a temporary solution to the South Lake Union area's electrical capacity issues. Eventually, even assuming aggressive electrical conservation measures were in place, economic growth and development expected to occur consistent with the City's planning efforts for the area would mandate construction of a new substation to serve the proposed network.

2.5.4 Options for Co-development Considered

City Light was asked by the Seattle City Council to consider options for constructing the substation so that a residential or commercial development could also be constructed on the substation site, in order to support housing and employment policy goals for the South Lake Union neighborhood. Various co-development options were developed by City Light and presented to the City Council. City Light's analysis of the options indicated that all would add cost to the project, ranging from approximately $22 million to $200 million. City Light also determined that development and implementation of any of these options would cause a minimum of 2 years in schedule delay for the substation. The extra costs and schedule delay would not be offset by any operational benefits to the City Light utility rate-payers, and would not have fit within City Light's current mission or project objective for the Denny Substation Project and was therefore not considered further.

2.5.5 Structural Roof for Denny Substation

City Light considered the possibility of designing a substation with a solid roof providing no views into the substation yard. A solid roof above the substation would require a series of columns or a similar support system. Placing columns in the substation yard would limit the movement of crane-operated equipment, which is necessary for the placement of substation equipment planned for future phases. A solid roof would also trigger a requirement to ventilate the enclosed space. Ventilation and support systems would add significant cost to the project. Placing overhead screening across the entire substation yard that allows for natural ventilation would still require a support system, limiting the flexibility of equipment placement. Based on these considerations, City Light chose to evaluate alternatives with partial overhead screening and no overhead screening and eliminated from further consideration the prospect of a solid roof.

2.6 Benefits and Disadvantages of Delaying the Proposal

The benefits of delaying the proposal are that construction costs would be avoided in the near term, and the environmental impacts described in this EIS would not occur until the project moved forward. Because of the high rate of redevelopment currently occurring within the project vicinity, it is possible that some of the overlap of construction impacts among projects would be avoided by delaying the project. If the proposed site for the substation was not used and was sold off at this time, the cost of obtaining a suitable property for a substation in the South Lake Union area in the future would be higher.

Disadvantages of delaying the proposal include an increase in risk to the electric supply serving the South Lake Union and Denny Triangle areas due to increasing loads. The pace of development in the South Lake Union area requires immediate implementation of system improvements to provide reliable electric power. In fact, loads are increasing faster than were originally projected for the area. Even with the project, City Light is undertaking improvements to the existing system to maintain reliable network service south of Denny Way, including the BSCI work described below (in Section 2.7) as a separate but related action.

If implementation of the Denny Substation Project were delayed, City Light would employ the substation load transfers discussed under Section 2.5, Alternatives Evaluated and Not Included, to try and mitigate the overloads that could occur during peak summer conditions. Existing substation equipment would have to run at higher loads, which would reduce useful lifespan of the equipment and require earlier replacement. There would be a real possibility that these efforts would still not maintain network customer reliability south of Denny Way and existing customer service north of Denny Way, given the rate of growth in the area.

With the risk of unreliable power supply, some of the planned redevelopment in the service area might not occur or be delayed. As a result, some of the benefits of increased employment opportunities and increased tax base would be delayed as well.

In addition, if the proposed project were delayed, City Light would have three parcels of land that would need to be maintained or sold. If the sites were sold, City Light's ability to provide needed capacity in the future would likely cost more due to a greater scarcity of large undeveloped parcels capable of meeting the requirements of a future substation.

2.7 Separate but Related Projects

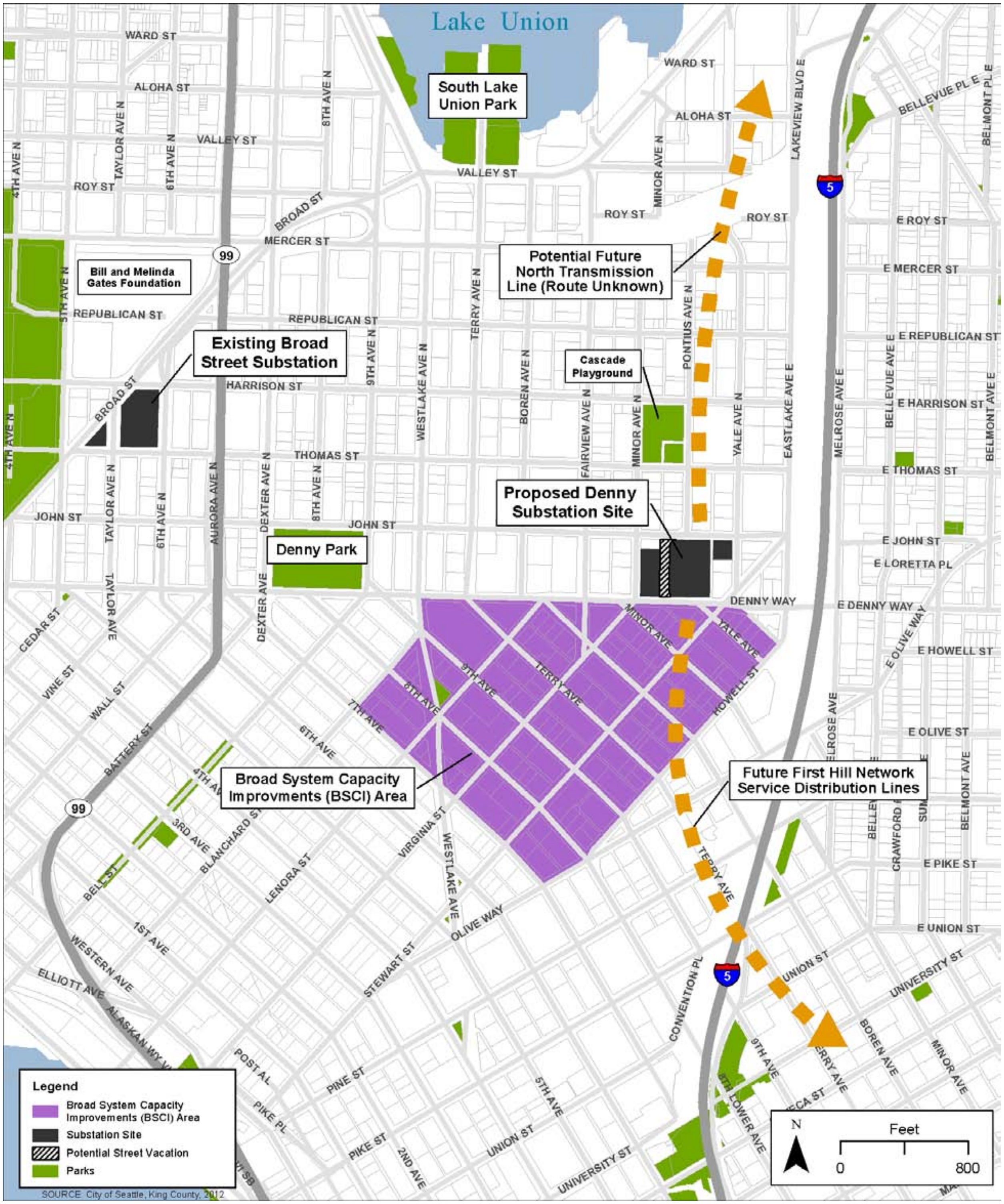
Several projects are related to the Denny Substation Project but considered separate for purposes of this EIS (see Figure 2-20) and therefore not evaluated in this EIS:

- Construction of a network distribution system in the BSCI area – This area is designated as part of the Downtown Network Service Area and would receive additional network service. Distribution lines would be installed underground through trenching within city street rights-of-way. The distribution lines would run through concrete-encased duct banks that are 2 feet by

4.5 feet. The exact location of the distribution lines has not yet been determined. Design is ongoing and will be completed in 2014. Construction of this network distribution system would likely begin in late 2014 and is anticipated to be completed by 2016. Distribution feeders from the Denny Substation would be constructed to eventually serve the BSCI area and construction of those feeders is included in this EIS.

- Distribution feeders to the First Hill Network Service Area – Distribution feeders originating from the proposed Denny Substation site would likely be constructed eventually to serve the First Hill Network Service Area. The need for future distribution feeders would depend on the rate of growth in this service area.
- Transmission Line to the North – A transmission line originating from the proposed Denny Substation site to the north could be constructed in the future if needed to serve Seattle's power needs.

Figure 2-20. Separate but Related Projects



Chapter 3: AESTHETICS

3.1 Affected Environment

3.1.1 Substation Alternatives

The substation study area includes the city blocks immediately surrounding the three parcels of land included in the proposed substation site (Figure 3-1). The visual character of the substation study area is highly urban, with improved streets, several surface parking lots, and buildings ranging in height from 1 to 12 stories (approximately 125 feet). The age of the buildings varies widely, as described in Chapter 9, Historic and Cultural Resources, as does the visual character of the buildings. All adjacent buildings appear to be in good condition, despite a wide range in age. Table 3-1 provides photos showing the character of the buildings adjacent to the site.

Parcels 1 and 3 are surface parking lots, as are the parcels directly south of Parcels 1 and 2 (across Denny Way) and the lot north of The Brewster apartments (across John Street). The parcels east of Parcel 3 across Yale Avenue North include another surface parking lot and a small two-story building.

Parcel 2 is the site of the former Greyhound maintenance facility, which was demolished to allow remediation of contaminated soil and groundwater. Parcel 2 slopes gently to the northwest, with the corner of John Street and Pontius Avenue North at an elevation approximately 12 feet lower than the southeast corner of the parcel.

There are no street trees along any of the sidewalks abutting Parcels 1, 2, or 3 and no vegetation on these sites. On the south side of The Brewster apartments is a small grouping of deciduous trees. On adjacent streets where recent redevelopment has occurred, street trees and other landscaping have been installed along street frontages facing the site.

Aesthetics Key Findings

The Denny Substation would look different than other structures in the area. The substation screen wall would obscure street views of equipment, but present some blank facades. Design features are intended to reduce the visual effect of blank walls.

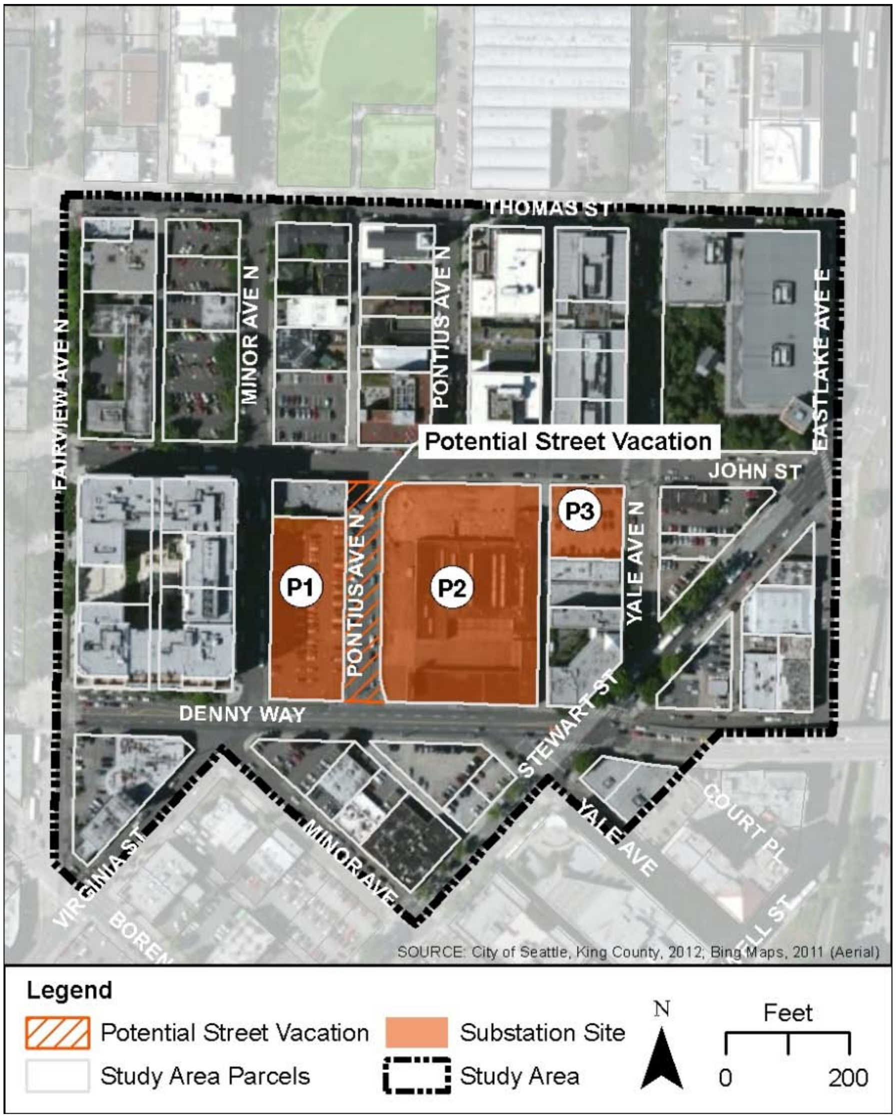
The Denny Substation would be shorter than most adjacent buildings and far shorter than zoning allows, thus preserving most existing public and private views. The proposed bulk of the substation screen wall is compatible in scale with other existing and proposed structures in the area. Substation Alternative 1 (SA1) would have the smallest footprint and the tallest walls; Substation Alternative 3 (SA3) would have the largest footprint and the lowest walls.

No protected views or views of designated Seattle Landmarks would be impacted.

Light and glare impacts from site lighting could be controlled by aiming or shielding lights. Materials such as glass and stainless steel can be highly reflective but can be treated to reduce glare.

No unavoidable significant impacts to aesthetics are anticipated.

Figure 3-1. Aesthetics Study Area for the Substation Site



To help evaluate aesthetic impacts of the Denny Substation site, visual simulations were developed. To determine which proposed projects located in the study area should be included in the visual simulations projects that have been approved or are planned for the project vicinity but have not yet been built were identified in April 2013 based on the permit application database maintained by Seattle Department of Planning and Development (DPD) (DPD, 2013). The planned development project list is included in Appendix D, Planned Infrastructure and Development Projects. Two 35-story (approximately 400-feet-tall) mixed commercial and residential towers are proposed at 1200 Stewart Street (known as Lexas Towers), south of the substation site and across Denny Way at the intersections of Minor Avenue, Denny Way, and Stewart Street (DPD, 2013). Although the Master Use Permit (MUP) has been issued, the timing of construction of this project was not known when this Draft EIS was prepared. Because this building has been issued a MUP, it is included in the visual simulations of the Denny Substation alternatives, as is a proposed mixed-use building at the northwest corner of John Street and Fairview Avenue North. Projects in the Early Design Guidance stage of review are not included in the visual simulations.

Table 3-1. Existing Development Adjacent to the Denny Substation Site

The Brewster
133 Pontius Avenue North

Feathered Friends
119 Yale Avenue North

Mirabella Seattle Retirement Community
122 Fairview Avenue North

David Colwell Building
111 Yale Avenue North

Seattle Cancer Care Alliance House
207 Pontius Avenue North

Alley 24 Mixed Use Development
224 Pontius Avenue North

US Healthworks
1151 Denny Way

1370 Stewart Street

Source: ESA (Photos)

Figure 3-2 indicates the locations of the viewpoints used for the visual simulations. Figures 3-3 through 3-13 show the existing conditions from viewpoints shown in Figure 3-2. Street level views on Figure 3-2 are numbered A through E and represent an eye-level view toward the substation site from the point indicated. Building views, numbered 1 through 5, are based on photographs taken from representative viewpoints in surrounding buildings above street level. The "bird's-eye" view is based on a view from an upper floor of the Metropolitan North Building, about two blocks south of the site. These photographs were taken during the remediation project and thus show Parcel 2 of the substation site with grading activity and some of the former structures still standing. Since these photos were taken, grading for remediation has been completed, all former structures have been removed, and equipment has been cleared from the site. Parcel 2 is currently fenced and vacant and is expected to largely remain in that condition until project construction begins.

Identifying the Affected Environment

City of Seattle has adopted State Environmental Policy Act (SEPA) policies and regulations for height, bulk, and scale; public view protection; and light and glare.

The proposed height, bulk, and scale of existing and expected development in the project vicinity are described. The scale of potential future development was evaluated by examining height and bulk regulations of Seattle Municipal Code (SMC) Chapter 23, and examining permit applications for nearby development

Views were analyzed in relation to view corridors designated in the Land Use Code, SMC 23.48.012, and protected views designated in accordance with SMC Section 25.05.675.P, which include views from Interstate 5 (I-5).

The affected environment for light and glare includes any areas where lighting or reflected light could create light or glare impacts on adjacent streets or building occupants.

The South Lake Union Neighborhood Design Guidelines (DPD, 2012) and the Seattle Design Guidelines (DPD, 2010) are described to provide a context for understanding what is expected and desired of surrounding development.

The photos in Figures 3-3 through 3-13 illustrate the diverse visual character of the study area, notably the variety of structures. The commercial buildings in the study area are among the smallest and oldest buildings. Also, the change in street grid orientation at Denny Way has resulted in numerous triangular and other non-rectangular sites south of Denny Way. As shown in Figure 3-2, both Pontius Avenue North (View B) and Virginia Street (View E) terminate at the substation site. This means that the substation site is visually prominent to people traveling on these streets in the direction of the substation. People in adjacent buildings have views across the site that improve in span and distance with height of the viewpoint. Buildings west of the site face the David Colwell building (six stories), Feathered Friends building (two stories), and a small area of Capitol Hill. Buildings to the south face Alley 24 Apartments (7 stories), and Seattle Cancer Care Alliance (SCCA) (6 stories), and The Brewster apartments (3 stories). Buildings to the east see the Mirabella Seattle Retirement Community (12 stories), SCCA, The Brewster, and a portion of the downtown skyline. Buildings to the north see the David Colwell building and a portion of the downtown skyline. However, the proposed Lexas Towers, if constructed, would eliminate most of the downtown skyline view from buildings looking south across the site.

There is only one protected view under Seattle Municipal Code (SMC) 25.05.675.P that includes views of the substation site. It is from Interstate 5 (I-5) one block east of the proposed project site, a designated scenic route under City of Seattle (City) Ordinance 97025. Designated scenic routes are road corridors that provide notable views of the city skyline, major water bodies, and/or the Cascades or Olympic Mountains. The I-5 roadway is approximately 30 feet above the elevation of the project site and provides views of the downtown Seattle skyline and the Olympic Mountains.

View corridors are designated in the City's Land Use Code as areas providing views looking parallel to the street toward some notable view. Denny Way is a designated view corridor with views of Puget Sound and the Olympic Mountains when traveling westbound. Under SMC 23.48.012 of the Land Use Code, on the substation site, portions of buildings above 75 feet must be set back from the street right-of-way by up to 15 feet to preserve the westward view along this corridor.

None of the adjacent buildings are designated Seattle Landmarks; therefore, there are no views of Landmarks that are protected under SMC 25.05.675.H. For a complete discussion of historic structures, see the Denny Substation Project Cultural and Historic Resources Discipline Report (ESA, 2014).

Figure 3-2. Locations of Visual Simulation Viewpoints

STREET-LEVEL VIEWS

- **A** SE corner of John Street & Yale Avenue North (facing southwest)
- **B** Pontius Avenue North, mid-block between Thomas & John Streets (facing south)
- **C** North side of John Street, mid-block between Minor & Pontius Avenues North (facing southeast)
- **D** NW corner of Minor Avenue & Virginia Street (facing northeast)
- **E** SE corner of Yale Avenue & Stewart Street (facing northwest)

BUILDING VIEWS

- **1** Alley24, 6th floor office (facing southwest)
- **2** Seattle Cancer Care Alliance, 2nd floor outdoor patio (facing south)
- **3** The Brewster apartments, 3rd floor corridor (facing southeast)
- **4** Mirabella Seattle, 10th floor common space (facing southeast)
- **5** David Colwell building, 6th floor elevator lobby (facing west)

BIRD'S EYE VIEW

- * Metropolitan Park North Tower, 10th floor office deck (facing northwest)

Source VIA Architecture, 2014

Figure 3-3. Existing View – Bird's-Eye View of Proposed Substation Site

Source: VIA Architecture, 2013

Figure 3-4. Existing View A – SE corner of John Street & Yale Avenue North (facing SW)

Source: VIA Architecture, 2013

Figure 3-5. Existing View B – Pontius Avenue North, between Thomas & John Streets (facing south)

Source: VIA Architecture, 2013

Figure 3-6. Existing View C – North side of John Street, mid-block between Minor & Pontius Avenues North (facing SE)

Source: VIA Architecture, 2013

Figure 3-7. Existing View D – NW corner of Minor Avenue & Virginia Street (facing NE)

Source: VIA Architecture, 2013

Figure 3-8. Existing View E – SE corner of Yale Avenue & Stewart Street (facing NW)

Source: VIA Architecture, 2013

Figure 3-9. Existing View 1 – From Alley 24 Office (facing SW)

Source: VIA Architecture, 2013

Figure 3-10. Existing View 2 – From Seattle Cancer Care Alliance(facing south)

Source: VIA Architecture, 2013

Figure 3-11. Existing View 3 – From The Brewster Apartments (facing east)

Source: VIA Architecture, 2013

Figure 3-12. Existing View 4 – From Mirabella Retirement Community (facing SE)

Source: VIA Architecture, 2013

Figure 3-13. Existing View 5 – From the David Colwell Building (facing west)

Source: VIA Architecture, 2013

Citywide Design Guidelines and South Lake Union Design Guidelines

While the adopted design guidelines for Citywide Design Review and the South Lake Union Design Guidelines do not apply to the project because it is a public project, they provide valuable information about the context expected for future private development. These design guidelines are applied on a case-by-case basis as proposals for large private developments are submitted for review by DPD. Not all guidelines would apply to a given project subject to the guidelines; through the City Design Review process, applicants are directed to prioritize specific guidelines in developing their designs.

Citywide Design Guidelines encourage use of natural systems and features of the site (in this case, solar access, a gently sloping site, for example); strengthening the most desirable urban forms and characteristics of the surrounding area (such as the street grid, the variety of style and scale of buildings); and making a positive contribution to the architectural context and character of a place. They encourage open spaces that compliment and connect to a network of public spaces (such as Cascade Playground); safe and comfortable walking environment (such as ample sidewalks, street trees and safe crossing zones); and streets that support human interaction and activity, as well as multiple forms of transportation (including walking, biking, and transit). They also encourage use of high quality elements and finishes in buildings and open spaces.

The South Lake Union Design Guidelines emphasize site characteristics like outlooks and overlooks, or other open spaces that give opportunities for views. They suggest addressing the pedestrian and auto experience of the height, bulk, and scale of development through a variety of measures, including building placement, stepping back facades above 55 feet in height, articulating the façade, and using architectural features. They encourage addressing architectural context, including the historic character of buildings, and the unique, fine-grained character of the neighborhood, and suggest elements such as community artwork, edible gardens, and innovative stormwater systems that support greenery. The guidelines encourage human activity by reinforcing open pedestrian connections that are safe and well-lit; encouraging landscaping that reinforces the design continuity and connections between open spaces; promoting graceful transitions between public and private uses; and encouraging business and community activity clusters that create high pedestrian traffic concentration. Parking is preferred to be placed underground. Building designs are encouraged to consider the "fifth elevation" or roofscape, considering what rooftops look like from higher elevations. The guidelines encourage landscaping for a variety of functions, from reinforcing continuity with adjacent sites to enhancing buildings and sites by evoking the history of the area. They also encourage taking into account views of downtown and the waterfront when designing landscaping.

3.1.2 Transmission Line Alternatives

The visual context for the visible portions of the transmission line alternatives encompasses the industrial area surrounding the Massachusetts Substation, the stadium area and rail yards of the South of Downtown (SODO) neighborhood, and, for Transmission Line Alternative 2 (TL2), the Downtown Seattle Transit Tunnel (DSTT). In the SODO area, the proposed overhead line would be along portions of South Massachusetts Street, the E-3 busway, and 6th Avenue South. Figures 3-14 and 3-15 show existing views of typical locations in the overhead portion of the transmission alternatives line corridors. As can be seen in these figures, there are overhead lines in the corridor already, including 26-kilovolt (kV) distribution lines (south side of street) and 115-kV transmission lines (south side of street). Figure 3-16 shows a typical location in the DSTT where transmission lines would be visible.

E-3 Busway

The E-3 Busway is a dedicated bus-only roadway connecting the (Downtown Seattle Transit Tunnel) DSTT with Interstate 90 and the South of Downtown (SODO) area. It also has an existing overhead transmission line.

Figure 3-14. Existing View – Facing West on South Massachusetts Street near E-3 Busway

Source: VIA Architecture, 2013

Figure 3-15. Facing North on South Massachusetts Street near 6th Avenue South

Source: VIA Architecture, 2013

Figure 3-16. Existing View – Typical Downtown Seattle Transit Tunnel (DSTT) Proposed Transmission Line Location (Pioneer Square Station)

Source: City Light, 2013

3.1.3 Broad Street Substation Inductor Options

The Broad Street Substation and Annex border a portion of Broad Street that is slated for closure due to the Alaskan Way Viaduct (AWV) Project (Washington State Department of Transportation [WSDOT], 2010). See Figures 2-16 and 2-17 in Chapter 2, showing the possible areas of the street right-of-way that would be used for this project. Figure 3-17 shows the Broad Street Substation and Annex looking at the sides of each facility where the inductor could be installed.

For Broad Street Substation Inductor Option 1 (BI1), the proposed inductor would be installed in a portion of the closed Broad Street right-of-way in a location where the public would no longer have access because the street and sidewalk will have been removed. Instead, there would be a new alley extension on the west side of the Broad Street Substation Annex, and Taylor Avenue North would be extended north to Harrison Street.

For Broad Street Substation Inductor Option 2 (BI2), the proposed inductor would be installed near the reconstructed intersection of Taylor Avenue North and Harrison Street, an area that is currently part of Broad Street.

The existing visual character of the Broad Street Substation and Annex area includes low-scale commercial buildings and wide roadways carrying heavy traffic. By the time the Denny Substation Project is completed, the character of this area will have been altered by closure of Broad Street and reconnection of the east-west and north-south street grid. Those changes could result in more public open space in what will be the former street area and/or redevelopment on lots adjacent to newly improved and reconnected streets.

Figure 3-17. Existing View – Broad Street Substation and Annex

Source: ESA, 2013

The areas that could be affected by the inductor installation do not contain vegetation. There is minimal vegetation currently planned for the area near BI2 after closure of Broad Street (see Figure 2-16 in Chapter 2, Description of Project and Alternatives). The existing fence enclosing the Broad Street Substation Annex is part of an artwork installation that was incorporated into the design of the annex and is considered part of the City's art collection (WSDOT, 2013)

3.1.4 Distribution System

The Phase 1 Build-out and Future Build-out areas extend through most of the South Lake Union neighborhood. Figure 3-18 shows typical streetscapes in the network distribution area. Streets are fully developed with curbs and sidewalks, some with street trees and some without.

Figure 3-18. Typical Views – South Lake Union Neighborhood Streetscapes

Source: ESA, 2013

3.2 Construction Impacts

Construction impacts on visual character from all components of the project would be temporary; therefore, no significant impacts are expected and this Draft EIS does not address this topic further.

3.3 Operational Impacts

3.3.1 Substation Alternatives

Impacts Common to All Alternatives

No significant long-term aesthetic impacts are expected from any of the substation alternatives. Aesthetic impacts from development of any of the alternatives would include a change in the visual character of the substation site and streetscape by introducing large electric equipment and utilitarian buildings within a large screen wall enclosure, which would differ from surrounding development and the character of existing and expected residential and commercial development in the aesthetics study area. The large-scale electrical equipment would not be visible from street level due to the screen wall. Figure 3-19 shows electrical equipment similar to the equipment that would be within the substation for any alternative but keyed to the site layout for Substation Alternative 3 (SA3). With landscaping and attention to design, this dissimilarity would not be considered a significant impact and would be similar to the contrast between new and older structures found throughout the neighborhood and downtown Seattle.

Assessing Aesthetics Impacts

Preliminary designs for each substation alternative, developed by City Light's design team, were used in visual simulations of the proposed project within the setting expected when the substation opens. Photographs taken in April and May of 2013 provide the basis for the simulations.

In the substation vicinity, simulations include "pipeline" projects expected before the substation would be constructed (2016), represented by simple, semitransparent massing figures, created based on zoning or project-specific data, such as approved permit plans.

Transmission line alternatives were simulated to show views of the overhead portion of the transmission line in South of Downtown (SODO) area and through transit stations of the Downtown Seattle Transit Tunnel (DSTT).

<u>Height, Bulk, and Scale</u>

The screen structure that would surround the substation with any of the alternatives is intended to reduce the visual impact of this type of equipment. The screen itself would be a large structure compared to many in the vicinity, and unlike typical occupied buildings, it would be largely opaque metal or translucent glass and have no windows or doors, except for gates to allow truck and worker access. The exceptions would be the shell spaces shown in SA3 with storefront-style windows and doors, which could also be provided in Substation Alternative 2 (SA2) but are not shown in the visual simulations in this chapter.

Table 3-2 provides information on the approximate footprint of the substation yard and approximate façade lengths for each side of the substation under each alternative, and similar data for adjacent structures. Table 3-3 shows the height relationship between adjacent buildings and the nearest screen wall, for each alternative. Exact heights of adjacent buildings were not available, but for comparison the number of stories of each adjacent building is shown. One story is typically about 10 feet in height, although this varies from building to building.

Table 3-2 Footprint and Façade Length of Substation Alternatives and Adjacent Buildings

	Footprint	Façade Length (feet)			
Substation Alternatives[1]					
		East	West	North	South
Substation Alternative 1 (SA1)	63,500 square feet	250	250	220	220
Substation Alternative 2 (SA2)	95,250 square feet	290	260	220	320
Substation Alternative 3 (SA3)	111,500 square feet	290	360	260	420
Adjacent Buildings					
		East	West	North	South
The Brewster Apartments	6,000 square feet	60	60	100	100
Mirabella Seattle Retirement Community	88,400 square feet	340	340	250	250
Proposed Lexas Towers	55,000 square feet	330	330	350	350
David Colwell Building	15,000 square feet	80	160	120	60
Feathered Friends	9,600 square feet	80	80	120	120
1370 Stewart Street Building	3,600 square feet	40	40	80	90
Recreational Equipment, Incorporated (REI)	43,500 square feet	290	290	250	150
Alley 24 Apartments	14,000 square feet	120	120	120	120
Seattle Cancer Care Alliance (SCCA)	14,000 square feet	120	120	120	120

Notes: All values provided in this table are approximate. Some buildings have complex shapes such as a triangular or U-shaped footprint, and the values may simplify some of the variations in their façades

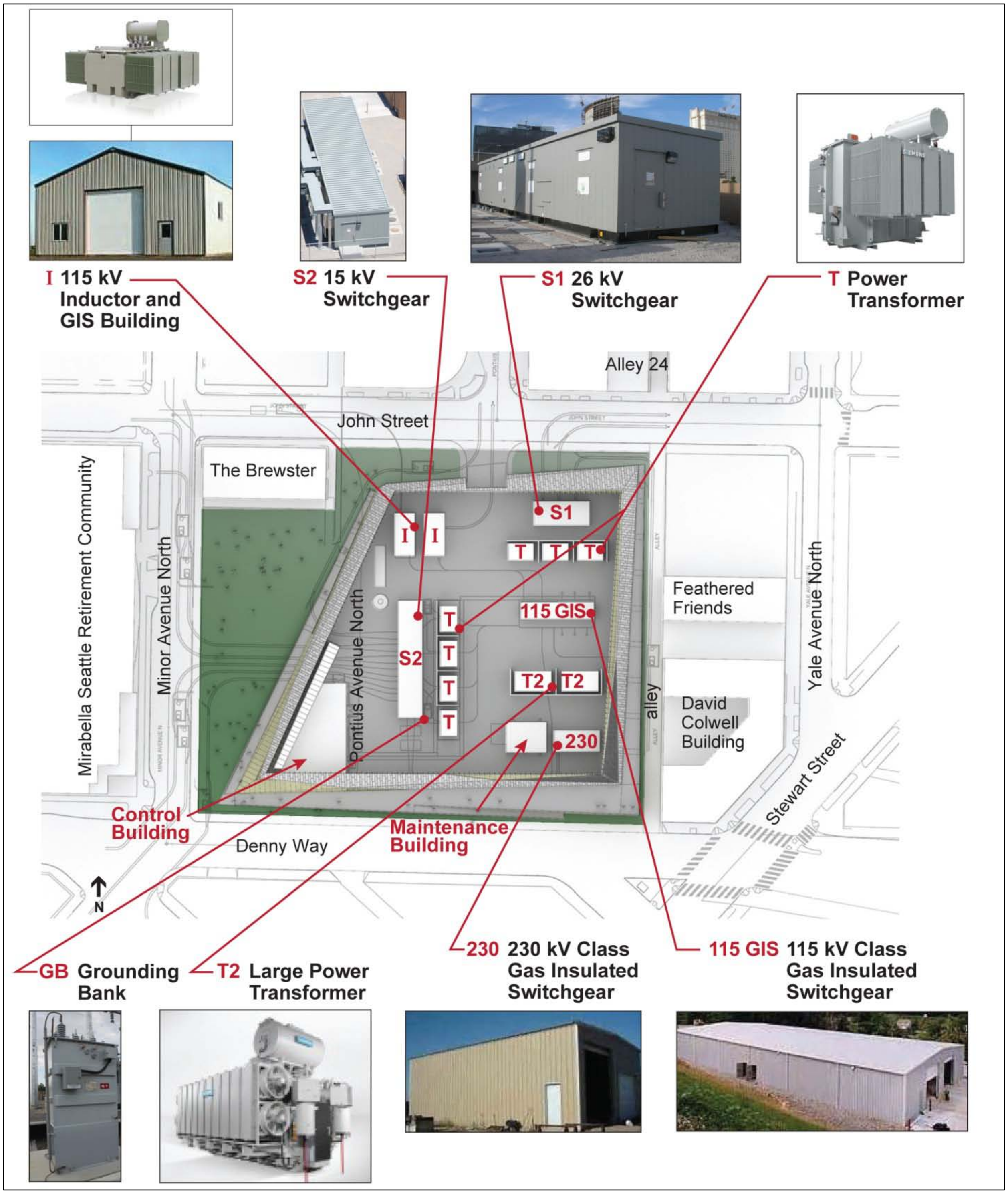
[1] The footprints provided for the substation alternatives is the total interior of the yard.

Table 3-3 Height of Substation Screen Walls Closest to Adjacent Buildings

Adjacent Buildings (# of stories)	Substation Alternative 1 (SA1) (feet)	Substation Alternative 2 (SA2) (feet)	Substation Alternative 3 (SA3) (feet)
The Brewster Apartments (3 stories)	44	43	30
Mirabella Seattle Retirement Community (12 stories)	44	25	20
US Healthworks Building (2 stories)	34	25	20
Proposed Lexas Towers (40 stories planned)	34	33	35
David Colwell Building (6 stories)	34	25	35
Feathered Friends (2 stories)	38	25	28
1370 Stewart Street Building (2 stories)	38	25	28
Alley 24 Apartments (7 stories)	38	38	28
Seattle Cancer Care Alliance (SCCA) (6 stories)	44	43	30

The substation screen wall would have the largest or second largest footprint (depending on the alternative) among adjacent structures, similar in scale to the Mirabella. It would also be among the shortest structures. Given the context of a variety of large-scale and smaller-scale buildings, the substation under any alternative would not be out of scale with adjacent development. With proposed landscaping, under any alternative the substation could represent an aesthetic improvement over existing conditions because the site and surrounding streets have no landscaping or street trees. The relatively low height of the substation would also preserve open views and light across the site that could be affected if the property were developed with taller structures allowed by the City's Land Use Code. As such, the substation would provide an aesthetic benefit to taller buildings with territorial views as well as to lower buildings by preserving access to sunlight.

Figure 3-19. Typical Substation Electrical Equipment (shown with possible site layout for SA3 once the substation is fully built-out)



Source: City Light, 2013

Scenic View Protection

Under any of the substation alternatives, the structures and equipment of the substation would not obstruct any views protected under City policies or regulations. There are no views of the Olympic Mountains or the downtown Seattle skyline from I-5 that would be obstructed. Views of the mountains are already obstructed by the Mirabella Seattle Retirement Community building west of the site. Views of downtown would not be obstructed because the proposed substation structure would not be tall enough to affect any views from I-5, being only 15 feet higher in elevation than the I-5 roadway and located approximately 550 feet from the nearest freeway lanes. Because of the height of downtown buildings, the substation would not block views of the skyline. Denny Way is a designated view corridor. The project would not affect the views protected by the view corridor designation because the view corridor only applies to floor levels above 75 feet.

Although private views are not protected under Seattle State Environmental Policy Act (SEPA) policies, an analysis was conducted to examine whether private scenic views would be affected. From adjacent buildings, the view of the substation would be of a large, wide, low-scale structure with an opening at the top center of the structure (unless overhead screening is included). For all adjacent development, the views that would be most affected are those from lower floors, typically the third or fourth floor, where the screen wall would be high enough to prevent views across the site (NBBJ, 2013a). Some views of the downtown skyline from the lower floors of the David Colwell building, SCCA, and Alley 24 Apartments could be affected by any of the alternatives. From floors above the elevation of the screen wall, any views across the site would be preserved.

The upper floor of some buildings would have views of the electrical equipment within the substation (NBBJ, 2013a). From the top floor of The Brewster apartments, the east-facing windows would be slightly higher than the screen wall on SA3, allowing views of the tops of the tallest pieces of equipment or the firewalls that surround them. From all other surrounding buildings and for all alternatives, views into the yard would begin on the fourth floor and increase with elevation. Because of the scale of the substation yard and the utilitarian character of the equipment, some people may consider views into the substation yard undesirable. Alternatively, some may find the equipment as interesting to view. The availability of views into the substation yard from upper floors of adjacent buildings is graphically depicted in Appendix E, Private Views of Substation Yard.

Under any alternative, the substation would not have a roof. Landscaping and street trees would eventually provide additional screening, although for safety and security reasons vegetation would not be allowed to overhang the substation; therefore, site landscaping and street trees would potentially provide only limited screening of views into the substation yard from taller buildings. Partial overhead screening, if included, would screen portions of the yard nearest the perimeter.

Light and Glare

Although lighting design for any of the alternatives has not yet been developed, the substation would include security lighting, which is not expected to adversely affect adjacent properties because it can be shielded and directed downward toward site areas that require illumination. Other forms of site lighting are also being considered for aesthetic purposes. Similar to security lighting, no adverse effects are expected provided that the lighting is shielded and not directed toward sensitive uses or traffic. Glass and other materials can also have light and glare impacts resulting from reflected sunlight when the sun is at a low angle. Depending on the materials selected, there could be glare from reflected sunlight. Landscaping and street trees serve to reduce any light and glare impacts and would be included on all sides of the structure facing streets. The driveway on the north side of the site and areas where underground distribution duct banks exit the site would restrict the placement of street trees in some portions of John Street, Pontius Avenue North, and Minor Avenue North adjacent to the site. However, these areas would be less susceptible to glare impacts because of their orientation and because of the height of buildings surrounding the site, particularly the Mirabella Seattle Retirement Community building that would block any low angle sunlight from the west.

Transparency, Setbacks, Landscaping, and Design Review

All of the substation alternatives are designed to be consistent with most standards of the City's Land Use Code (see Appendix F, Summary of Substation Alternatives Zoning Analysis Matrix). However, the substation under any of the alternatives would not include the amount of streetfront "transparency" required in the Land Use Code for other types of development, and the amount of transparency varies between alternatives. From an aesthetics perspective, the purpose for these requirements is to provide visual activity and interest for pedestrians, and discourage graffiti and similar vandalism that commonly occurs with blank building façades in urban settings. In place of transparency, each alternative would include design treatments such as translucent glass or artwork to provide some visual interest for pedestrians, motorists, and occupants of adjacent buildings. Along the alley, the project would have a blank façade, as is typical of many commercial developments. There are no design guidelines specifically addressing blank façades in alleys.

Under any substation alternative, the structure would have at least one façade that is set back farther from the property line than the maximum allowed in the City's Land Use Code for typical development anticipated for the site's zoning district. The purpose of the maximum setbacks in the code is to promote an active and interesting pedestrian environment. The larger setbacks are generally proposed as open space amenities or landscaping, although in some cases they are also needed for substation functions such as emergency access to the perimeter, or for access to install large equipment in the yard.

Under each substation alternative, the screen structure would be set back from all property lines, and landscaping would be provided in some areas of the setback (Figures 2-6, 2-8, and 2-10 in Chapter 2). Table 3-4 provides a comparison of the approximate setbacks for each substation alternative. Landscaping would soften the utilitarian character of the facility, and could also reduce the likelihood of graffiti.

Table 3-4. Setbacks of Screen Wall from Rights-of-Way for Each Substation Alternative

Right-of-way	Substation Alternative I (SA1) (feet)	Substation Alternative 2 (SA2) (feet)	Substation Alternative 3 (SA3) (feet)
Denny Way	6	10–35	4-10
John Street	50	35–90 feet	10-40
Pontius Avenue North	7	Not applicable	Not applicable
Minor Avenue North	Not applicable	90–120 feet	15–150
Alley on east side of Parcel 2	5	20	3.5

Source: NBBJ, 2013b

Landscaping would be included, as required, for all streets, including Denny Way and John Street. Although John Street is a designated Green Street, development according to Green Street standards is voluntary, and a final decision has not been made as to whether the project would be developed to Green Street standards.

The substation is being designed with guidance from the Seattle Design Commission (Design Commission) with the objective of making the substation an attractive addition to the project vicinity and the larger neighborhood. The screen wall is being designed to be visually interesting in and of itself. In addition, the overall site would include artwork (in accordance with the City's public art program), lighting, and landscaping that could add visual interest. Because taste in design is subjective, it is likely that there would be individuals or groups who do not like the design of the structure. However, differences of opinion about design do not imply a significant adverse impact under SEPA. The substation under any alternative would be consistent with Seattle's SEPA policies regarding aesthetics, described in Section 3.1.1.

Figures 3-20 through 3-30 included in Section 3.3.1 below are visual simulations that depict views of the substation under each substation alternative. These figures are organized by viewpoint (see Figure 3-2 for locations of the viewpoints) to allow for a comparison of the alternatives. In these figures, SA3 is depicted both without the overhead screening and shorter walls (labeled as SA3) and with the overhead screen and taller walls (labeled as SA3a). However, the figures for Substation Alternative 1 (SA1) and SA2 show only the lower screen wall and no overhead screen to represent the "worst case" situation – where the most extensive views of the facility interior would be visible. If overhead screening were applied to SA1, the screen walls would be approximately 5 feet taller than shown. For SA2, if overhead screening were applied it would be over the center component (the 'superstructure'), and the sides of the superstructure would likely be reduced in height by 5 feet.

Notes on Visual Simulations

The simulations are conceptual drawings superimposed on photographs for the purposes of understanding the scale of the substation alternatives relative to surrounding development, and are not intended to show detailed landscape design or exact materials proposed. Final design may place trees in different locations, include art features, and incorporate different materials than depicted.

The gray ground plane areas shown in the figures represent vehicular access, brown ground plane areas represent sidewalks, and green ground plane areas represent other open areas that could include landscaping, pathways, or other open space uses.

Substation Alternative 1 (SA1)

Height, Bulk, and Scale

For SA1, the substation would be contained within Parcel 2, and Pontius Avenue North would remain an open street. The screen wall would screen the transformers, control building, and inductors. If there is no overhead screening, the structure would be approximately 44 feet in height above finished grade at its highest elevation, at the corner of John Street and Pontius Avenue North. If it includes an overhead screen, the screen wall structure would stand approximately 49 feet tall at the same location. See Table 3-3 for a comparison of wall heights with adjacent structures.

The screen wall would be set back from John Street to accommodate future equipment installation and replacement, access drives, and an areaway that connects to the basement level.

The screen wall of SA1 could be an assembly of glass, metal, or other materials, with an opportunity to incorporate art. The partial overhead screen, if constructed, could be closely spaced cables, sheet metal arranged like a louver, or other materials that would allow ventilation, and would have open areas to avoid hazards within the site in the event of excessive heat from equipment failure. The screen wall with SA1 would screen all street-level views of the equipment and substation yard (Figures 3-21 to 3-25) and would also screen some views from upper floors of adjacent buildings (Figures 3-26 to 3-30).

The scale of the structures and equipment on the site would differ from adjacent development in that most adjacent development is or could be generally taller, especially newer structures that would be possible to the south, west, and east. These newer structures could range from 125 feet to 400 feet in height. In Figures 3-26, 3-27, and 3-30 the larger scale of the Mirabella Seattle Retirement Community building and the proposed Lexas Towers south of Denny Way can be compared to SA1. However, two of the structures nearest to the site are shorter than the substation screen structure in SA1. The Brewster apartments at the northwest corner of the site is approximately 30 feet in height and would be approximately 67 feet west of the substation screen wall. The Feathered Friends building east of the site is approximately 15 feet to 30 feet in height, and would be approximately 21 feet east of the screen wall. This transition in height between these smaller structures and the proposed substation screen wall is not considered to be significant in this context, given the range in height of adjacent development, the distance between the substation screen walls and these buildings, and the anticipated height of newer buildings allowed under current zoning.

Although larger than most other structures in the vicinity, the substation yard would have a smaller footprint than the Mirabella Seattle Retirement Community building (see Table 3-2). For comparison, most buildings in the area have an east-west dimension of approximately 120 feet. The Brewster apartments has one of the smallest building footprints among buildings in the vicinity at approximately 6,000 square feet. Some of the newer buildings in the aesthetics study area have footprints that are more similar to the scale of the proposed substation. For example, in addition to the Mirabella described above, the Recreational Equipment, Inc. (REI) building is approximately 290 feet by 150 feet, and the proposed Lexas Towers at 1200 Stewart would have a north façade on Denny Way extending approximately 350 feet in width. In this context, the proposed bulk of the substation screen wall is compatible in scale with other existing and proposed structures.

Figure 3-20. Bird's Eye View * of Proposed Substation

Figure 3-21. Street View A of Proposed Substation

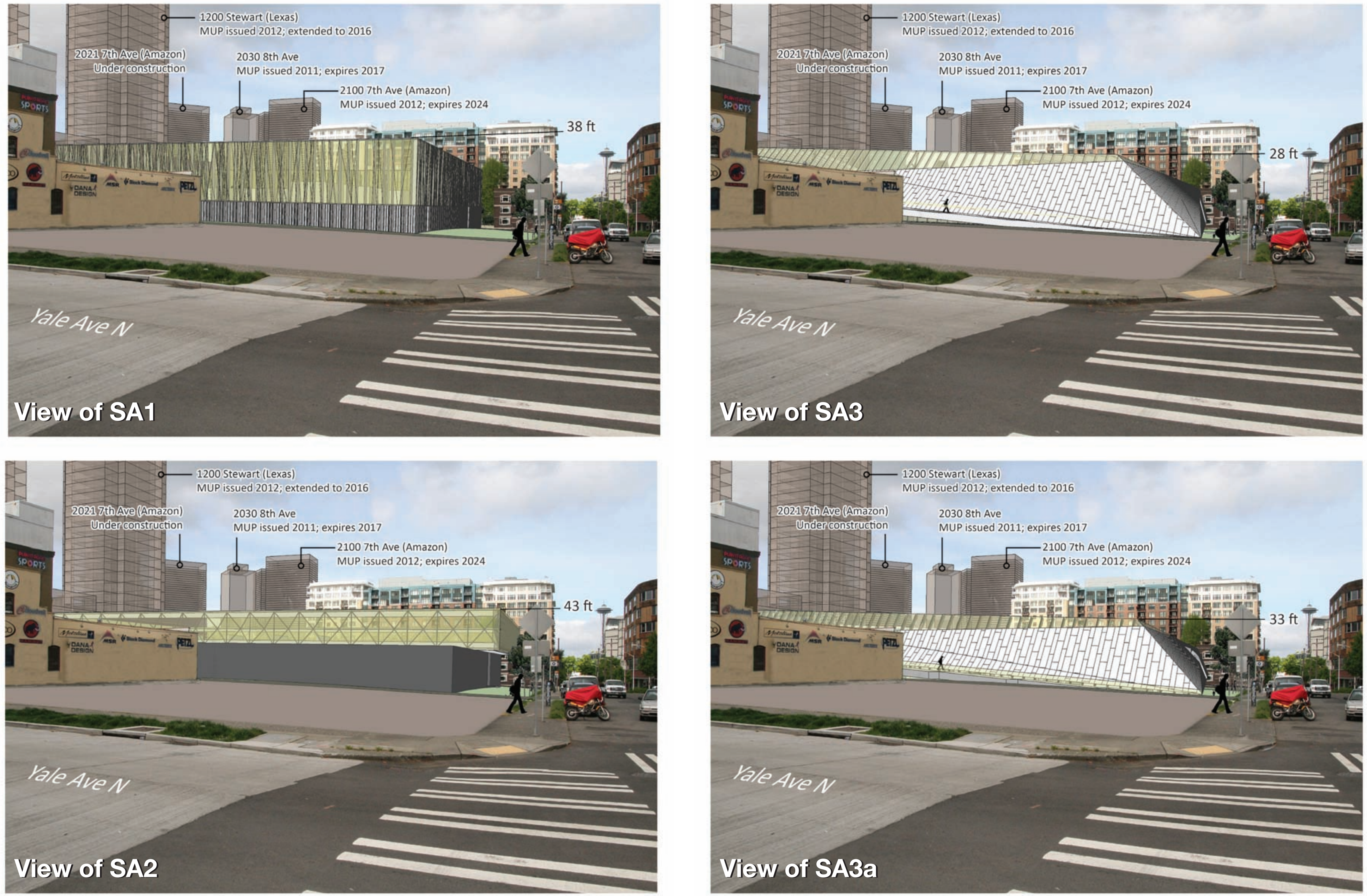


Figure 3-22. Street View B of Proposed Substation

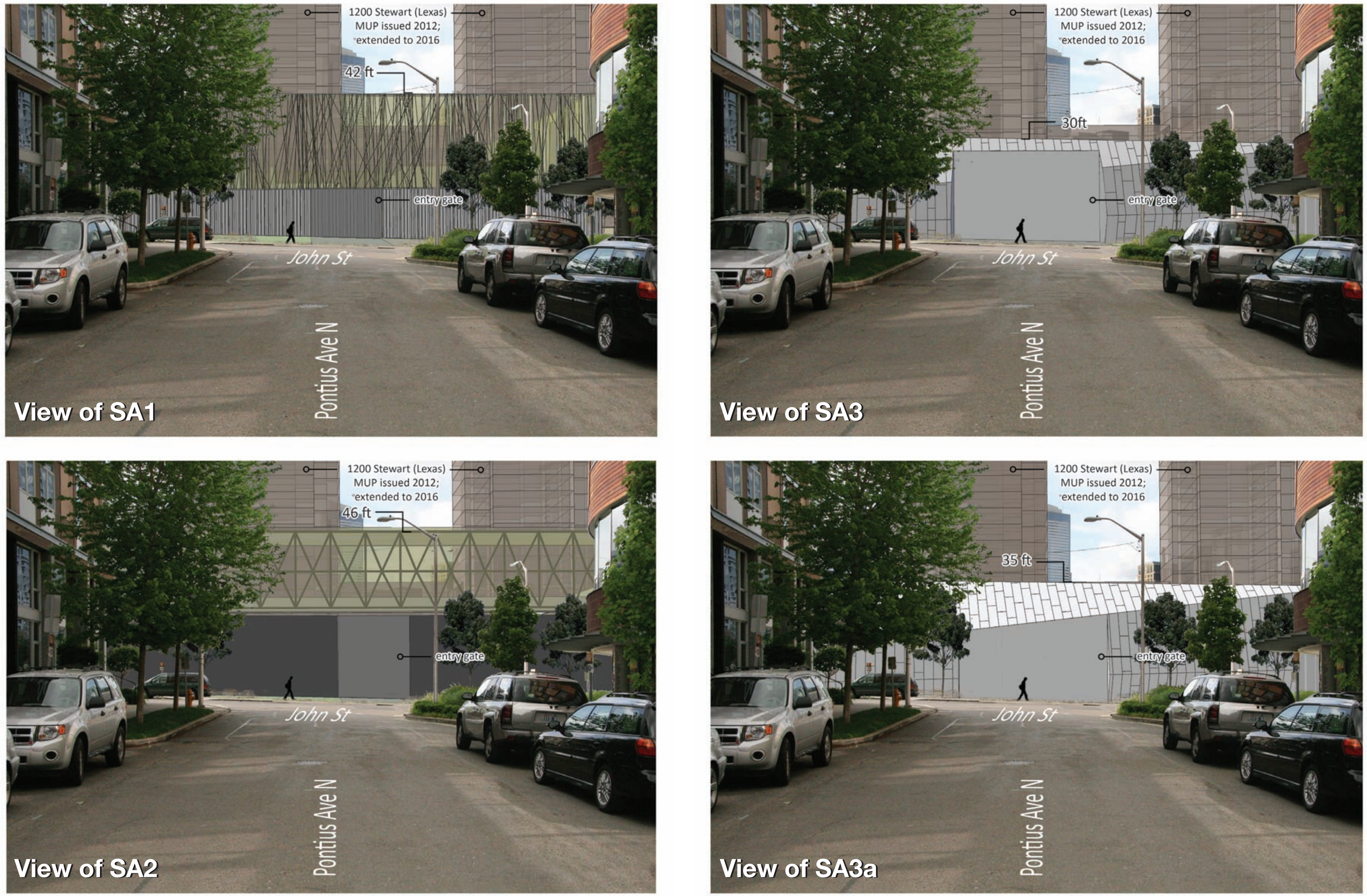


Figure 3-23. Street View C of Proposed Substation

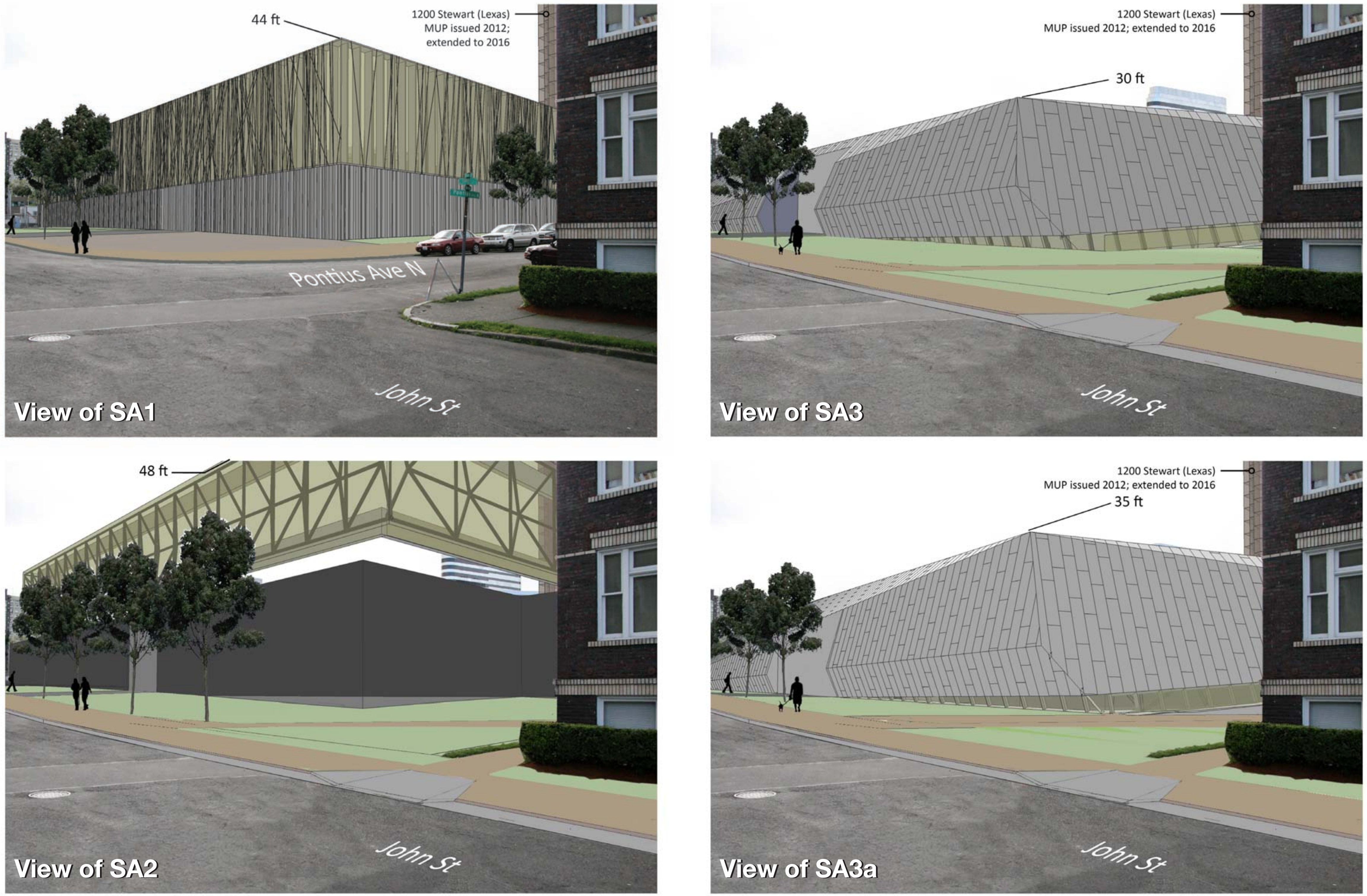


Figure 3-24. Street View D of Proposed Substation

Figure 3-25. Street View E of Proposed Substation

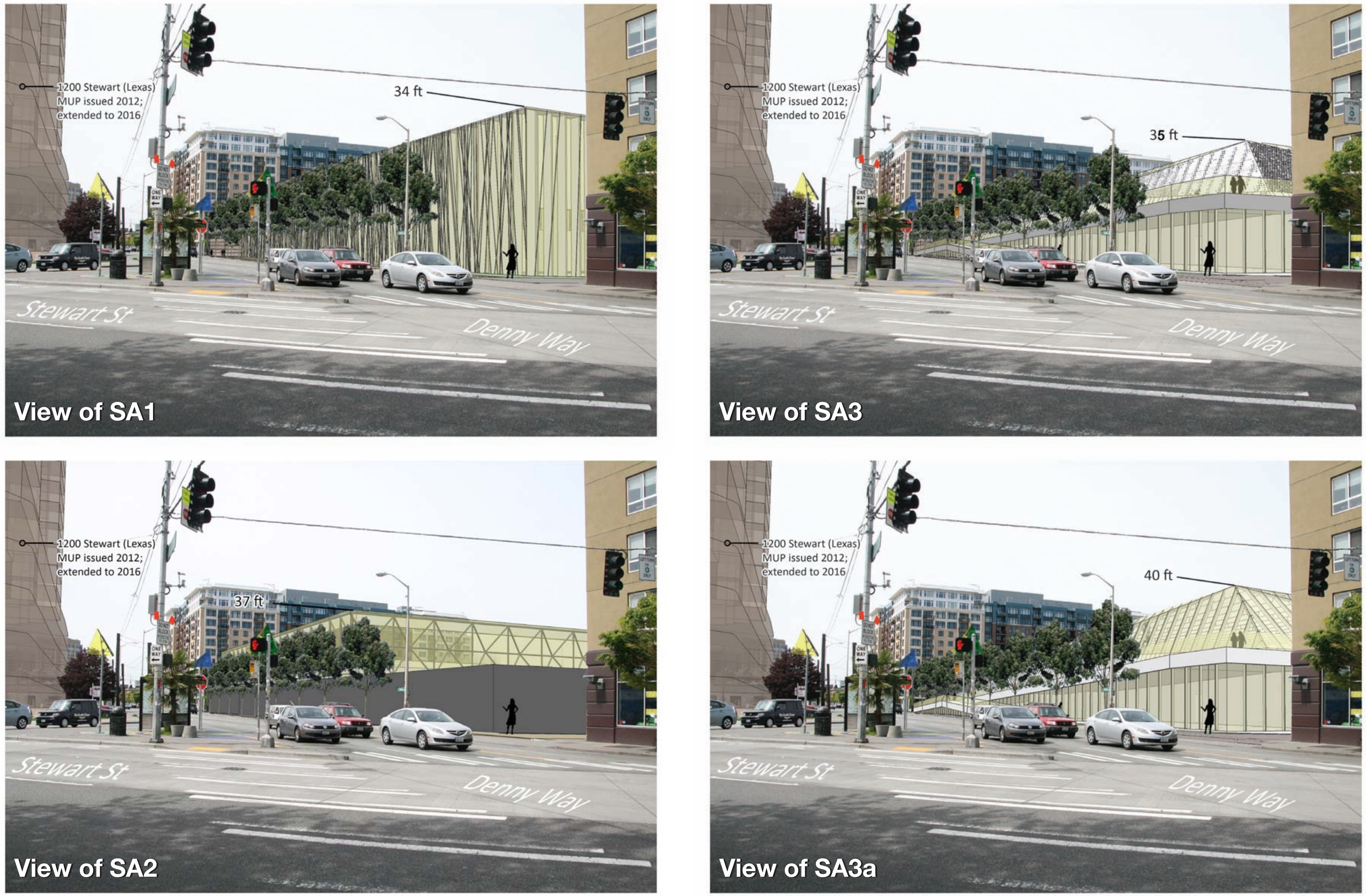


Figure 3-26. Building View 1 of Proposed Substation from Alley 24

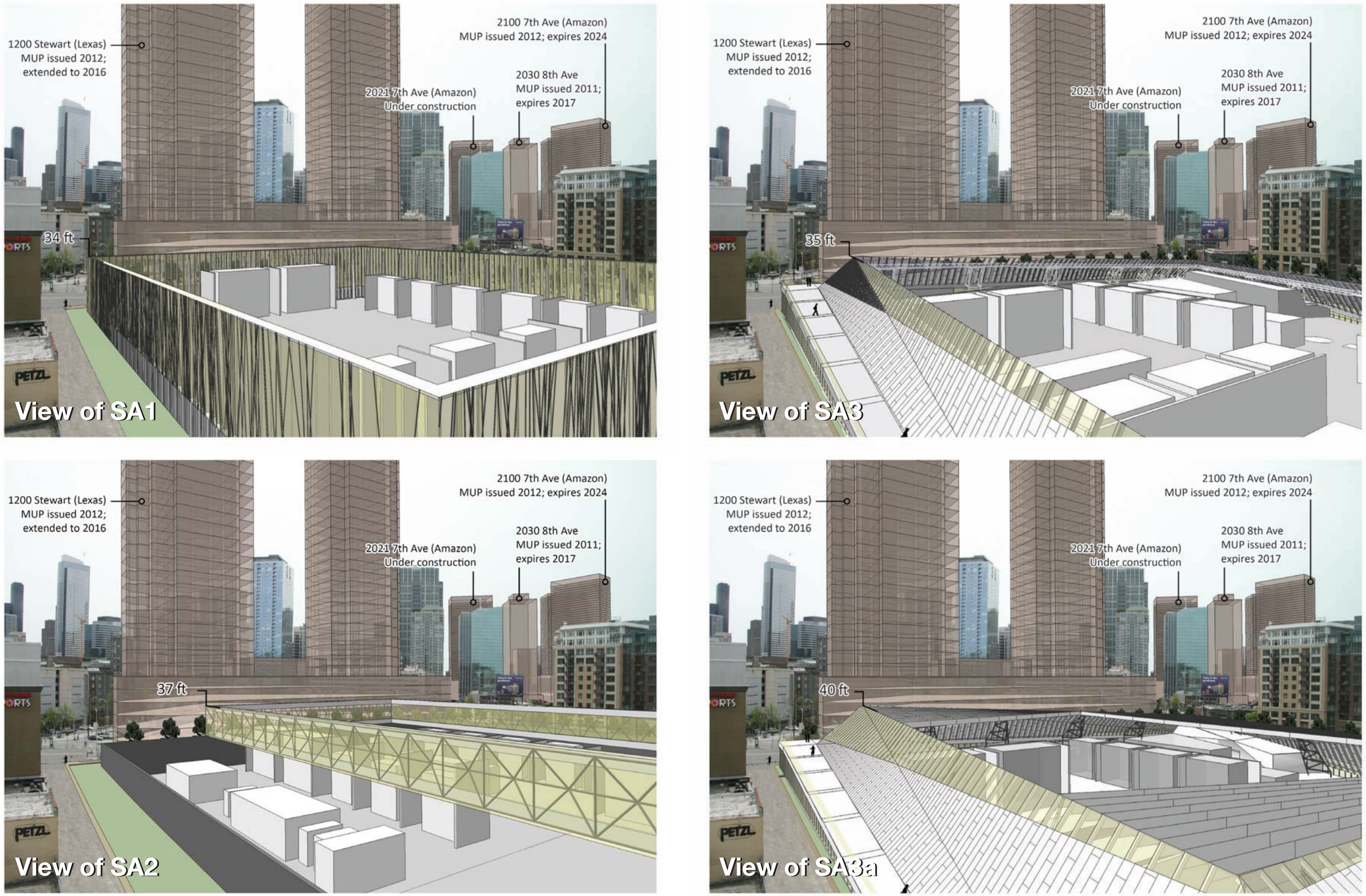


Figure 3-27. Building View 2 of Proposed Substation from SCCA

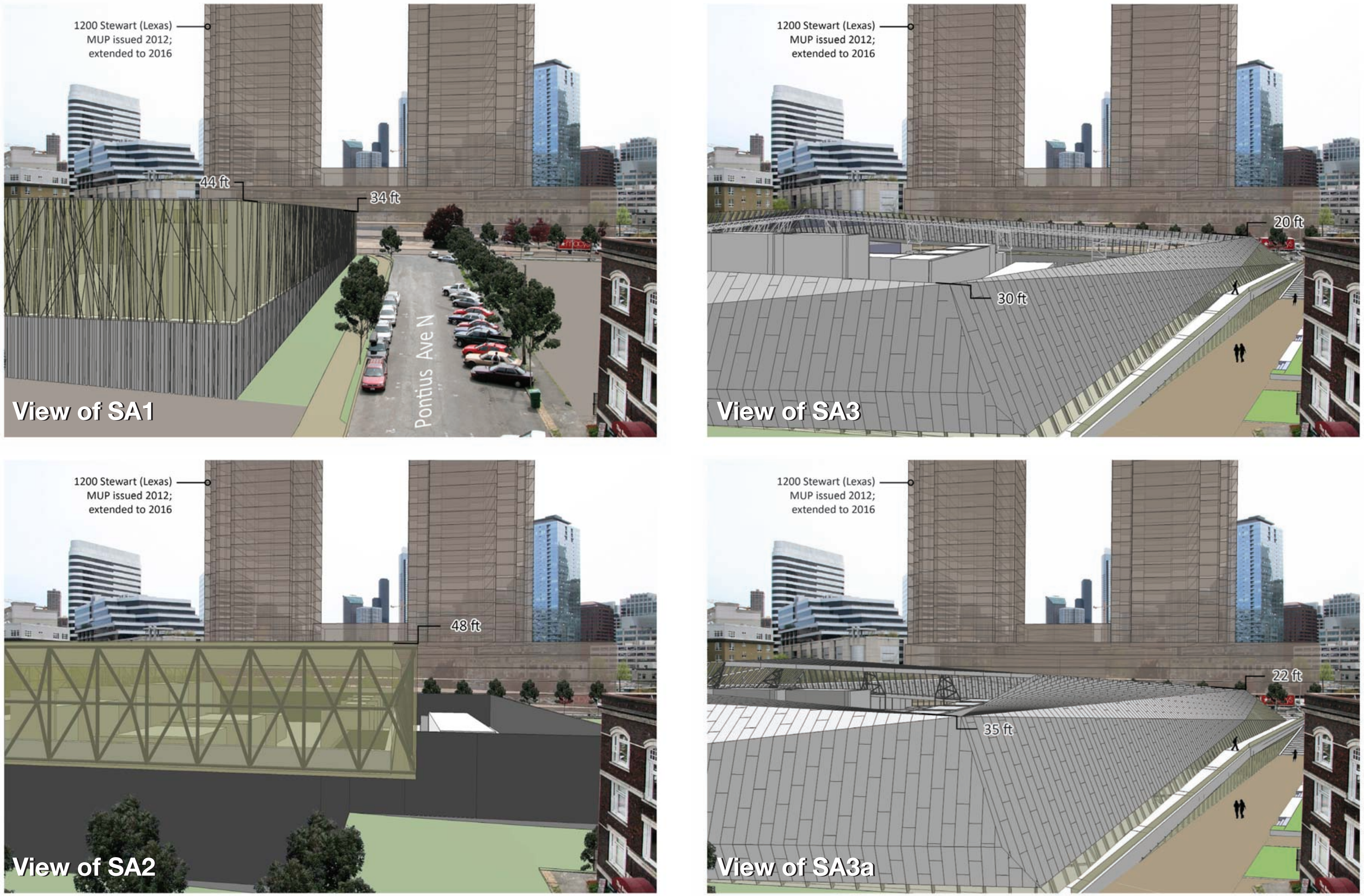


Figure 3-28. Building View 3 of Proposed Substation from The Brewster

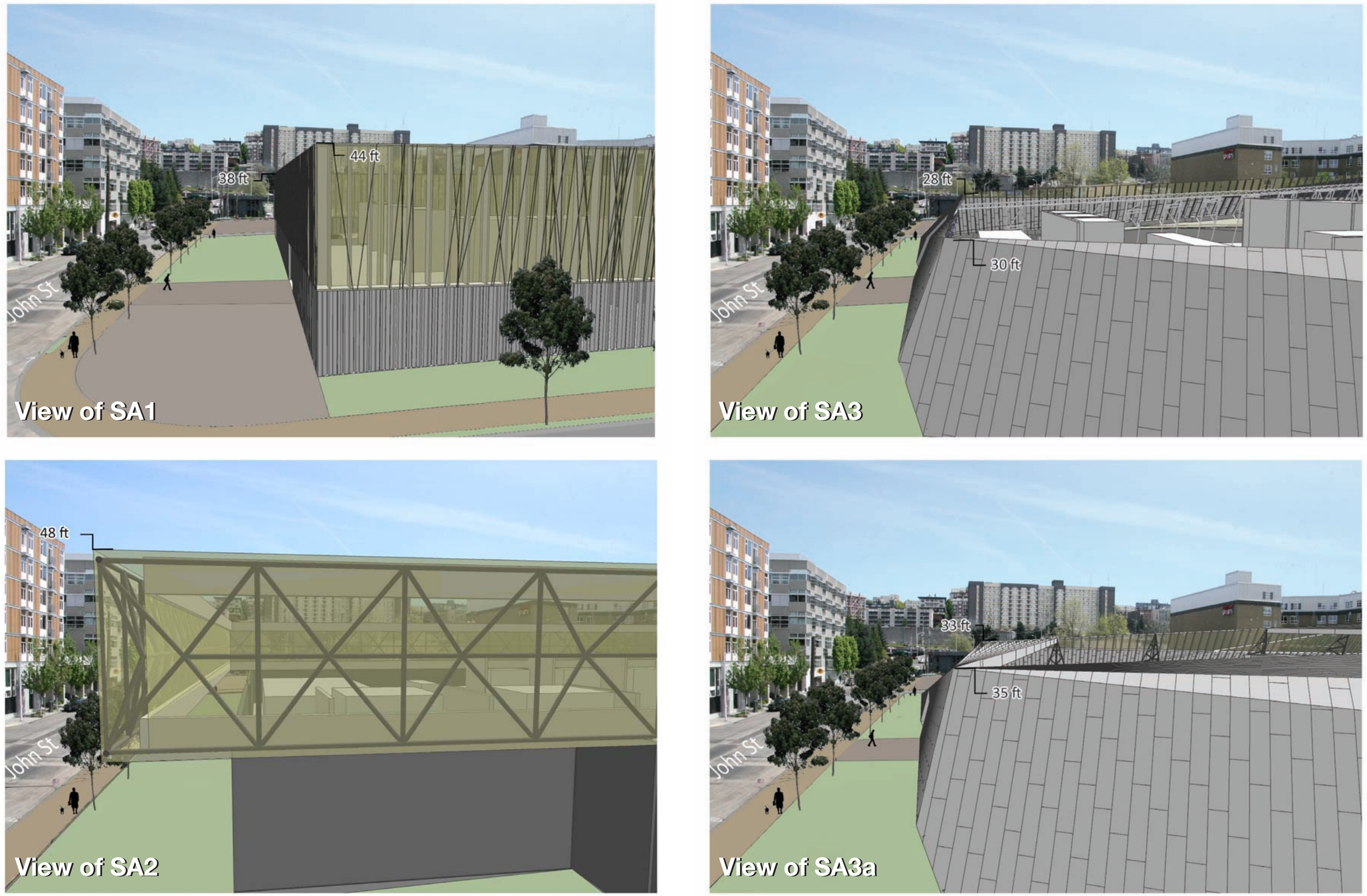


Figure 3-29. Building View 4 of Proposed Substation from Mirabella

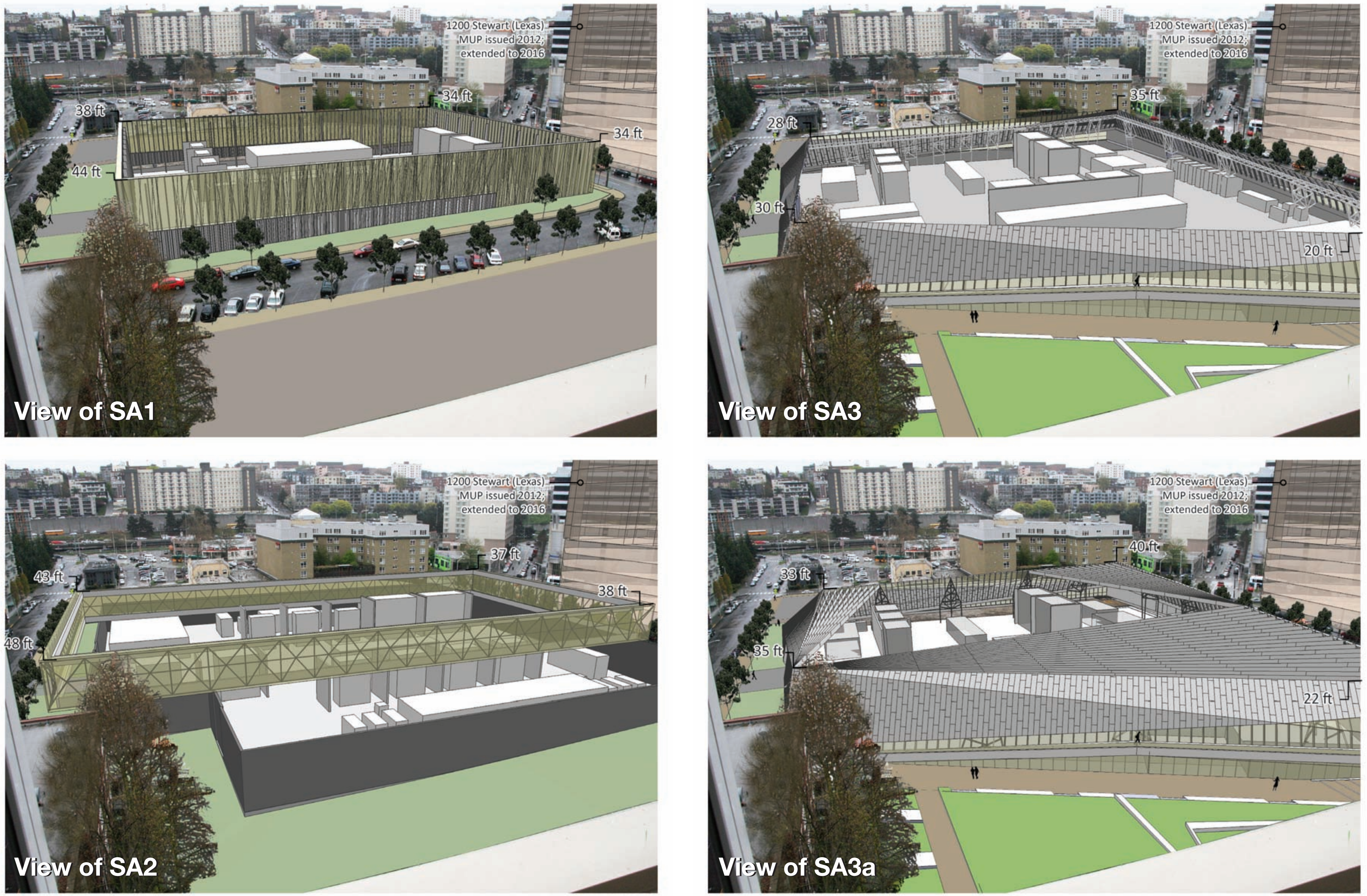
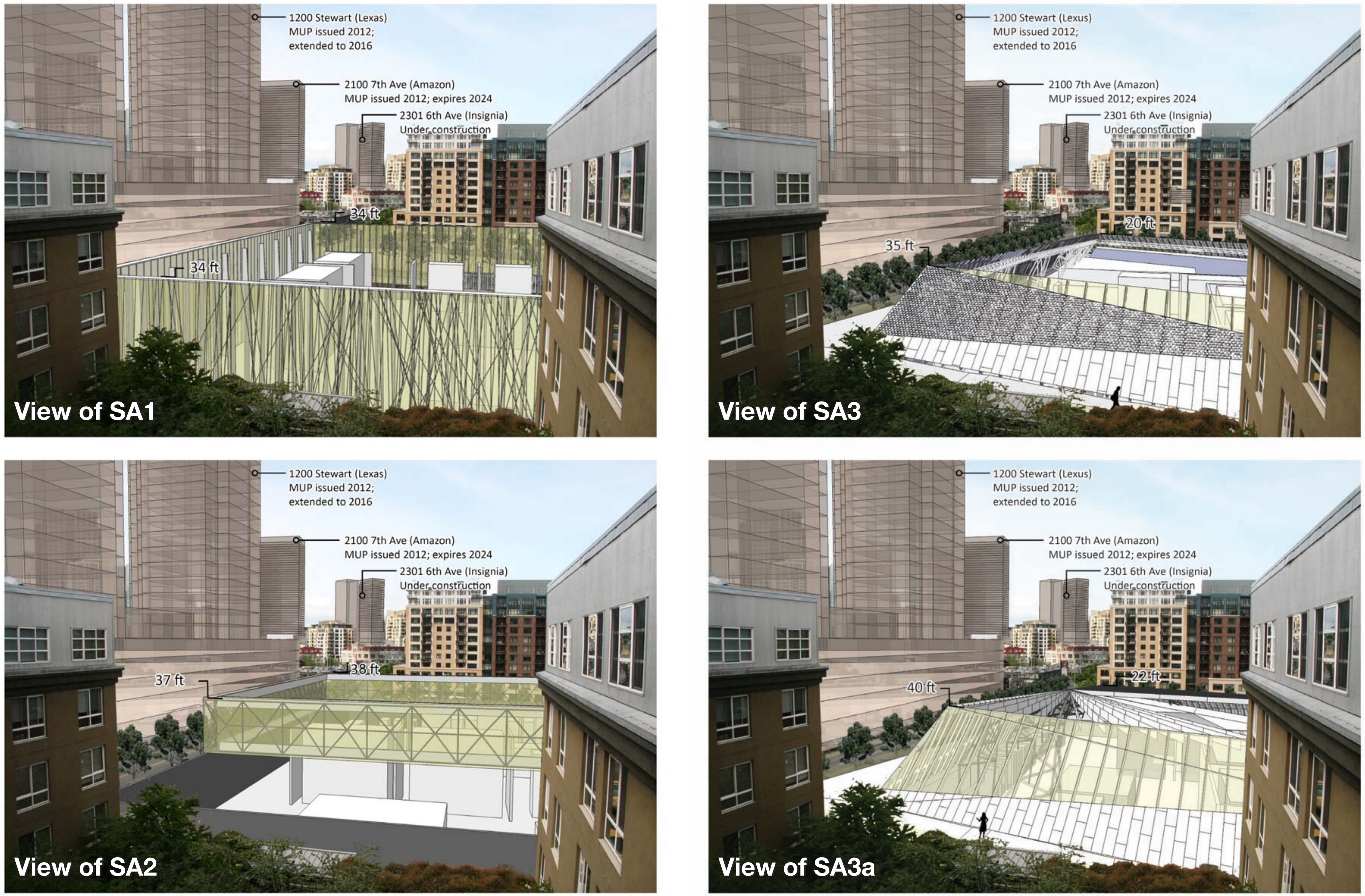


Figure 3-30. Building View 5 of Proposed Substation from Colwell Building



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The east side of the screen wall, facing the alley, would be set back by approximately 12 feet from the east property line on Parcel 2, which is greater than required by the City's Land Use Code. The alley would be paved and have security lighting. This wall would have no windows or doors, making it the largest area of blank façade without landscaping of the SA1 design. The vertical screen wall in that location would be slightly lower in height than the David Colwell building, but much broader, extending nearly the full length of the block.

Transparency, Setbacks, Landscaping, and Design Review

Under SA1, none of the screen walls would provide the streetfront transparency required for typical development under the City's Land Use Code, and the setback along John Street would exceed the required maximum for typical development (see Appendix F, Summary of Substation Alternatives Zoning Analysis Matrix). These would require waivers from City Council. As with all alternatives, landscaping could be provided in the setback area surrounding the screen wall, and lighting and artwork would be incorporated to provide visual interest in lieu of streetfront windows.

Under SA1, it is possible that both Parcels 1 and 3 could be developed with other uses at a later date, or that they could remain as surface parking lots. Pontius Avenue North would remain an open street, which would contribute to a slightly more open visual quality for the project vicinity than under SA2 or SA3.

Substation Alternative 2 (SA2)

Height, Bulk, and Scale

Impacts on aesthetics under SA2 would include a similar change in the visual character of the substation site and streetscape as described for SA1. The substation would include the same electrical equipment and facilities in the substation yard and have a similar screen wall structure constructed of similar materials. As in SA1, the screen wall would screen all substation equipment from view at street level (Figures 3-20 to 3-24). If it were to include an overhead screen, the screen wall structure would stand approximately 48 feet tall above finished grade at its highest elevation, at the northwest corner near John Street and the vacated portion of Pontius Avenue North. If there were no overhead screening, the structure would be approximately 5 feet shorter than shown in the simulations, or about 43 feet in height. See Table 3-3 for a comparison of wall heights with adjacent structures.

As with SA1, the screen wall would be an assembly of glass, metal, or other materials. The SA2 substation would have a lower perimeter wall around the entire substation yard and a taller superstructure covering the center of the site where the tallest equipment would be placed (see Figure 2-9 in Chapter 2).

The structure would be set back from John Street and Minor Avenue North to accommodate landscaping and open space as described earlier in this chapter (Table 3-4). A setback of 10 to 15 feet is proposed along the alley east of Parcel 2 and along Denny Way. The screen wall and open space areas would provide opportunities to incorporate art. The screen wall surrounding the substation would screen some views from upper floors of adjacent buildings. The lower height of the perimeter screen wall means that views into the site from buildings adjacent to the substation would be less screened than under SA1, specifically views that are more than two stories above the adjacent grade level.

Like SA1, the scale of the structures and equipment under SA2 would be shorter than most adjacent buildings but, like SA1, SA2 would be taller than The Brewster apartments and the Feathered Friends building (Figures 3-21 and 3-23). The structure would be closer to The Brewster than under SA1, with a separation of approximately 22 feet to the south of The Brewster (Figures 2-9 in Chapter 2 and 3-28). Even with the closer proximity of the substation structure to The Brewster, the approximately 15-foot transition in height between smaller buildings and the proposed substation under SA2 is not considered to be a significant adverse impact in this context, given the range in height of adjacent development, the distance between the proposed substation structure and these adjacent buildings, and the anticipated height of newer buildings under current zoning. The proximity of the substation to the south and east of The Brewster would be closer than the distance that the Mirabella Seattle Retirement Community and SCCA buildings are from The Brewster (by about one third), but the screen wall would be approximately one-third the height of the Mirabella building and similar in scale to the SCCA building. The roadway in the former Pontius Avenue North right-of-way would be replaced with an entrance drive to the substation, landscaping, and a pedestrian walkway. The landscaped setback of the substation and the open space retained to the south of The Brewster would provide aesthetic benefits to The Brewster as compared to existing conditions, which would offset some of the impact of the placement of substation.

The closure and vacation of Pontius Avenue North under SA2 would enable a portion the screen wall to partially extend into the former street right-of-way. The street right-of-way comprises 22,090 square feet of open space at present. As part of the public benefit proposed with SA2, approximately 28,000 square feet of open space would be created on the substation site, with the majority of that area located on Parcel 1 and the remaining portion on the former Pontius right-of-way.

The screen wall structure surrounding the substation would extend approximately 320 feet east-to-west and approximately 290 feet north-to-south. As with SA1, SA2 would have a smaller footprint than the Mirabella Seattle Retirement Community building, a larger footprint than The Brewster apartment and REI, and the same footprint as the proposed Lexas Towers (see Table 3-2). However, its footprint would be 68 percent larger than SA1. In this context, the proposed bulk of the substation structure is compatible in scale with other existing and proposed structures.

Transparency, Setbacks, Landscaping, and Design Review

Like SA1, SA2 would be consistent with most standards of the City's Land Use Code (see Appendix F, Summary of Substation Alternatives Zoning Analysis Matrix), but would not provide any of the transparency required by the Land Use Code for typical development anticipated in this zone. However, SA2 would include landscaping and artwork to provide some visual interest for pedestrians passing the site.

Substation Alternative 3 (SA3)

The design of SA3 is currently under review by the Design Commission, which is charged with ensuring that public facilities and projects incorporate high standards of design quality. (If another alternative were selected at the end of the SEPA process, it would also require review by the Design Commission.) The Design Commission reviews public projects and makes recommendations in the areas of urban design merit, street vacation, public access, open space planning, integration of public art, and streetscape design. Because that process is ongoing, the design of SA3 could change in response to recommendations by the Design Commission.

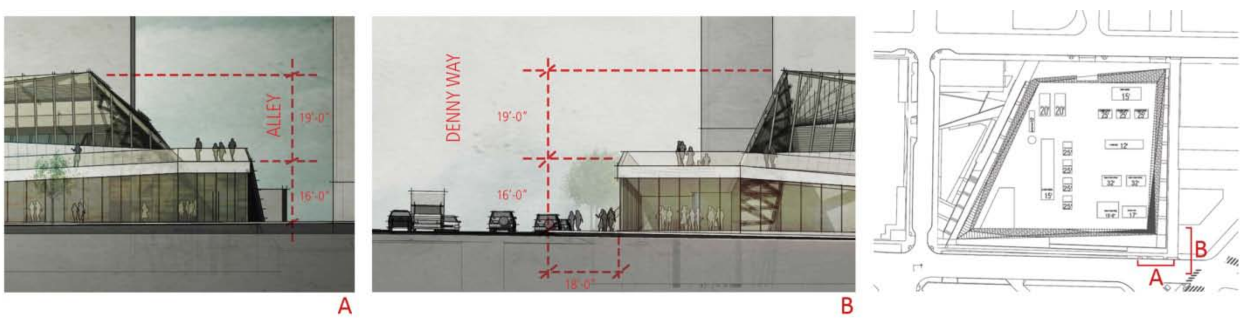
Height, Bulk, and Scale

The form of the structure in SA3 would be less rectilinear than the other two substation alternatives, which means that the contrast with adjacent buildings would be greater than under SA1 or SA2. However, the non-rectilinear shape also helps to create visual interest and reduce the potential monotony of a solid and opaque screen wall. This contrast in building form is not considered an adverse impact.

The highest point of the structure in SA3 would be in the southeast corner of the substation site, near the David Colwell building. As shown in Figure 3-31, the highest point of the wall would be approximately 35 feet above the sidewalk elevation, but that high point would be set back from both the sidewalk and the alley. If the screen wall were to include partial overhead screening, the SA3 structure could be approximately 5 feet taller in this corner. (Note that the ground elevation inside the substation yard would be approximately 12 feet lower than the adjacent street at the southeast corner). See Table 3-3 for a comparison of wall heights with adjacent structures.

By comparison, the highest points on SA1 and SA2 would be in the northwest corner, near The Brewster apartments, which is a relatively low-scaled building in this context. Near the David Colwell building, SA3 would be taller than SA2 and about the same height as SA1, although the sloped walls would also place the high points farther from the David Colwell building. (Figure 3-30).

Figure 3-31. Height of SA3a from Adjacent Streets



Source: NBBJ, 2013

The structure would be set back from John Street and Minor Avenue North to accommodate landscaping and open space that would be part of the public benefit features proposed along with the street vacation (see Table 3-4 and Figures 3-23, 3-27, 3-28, and 3-29). A 2- to 4-foot setback is proposed along the alley to the east of Parcel 2 and along Denny Way.

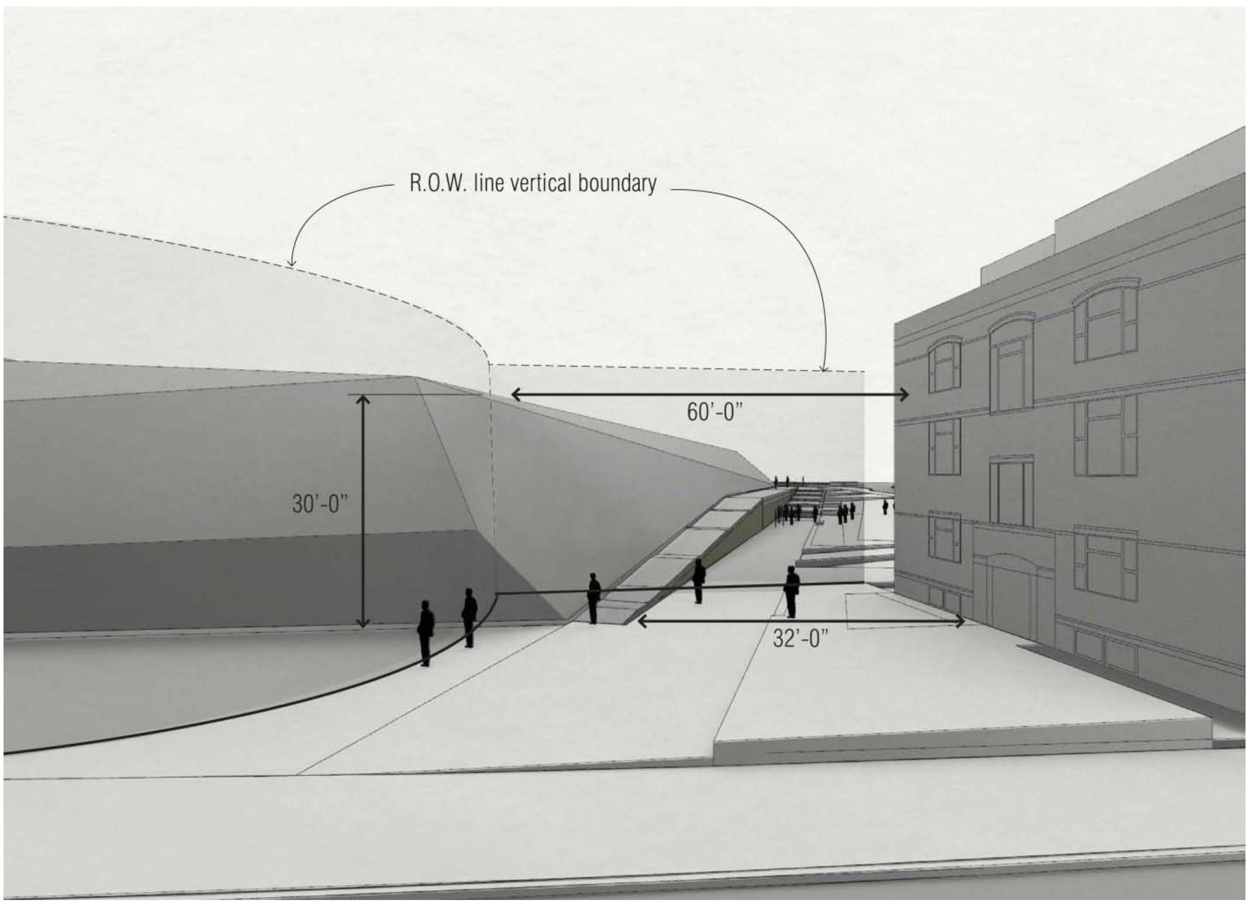
The closure and vacation of Pontius Avenue North under SA3 would enable a portion of the screen wall to extend partially into the former street right-of-way. The street right-of-way comprises 22,090 square feet of open space at present. Including the pedestrian ramps and viewing areas and other open space provided for public benefit proposed with SA3, approximately 46,000 square feet of open space would be created on the substation site, with the large portion of that area on Parcel 1 and the remaining portion in the former Pontius Avenue North right-of-way.

The partial overhead screen, if constructed, would be similar to that described for SA1 (Figures 3-26, 3-27, and 3-29). The structure surrounding the substation would screen street level views of the equipment and substation yard and would also screen some views from upper floors of adjacent buildings. Because the site would have a broader footprint, it would be closer to the Mirabella Seattle Retirement Community building than SA1, and thus views into the site would be less screened than under SA1 (Figure 3-29). If there is no overhead screen, the lower walls of SA3 would allow views into the site from the upper floors of most buildings in the vicinity (Figures 3-26 to 3-30).

Like SA1, the scale of the structures and equipment under SA3 would be shorter than most adjacent buildings, but like SA1 would be taller at its highest point than The Brewster apartments and the Feathered Friends building. The structure would be closer to The Brewster than under SA1, extending at an angle within approximately 35 feet of the apartment building (see Figure 3-32). Because of the sloping screen walls on SA3, the highest point on the wall would be approximately 60 feet from The Brewster, as with SA2, but would be lower in height than The Brewster (Figure 3-28). As with SA2, the 10-foot to 20-foot transition in height between smaller buildings and the proposed substation under SA3 is not considered to be a significant adverse impact in this context.

The screen wall surrounding the site, although not rectangular, would extend approximately 320 feet east-to-west and approximately 290 feet north-to-south. SA3 would have a larger footprint than any of the existing buildings in the vicinity, but because it would be lower in height than either the Mirabella Seattle Retirement Community or the proposed Lexas Towers (the buildings with the next largest footprints), it would not appear out of scale (see Tables 3-2 and 3-3). In this context, the proposed bulk of the substation structure is compatible in scale with other existing and proposed structures.

Figure 3-32. Distance between The Brewster Apartments and SA3



Source: NBBJ, 2013

Transparency, Setbacks, Landscaping, and Design Review

Like SA1 and SA2, SA3 would be consistent with most standards of the City's Land Use Code (see Appendix F, Summary of Substation Alternatives Zoning Analysis Matrix). In the shell spaces at the southeast and southwest corners of the structure, SA3 would provide some streetfront transparency as required under the Land Use Code on Denny Way and on the west façade, facing Minor Avenue North. However, SA3 would not provide the full amount of transparency required on these façades, and it would provide no transparency on John Street; therefore, a waiver would be required from City Council.

As with the other two alternatives, SA3 would include landscaping and artwork that would provide some visual interest for pedestrians and vehicles passing the site. It would also provide landscaping as required for all streets. The structure would exceed maximum setback requirements on Minor Avenue North in order to provide open space in that location. This would also require a waiver from City Council.

The City has adopted design polices and developed a design framework for the neighborhood. Appendix G, Summary of Adopted Design Guidelines for the Substation Area, summarizes the relevant adopted design review guidelines that apply to private development. Although these guidelines do not directly apply to the project they provide some context of community desires for the area. For example, provision of open space and community amenities in the SA2 or SA3 designs could achieve some of the objectives described in the adopted policies and design framework.

The open space created under SA3 would provide a permanent area of visual relief from the otherwise intensively developed context, slightly more in total area than with SA2. Both SA2 and SA3 would create much more open space than SA1 because under SA1, Pontius Avenue North would not be vacated and public benefits, such as open space, would not be a requirement of the project. Parcel 3 would likely be either used for parking or sold for development.

As with SA1 and SA2, the relatively low height of the project with SA3 would also preserve open views and light across the site.

Pontius Avenue North would be closed and incorporated into the site, while maintaining the pedestrian connection it provides between John Street and Denny Way. Some of the open character provided by Pontius Avenue North would be eliminated.

3.3.2 Transmission Line Alternatives

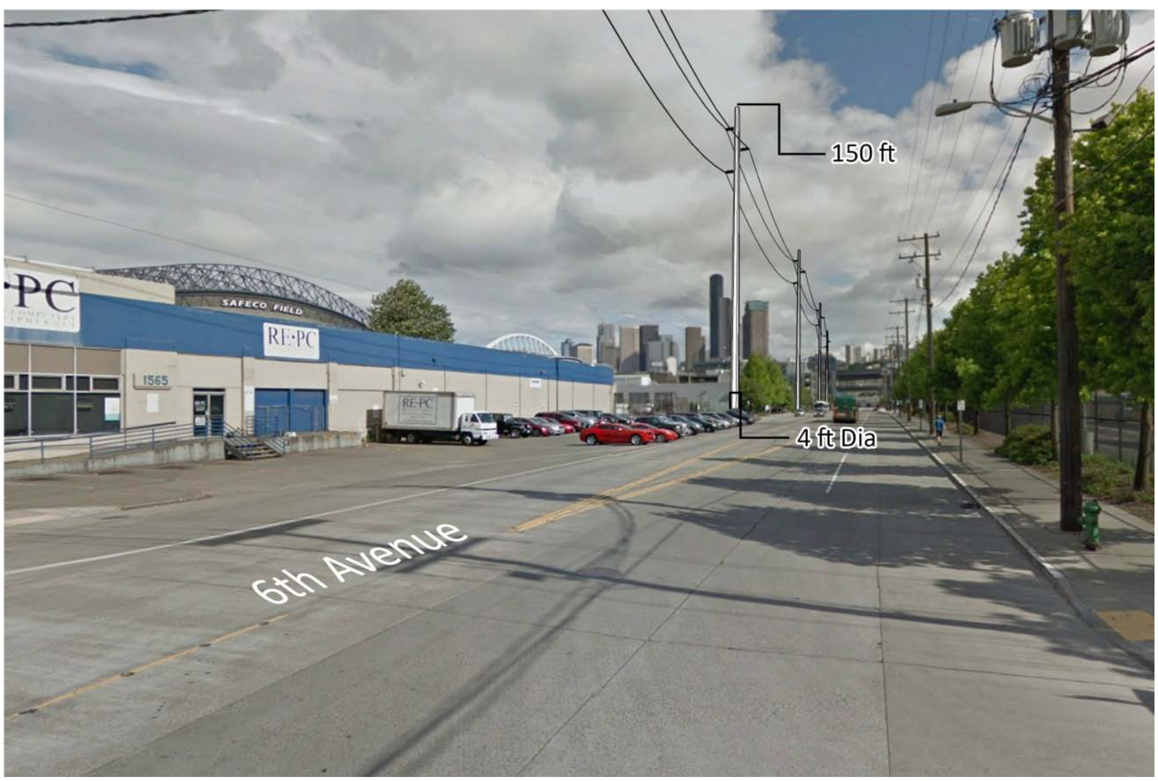
Impacts Common to All Alternatives

All three of the transmission line alternatives would be primarily underground; the underground segments would have no long-term effect on visual quality and scenic resources. Any of the three transmission line alternatives could include an overhead line along South Massachusetts Street and replace existing transmission poles with poles up to 50 feet taller, or approximately 150 feet in overall height. As described in Chapter 2, Description of Project and Alternatives, the final height of these poles would be determined in final design. Figures 3-33 and 3-34 depict typical views of the transmission line under Transmission Line Alternative 1 (TL1), Transmission Line Alternative 2 (TL2), and Transmission Line Alternative 3 (TL3), with the maximum height of 150-foot poles. The visual context surrounding the overhead line is industrial, with railroad yards and commercial, warehouse, parking, and industrial buildings along the route. While taller than most surrounding structures, the transmission line would not adversely affect the visual quality of the areas where they would be constructed. The overhead line also would not affect any protected views or view corridors.

City Light is considering placing the southern segment of the transmission line underground. If placed underground, the transmission line would have no long-term visual impacts.

Figure 3-33. View of Proposed Transmission Line on South Massachusetts Street near E-3 Busway (facing west)

Figure 3-34. View of Proposed Transmission Line on 6th Avenue South (facing north)



Transmission Line Alternative 1 (TL1) and 3 (TL3)

The potential for impacts on aesthetics from TL1 and TL3 would be from the overhead segment at the south end of the alignment. However, the visual context for these lines is industrial, and the transmission line would not be considered out of character in this area. Also, the overhead line segment would not be within historic districts and would not approach any designated historic structures. Therefore, TL1 and Tl3 would not have significant adverse impacts to aesthetics in this context.

Transmission Line Alternative 2 (TL2)

Other than the overhead line common to all three transmission line alternatives, the entire TL2 route would be underground or through the DSTT. For the segment within the DSTT, portions of the transmission line conduits would be visible where they leave the travelway within each station and enter the bored tunnel sections between stations. Figure 3-35 is a visual simulation of typical conduits that would be visible to users in the DSTT stations. These visible conduits are similar to other conduits in the DSTT and are not considered an adverse visual impact.

Figure 3-35. Typical View of Transmission Line Conduits in DSTT

3.3.3 Broad Street Substation Inductor Options

Impacts Common to All Options

The inductor would be shorter than much of the equipment already on the Broad Street Substation or Annex site and much smaller in height, bulk, and scale than existing and anticipated development surrounding the site. The installation of the inductor would likely include minor changes to the security lighting at the Substation or Annex but it would be aimed or shielded to prevent off-site light or glare impacts. The inductor would not impact any protected views or views of designated landmarks.

Broad Street Substation Inductor Option 1 (BI1)

The BI1 site is largely separated from the street and thus would be less visible than would BI2. The fence that encloses the Broad Street (northwest) side of the Substation Annex would be removed and a new fence installed around the new inductor and associated equipment. The artwork in the fence would either be relocated or replaced. Moving or replacing the artwork would not be considered an adverse impact so long as planning and consultation occurs involving the City of Seattle Arts Commission, included as a mitigation measure under Section 3.5, Mitigation Measures.

Broad Street Substation Inductor Option 2 (BI2)

The BI2 site is located at what will be the street corner of Taylor Avenue North and Harrison Street, and would therefore be more visible than BI1. The wall and fence that encloses the Broad Street (northwest) side of the substation would be removed and a new fence installed around the new inductor and associated equipment.

3.3.4 Distribution System

Because the distribution system in the Phase 1 Build-out and Future Build-out areas would be underground, it would not be visible and, therefore, would have no adverse effects on aesthetics.

3.4 Impacts of No Action Alternative

Under the No Action Alternative, direct impacts on aesthetics would not occur from the proposed Denny Substation, transmission line, or distribution system north of Denny Way.

Parcels 1 and 3 could continue to be used for parking, the established land use prior to the substation site remediation project, with no visual changes to those parcels. Any of the three substation site parcels could be developed, which would cause visual change to the parcels. Any new use on any of the parcels would be a separate action from the Denny Substation Project and would require separate environmental review.

Construction of a new inductor at the Broad Street Substation or Annex and a possible second inductor on Parcel 1, 2, or 3 would have similar aesthetic impacts to the Broad Street Substation options described above in Section 3.3.3

Installation of underground lines to support the distribution system south of Denny Way would have temporary aesthetics impacts, but no long term aesthetics impacts.

3.5 Mitigation Measures

Since no construction impacts are identified for the Denny Substation project, no mitigation measures are warranted. This section presents general mitigation measures identified to avoid or reduce the aesthetic impacts expected to occur during project operation.

3.5.1 General Avoidance and Minimization Measures Common to All Alternatives

The design of the proposed Denny Substation is subject to review and approval by the Design Commission. As part of that review, the Design Commission recommends design treatments that are intended to make public projects such as the proposed substation fit into the neighborhood context and become urban design assets to the community. To date, several features have been proposed that are intended to reduce any adverse impacts of the substation and help make it compatible with the existing and expected neighborhood context. These include the screen wall, which could include some transparency and incorporate art for visual interest and help reduce the visibility of the electrical equipment from more distant viewpoints, street tree plantings at the site abutting streets, on-site landscaping, public art installations, and public open space areas (with SA2 and SA3). These components are considered part of the project and they would also serve to reduce adverse aesthetic effects of the substation. City Light is also examining lighting and color effects for the equipment and firewalls in the substation yard to add visual interest for passersby and neighboring properties that would have views over the screen wall.

Any security or other site lighting would be shielded or aimed to avoid creating glare impacts for adjacent development.

City Light is consulting with the City of Seattle Arts Commission to determine whether relocation or replacement of the existing art fence at the Broad Street Substation Annex is appropriate.

3.5.2 Specific Mitigation Measures

With implementation of the avoidance and minimization measures described in Section 3.5.1 above, no adverse impacts to aesthetics are expected. Therefore, no additional specific mitigation measures for aesthetic impacts are required or proposed.

3.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to aesthetics are anticipated.

Chapter 4: NOISE

4.1 Affected Environment

4.1.1 Environmental Noise and Vibration Fundamentals

Noise Key Findings

Construction of the substation and transmission line alternatives, Broad Street Substation Inductor options and the distribution system would avoid significant noise impacts during nighttime hours only with mitigation that would restrict noisy construction activity (such as concrete removal) in the proximity of sensitive receptors to daytime hours.

Construction of the project outside of normal daytime hours would require a variance from the requirements of the City of Seattle's Noise Ordinance.

Vibration levels associated with impact equipment would exceed the human annoyance threshold and result in minor to moderate impacts for the substation and transmission line alternatives, and distribution system.

Substation Alternatives 1 (SA1) and 2 (SA2) would meet standards of the Seattle Municipal Code for operational noise levels only with mitigation. Operation of Substation Alternative 3 (SA3) would not result in a minor impact due to a different arrangement of the predominant noise sources located within the substation yard as well as shielding effects of the perimeter wall. Operation of the Broad Street Substation inductor, the transmission line alternatives, and the distribution system would not result in significant adverse impacts.

Noise Exposure Fundamentals and Descriptors

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise is defined as unwanted sound, which is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level is measured in decibels (dB), a logarithmic loudness scale with 0 dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain. Because sound pressure can vary by over 1 trillion times within the range of human hearing, the logarithmic loudness scale is used to calculate and manage sound intensity numbers conveniently.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. Therefore, when assessing potential noise impacts, sound is measured using an electronic filter that deemphasizes the frequencies below 1,000 hertz (Hz) and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA).

Given the variation of community noise level from instant to instant, community noise levels must be measured over an extended period of time to characterize a community noise environment and evaluate cumulative sound impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are as follows:

L_{eq}: The equivalent sound level is used to describe noise over a specified period of time, typically 1 hour, in terms of a single numerical value. The L_{eq} is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

L_{max}: The L_{max} is the instantaneous maximum noise level measured during the measurement period of interest.

L_{dn}: The day-night average sound level (also written as DNL) is the energy average of the A-weighted sound levels occurring during a 24-hour period, accounting for the greater sensitivity of most people to nighttime noise by weighting ("penalizing") nighttime noise levels by adding 10 dBA to noise between 10:00 p.m. and 7:00 a.m.

Steady-state sound is sound for which average characteristics remain constant in time (e.g., sound of an air conditioner, fan, or pump) and are typically described using the L_{eq} descriptor. Impulse sound is sound generated over a relatively short duration period (e.g., a car horn or back-up alarm). Impulsive sound is typically characterized using the L_{max}.

Effects of Noise on People

The effects of noise on people can be placed into three categories: (1) subjective effects of annoyance, nuisance, and dissatisfaction; (2) interference with activities such as speech, sleep, and learning; and (3) physiological effects such as hearing loss or sudden startling.

Because there is such wide variation in individual noise thresholds, an important way of predicting human reaction to a new or changed noise environment is the way the noise levels compare to the existing environment to which one has adapted, or the "ambient" noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be to the individual. With regard to increases in A-weighted noise levels, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived by the human ear.
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A change in level of at least 5-dBA is required before any noticeable change in human response would be expected.
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and can cause an adverse response.

Vibration Fundamentals and Descriptors

Groundborne vibration causes buildings to shake and generates audible rumbling sounds (FTA, 2006). Vibration levels can also result in interference or annoyance impacts at residences or other land uses where people sleep, such as hotels and hospitals. It is unusual for vibrations from sources such as buses and trucks on a normal roadway to be perceptible by individuals, even in locations close to major roads. However, there are some common sources of groundborne vibration, such as construction activities that involve operating heavy earth-moving equipment. Vibration intensity is generally expressed as peak particle velocity (the maximum speed that the ground moves while it temporarily shakes, referred to as PPV). Since ground-shaking speeds are very small, PPV is measured in inches per second. The types of construction activities that could be associated with propagation of groundborne vibration typically include pile driving, blasting, use of hoe rams for demolishing large concrete structures, and drilling (blasting activities would not occur for construction of this project and engineering designs indicate that piles would be augured and cast in place and not driven with an impact hammer). Hoe rams and auger drills would be used, though, in some instances. Each of these types of equipment can result in PPV of up to 0.089 inch per second at a distance of 25 feet. As a point of reference, construction vibration damage criteria published by the U.S. Department of Transportation (USDOT) range from 0.5 inch per second (in/sec) for reinforced structures to 0.2 in/sec for the protection of "fragile" (non-engineered or masonry) buildings (FTA, 2005).

There are no adopted state or local policies or standards for groundborne vibration with regard to human annoyance; however, the Federal Transit Administration (FTA) has established some standards for acceptable levels of vibration associated with impact equipment as experienced by sensitive receptors[1]. Those criteria are established in terms of vibration velocity level (VdB). For frequent events, the criterion is 72 VdB, while for infrequent events the criterion is 80 VdB. Construction-related activity, which is temporary in nature and would typically be restricted to daytime when most people are not sleeping, is generally assessed by applying the 80 VdB criterion, unless such activity were to occur during nighttime when most people would be sleeping.

4.1.2 Existing Noise Environment

Substation Alternatives

The Denny Substation site is in a mixed-use developed area with both commercial and multifamily residential land uses, as discussed in Chapter 8, Land Use and Housing. The predominant noise sources in the area are vehicle traffic on Denny Way, which is a principal arterial roadway with 22,000 average daily trips including diesel bus transit service, and freeway traffic on Interstate 5 (I-5), which is 600 feet east of the Denny Substation site and contributes to ambient noise levels, particularly during nighttime when traffic volumes on Denny Way are the lowest. Other typical urban noise sources included overhead aircraft and ambulance and police sirens.

Ambient noise was measured in the Denny Substation study area to characterize specific noise conditions in the vicinity (BRC, 2012)[2]. Long-term measurements were taken at seven noise-sensitive locations within the study area (see Figure 4-1 for specific locations). Generally, noise-sensitive land uses may include residences, schools, hospitals, rest homes, long-term care facilities, and libraries. The closest noise-sensitive land uses to the proposed Denny Substation site were inventoried. There are several multifamily residential buildings and assisted living facilities within 500 feet of the proposed substation site. The nearest of these is the David Colwell building, a mixed-use building with apartments on the second through sixth floors, which is across an alley from the

Identifying the Affected Environment

Long- and short-term noise data were collected in the vicinity of the proposed substation site as well as along the proposed transmission line alternatives routes and in the distribution system area. These data were used as a baseline to determine the expected increase over existing conditions.

[1] In general, people in residences, schools, hospitals, and nursing homes are considered to be the most sensitive to noise.

[2] This chapter summarizes the affected environment and construction and operational impacts for noise for the Denny Substation Project, as described in more detail in the Denny Substation Project Noise Discipline Report (ESA, 2014).

eastern boundary of the proposed substation site and the next nearest is The Brewster apartment building, which is across Pontius Avenue North from the site.

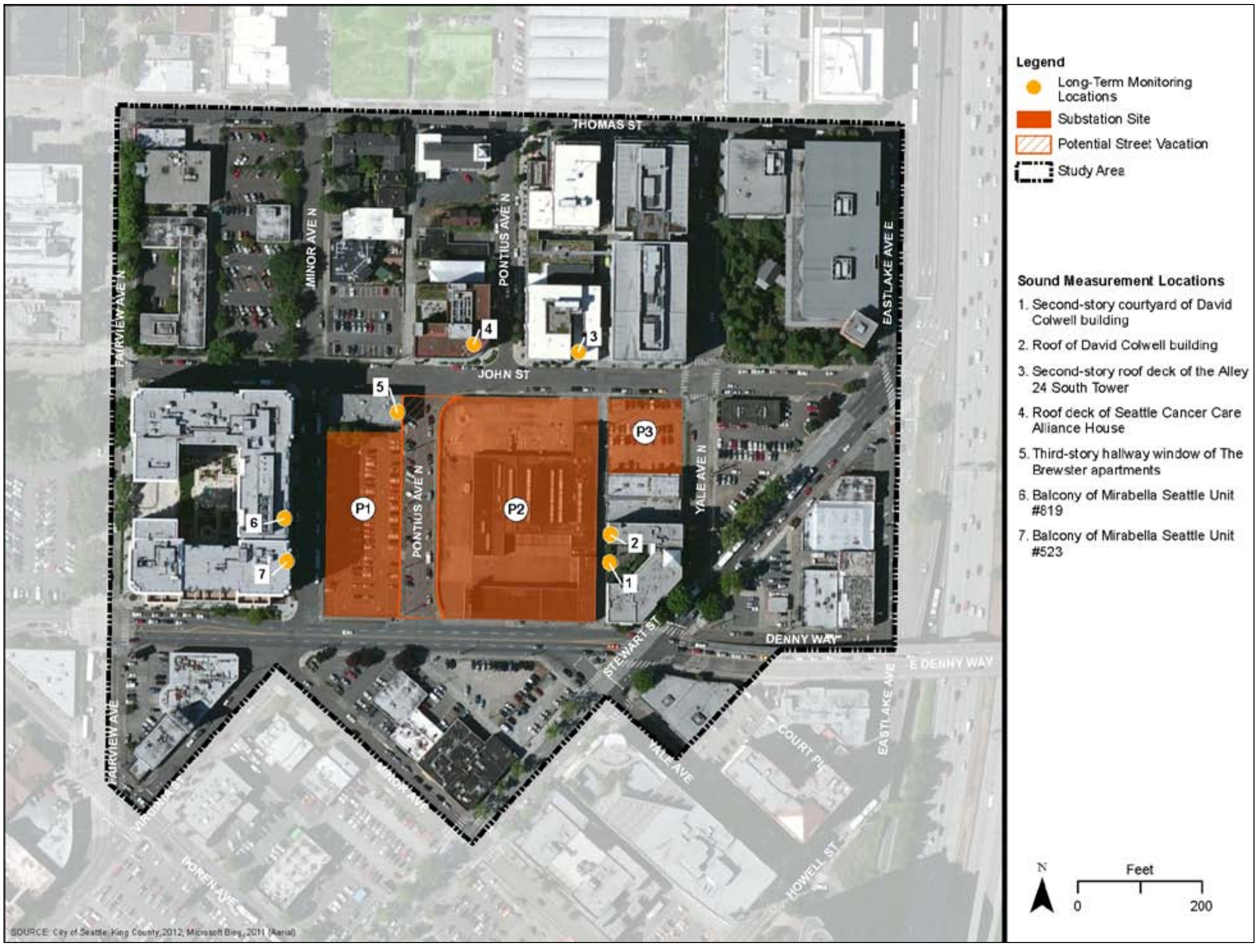
Table 4-1 presents the measured ambient noise levels in the Denny Substation study area in terms of the average hourly L_{eq} for both daytime (7:00 a.m. to 10:00 p.m.) and nighttime (12:00 a.m. to 5:00 a.m.), the L_{max}, and the calculated L_{dn} noise level for each long-term measurement location. The hourly L_{eq} noise level for the sites was measured ranging from a low of 62 dBA Leq at night to 67 dBA L_{eq} during the day. The maximum measured noise level was an L_{max} of 97.4 dBA. These existing noise levels reflect the consistent traffic noise from I-5 and the urban roadway traffic in the area.

Table 4-1. Ambient Noise Level Data in the Denny Substation Study Area

Measurement Location (see Figure 4-1)	Noise Levels in dBA			
	Average Daytime Hourly L_{eq}	Average Nighttime Hourly L_{eq}	L_{max}	DNL
David Colwell building – 2nd story	65	63	97.4	70
David Colwell building – rooftop	67	65	90.9	72
Alley 24 - roof deck	66	62	91.5	70
SCCA – roof deck	65	62	86.4	70
The Brewster apartments – 3rd story	64	64	90.1	70
Mirabella Seattle Retirement Community – 8th floor balcony	67	65	92.3	72
Mirabella Seattle Retirement Community – 5th floor balcony	67	64	94.1	72

dBA = A-weighted decibels; DNL = day-night average sound level; L_{eq} = equivalent sound level; L_{max} = instantaneous maximum noise level measured during the measurement period of interest; SCCA = Seattle Cancer Care Alliance

Figure 4-1. Noise Measurement Locations in Denny Substation Study Area



Transmission Line Alternatives

Transmission Line Alternative 1 (TL1)

The Transmission Line Alternative 1 (TL1) route passes through predominantly commercial areas from the Denny Substation site until it reaches South Dearborn Street, south of which land uses are predominantly industrial. There are upper-story residential units in mixed-use buildings along the TL1 route at Stewart Street and Minor Avenue and at 5th Avenue and Weller Street. These units would be approximately 50 feet from the proposed underground portions of the route. Noise measurements were taken at the location of sensitive land uses visually identified during a reconnaissance of the TL1 route (see Figure 4-2 and Table 4-2).

Daytime noise levels (L_{eq}) measured along the TL1 route averaged 67.6 dBA L_{eq} along Stewart Street and 71.5 dBA L_{eq} along 5th Avenue. The maximum measured noise levels were 81.3 and 86.1 dBA L_{max}, respectively. Local vehicle traffic was the predominant noise source.

Figure 4-2. Noise Measurement Locations along Transmission Line Alternative Routes

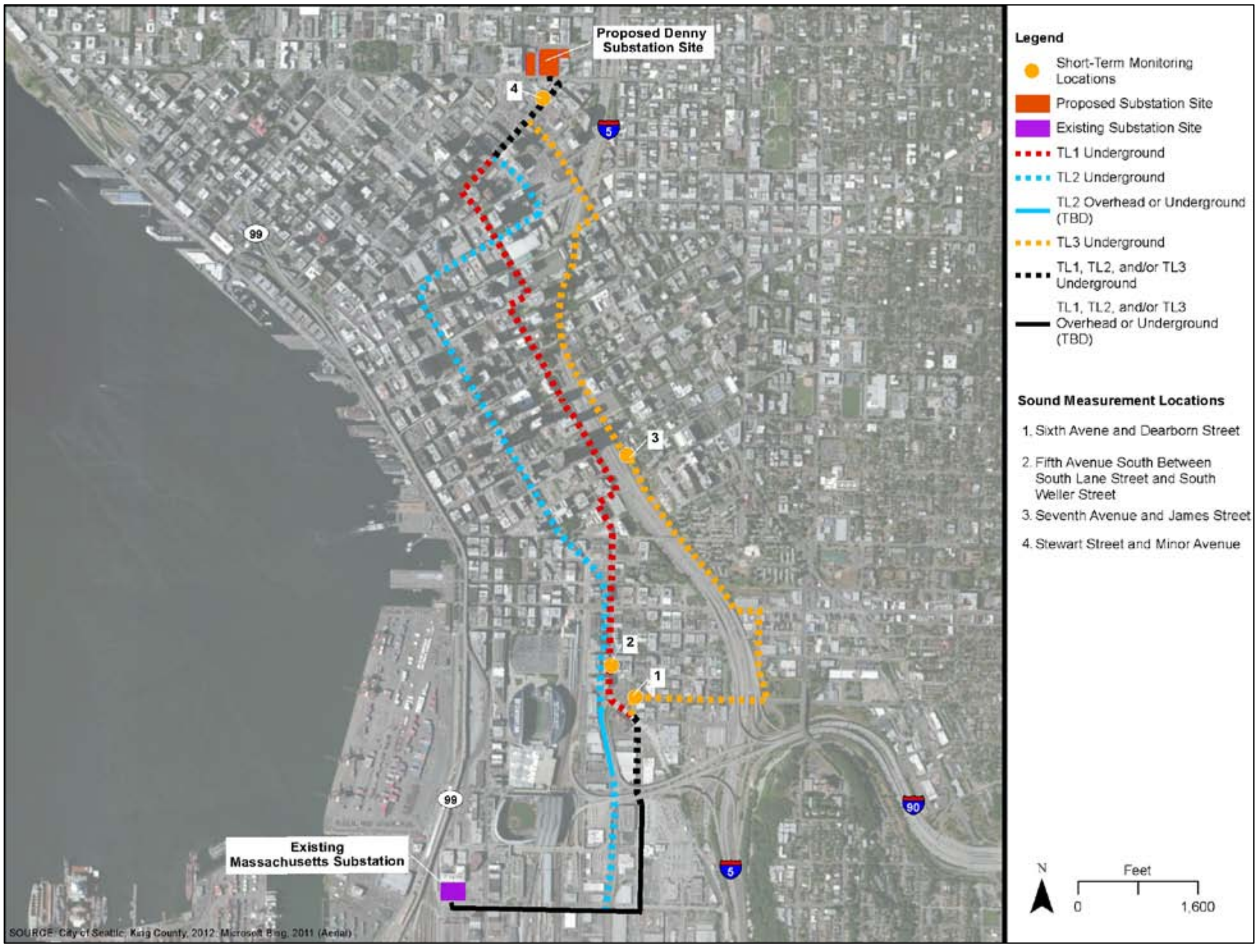


Table 4-2. Short-Term Ambient Noise Level Data along the Transmission Line Alternative Routes

Measurement Location (see Figure 4-2)	Time of Measurement	Noise Levels in dBA	
		L_{eq}	L_{max}
Sixth Avenue at Dearborn Street (TL1 and TL2)	4:55 pm	65.5	79.2
Fifth Avenue South between South Lane Street and South Weller Street (TL1 and TL2)	4:40 pm	71.5	86.1
Seventh Avenue and James Street (TL3)	4:18 pm	72.3	89.7
Stewart Street and Minor Avenue (TL1, TL2 and TL3)	5:30 pm	67.6	81.3

Leq = equivalent sound level; Lmax = instantaneous maximum noise level measured during the measurement period of interest; TL1 = Transmission Line Alternative 1; TL2 = Transmission Line Alternative 2; TL3 = Transmission Line Alternative 3

Transmission Line Alternative 2 (TL2)

The Transmission Line Alternative 2 (TL2) route passes through the existing Downtown Seattle Transit Tunnel (DSTT), where its construction would generally not represent a potential noise concern to sensitive land uses aboveground. There are upper-story residential units in mixed-use buildings along the non-tunnel portions of the TL2 route at Stewart Street and Minor Avenue. These units would be approximately 50 feet from the proposed underground portions of the route. Noise measurements were taken at the location of sensitive land uses visually identified during a reconnaissance of the TL2 route (see Figure 4-2 and Table 4-2).

Daytime noise levels measured along the TL2 route averaged 67.6 dBA L_{eq} along Stewart Street, the same as for TL1. Local vehicle traffic was the predominant noise source. The maximum measured noise level was 81.3 dBA L_{max}.

Transmission Line Alternative 3 (TL3)

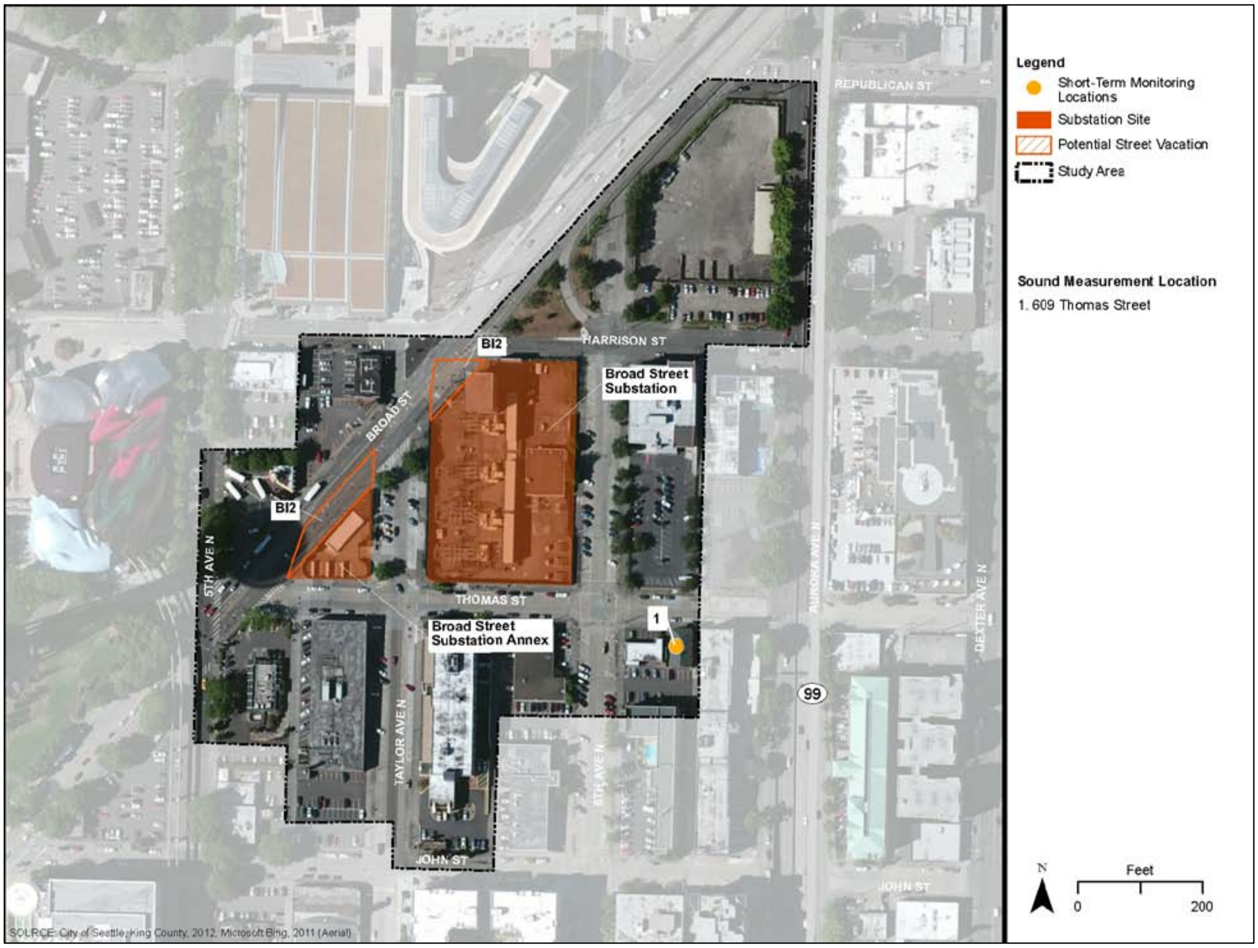
There are more sensitive receptors along the Transmission Line Alternative 3 (TL3) route than the TL1 or TL2 routes, and the potential exists for a greater number of people to be affected by construction noise along the TL3 route. These include upper-story residential units at Stewart Street and Minor Avenue as well as residences along South Dearborn Street and residences and healthcare facilities along 10th Avenue South and 7th Avenue, adjacent to I-5. Noise measurements were taken at the location of sensitive land uses visually identified during a reconnaissance of the TL3 route (see Figure 4-2 and Table 4-2).

Daytime noise levels measured along the TL3 route averaged 67.6 dBA L_{eq} along Stewart Street, the same as for TL1 and TL2. The maximum measured noise level was 81.3 dBA L_{max} at this location. Daytime noise levels measured at South Dearborn Street and 6th Avenue South averaged 65.5 dBA L_{eq}, with a maximum noise level of 79.2 dBA L_{max}. Local vehicle traffic was the predominant noise source at these two locations. Daytime noise levels measured at 7th Avenue and James Street averaged 72.3 dBA L_{eq}, with a maximum noise level of 89.7 dBA L_{max}. Vehicle traffic on I-5 was the predominant noise source at this location, which is representative of approximately 50 percent of the TL3 route where it parallels I-5.

Broad Street Substation Inductor Options

The land uses surrounding the Broad Street Substation and Annex are primarily office, retail, and lodging. There is a single residential apartment building on Thomas Street, approximately 200 feet east of the Broad Street Substation and 500 feet east of the Broad Street Substation Annex. A noise measurement was taken at the residential apartment building, the nearest sensitive land use visually identified during a reconnaissance (see Figure 4-3).

Figure 4-3. Noise Measurement Locations in Broad Street Substation Study Area



Daytime noise levels measured in the vicinity of the Broad Street Substation averaged 61.5 dBA L_{eq}, with a maximum recorded noise level of 74.4 dBA L_{max}. Local vehicle traffic was the predominant noise source. There is ongoing construction activity in this area, but the measurement was conducted outside of construction hours.

Distribution System

The noise levels measured around the Denny Substation site are generally reflective of those throughout the Phase 1 Build-out and Future Build-out areas in the distribution system because these areas are also mixed-use, commercially zoned areas bordered by I-5 to the east and State Route 99 to the west, where vehicle-generated noise on roadways, arterials, and elevated highways predominate.

There are multifamily residential land uses, parks, and schools scattered throughout the Phase 1 Build-out and Future Build-out areas. These uses would generally be within 50 feet of distribution system components that would be installed underground in the street right-of-way.

Because the land uses and traffic levels were similar to those found around the Denny Substation site, additional sound measurements were not taken at specific locations around the neighborhood where the distribution lines would be installed.

4.1.3 Regulatory Setting and Impact Assessment Criteria

Evaluating and understanding potential noise impacts requires an understanding of the types and levels of noise that are regulated by applicable codes. This section describes the noise codes applicable to the project.

Washington State Noise Control Act of 1974

The State of Washington recognized the harm that excessive noise can have on public health, safety and well-being and authorized the establishment of rules to abate and control noise pollution (Revised Code of Washington 70.107). The regulations on Maximum Environmental Noise Levels (Washington Administrative Code 173-60) apply to a variety of activities and facilities including general construction activities, park-and-rides, and maintenance facilities and exempts electrical substations, mobile noise sources, and vehicles traveling in public right of- way, as well as safety warning devices (i.e., bells). The state provisions have been adopted by most cities around the state, including the City of Seattle (City) (Seattle Municipal Code [SMC] 25.08).

Noise Policies of the Seattle Comprehensive Plan

The Seattle Comprehensive Plan does not contain a noise element or establish specific quantitative noise standards. The Land Use Element's policies (LU44 and LU45) direct the City to establish maximum permitted noise levels to reduce health hazards and nuisance factors associated with noise generated by some land uses. These standards are established in the SMC and discussed below.

Seattle Municipal Code 25.08 Noise Control

Construction Noise Standards

Chapter 25.08 of the SMC establishes exterior sound level limits for specified land use zones or "districts," which vary depending on the district generating the sound and the district affected by the sound (see Table 4-3). The Denny Substation site and the surrounding area within 800 feet of the substation site are designated as either SM (Seattle Mixed) or DMC (Downtown Mixed Commercial) zoning. SMC 25.08.100 classifies SM and DMC zones as Commercial Districts for purposes of noise control. The exterior sound level limit applicable to the substation site would need to meet the 60 dBA L_{eq} standard for a commercial district generating the sound and a commercial district receiving (or affected by) the sound. The same standard would apply to the underground routes of TL1, TL2, and TL3, the inductors at Broad Street Substation, and the distribution system which are all located within and adjacent to commercial districts. The overhead routes of TL1, TL2, and TL3 are located within and adjacent to industrial districts which have a 70 dBA L_{eq} standard.

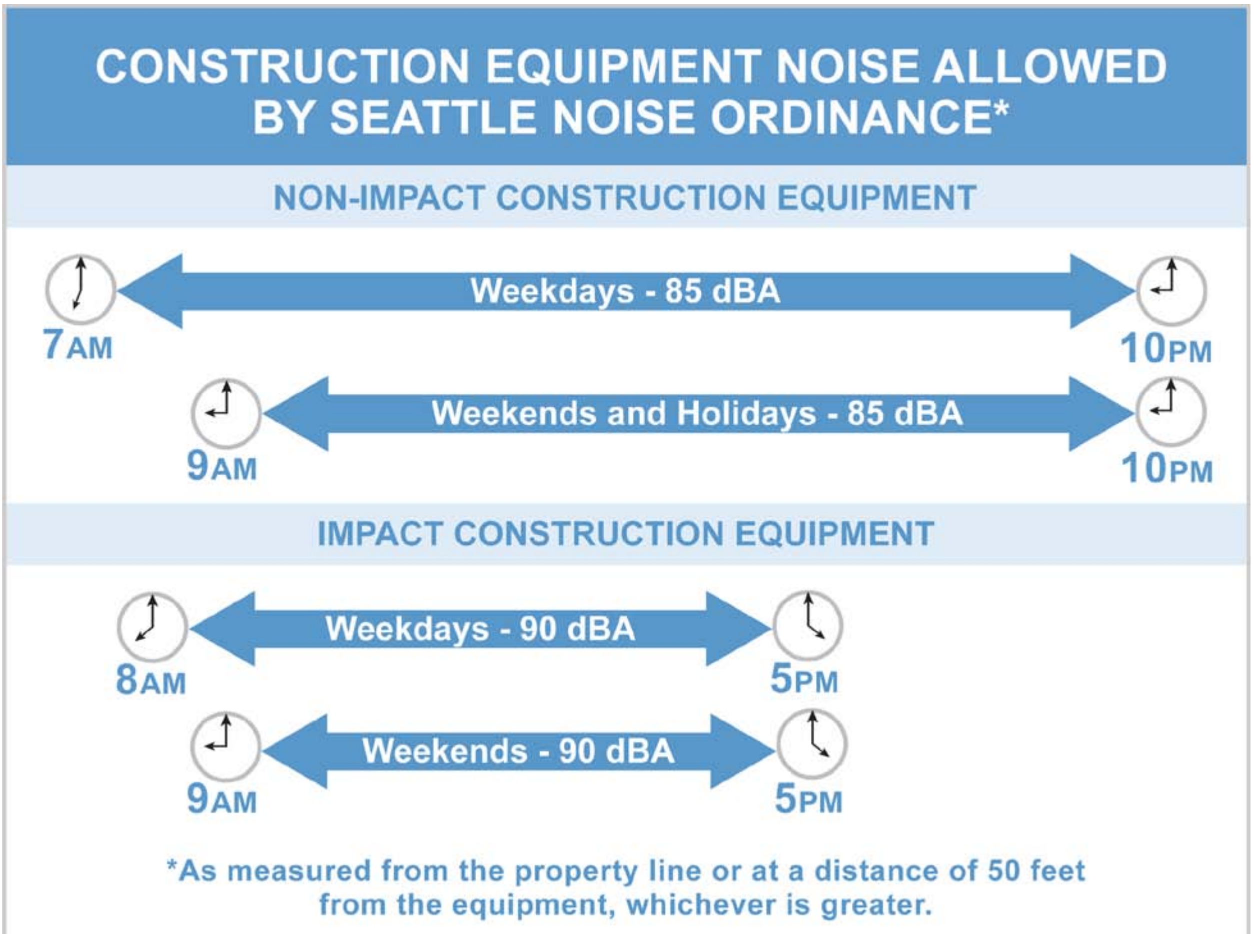
Table 4-3. Exterior Sound Level Limits (Seattle Municipal Code 25.08.410)

Sound Generating District	Sound Receiving District		
	Residential (dBA L_{eq})	Commercial (dBA L_{eq})	Industrial (dBA L_{eq})
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

The City's Noise Ordinance allows the exterior sound level limits to be exceeded by certain types of construction equipment operating in commercial districts between 7 a.m. and 10 p.m. on weekdays and between 9 a.m. and 10 p.m. on weekends and legal holidays, provided that the equipment is being used for a public project (SMC 25.08.425) (see Figure 4-2). The types of equipment that would usually exceed the exterior sound level limit of 60 dBA are loaders, excavators, and cranes. This equipment may exceed the commercial district 60 dBA standard by up to 25 dBA (an 85 dBA standard) when measured at a reference distance of 50 feet. Use of impact equipment, such as a concrete breaker, is restricted to 8 a.m. to 5 p.m. on weekdays and 9 a.m. to 5 p.m. on weekends and holidays and limited to a continuous noise level of 90 dBA and a maximum noise level of 99 dBA L_{max} when measured at a reference distance of 50 feet.

Contractors would be required to meet the criteria of the City's Noise Ordinance. Because of possible restrictions on daytime construction along major arterials (because of traffic disruptions), it is likely that at least some construction along major corridors could occur at nighttime. Outside normal weekday hours (i.e., 7 a.m. to 10 p.m.), this type of activity may be allowed by the City through issuance of a Noise Variance.

Figure 4-4. Construction Noise Time Limits for Public Projects in Commercial Zones under the City of Seattle's Noise Ordinance



<u>Operational Noise Standards</u>

The operational exterior noise standards applicable to the Denny Substation and Broad Street Substation sites are also 60 dBA Leq. The standard that would apply to the overhead route of TL1, TL2, and TL3 which are located within and adjacent to industrial districts is 70 dBA Leq. The City's Noise Ordinance also allows maximum noise levels of up to 15 dBA beyond this standard (up to 75 dBA), provided the average hourly noise level attains the 60 dBA standard (meaning particular activities could be louder than the 60 dBA limit for short durations within any given hour).

Noise and Vibration Criteria Applied for Construction Activities

The City's Noise Ordinance establishes acceptable noise levels for construction equipment, and contractors would be required to operate their equipment within the constraints of the ordinance. To assess the potential impacts related to construction activities and equipment, this analysis estimates construction equipment noise and compares it to the restrictions contained in SMC 25.08.425 discussed above.

The City has not established any regulations with respect to vibration levels. Consequently, this analysis applies the FTA measure of the threshold of architectural damage for conventional sensitive structures (as described in Section 4.1.1), which is 0.5 in/sec PPV for new residential structures and modern commercial buildings and 0.2 in/sec PPV for historic and older buildings (FTA, 2005).

Vibration levels can also result in interference or annoyance impacts at residences or other land uses where people sleep, such as hotels and hospitals. Vibration impact criteria published by FTA relative to these land uses are established in terms of VdB. For frequent events, a criterion of 72 VdB has been established, while for infrequent events a criterion of 80 VdB has been established. Construction-related activity, which is temporary in nature and would typically be restricted to daytime hours when most people are not sleeping, is generally assessed by applying the 80 VdB criterion.

Noise Criteria Applied for Stationary Sources

Noise impacts from stationary sources, including transformers, ventilation equipment, inductors, and generators, were assessed relative to the 60 dBA exterior receiving sound limits in commercial districts established by the City's Noise Ordinance. This comparison evaluates consistency with existing thresholds for stationary sources of noise.

Additionally, unrelated to the City's Noise Ordinance, the potential for the project to result in a substantial permanent increase over existing ambient noise levels was assessed by estimating the resultant increase in ambient noise levels. This analysis conservatively applied a 3 dBA increase over ambient noise levels to represent a moderate noise impact and a 5 dBA increase over ambient noise levels to represent a substantial noise impact.

4.2 Construction Impacts

4.2.1 Substation Alternatives

Substation Alternative 1 (SA1)

Construction Noise Impacts

Construction-related activities for Substation Alternative 1 (SA1) would temporarily increase ambient noise levels in the substation site vicinity. Construction noise levels at the site would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment. The effect of construction noise would depend upon the type of construction activity on a given day and equipment used, the distance between construction activities and the nearest sensitive land uses, and the existing noise levels around the site.

Table 4-4 shows the type of equipment that would likely be used for construction of all project components, including SA1, and the noise levels that would be perceived at distances of 50 feet from the noise source (the distance to use for assessing construction noise pursuant to SMC 25.08.425).

Assessing Noise Impacts

The evaluation of potential noise impacts from construction and operation of the proposed project started with a review of relevant City of Seattle noise standards and policies, and measurements of existing noise levels. Modeling of anticipated noise levels was conducted to compare the existing noise environment with modeled proposed project construction and operation noise levels. Noise levels for likely construction equipment are shown in Table 4-4.

Impacts were assessed by comparing the modeled noise levels of construction equipment and operational activities to applicable noise regulations and/or the ambient noise environment.

Table 4-4. Typical Noise Levels from Construction Equipment

Construction Equipment	Noise Level (dBA, Leq at 50 feet)	Will Equipment be used for Project Component Construction?			
		Substation	Transmission Line	Broad Street Substation Inductor	Distribution System
Hoe ram (concrete breaker)	90	Yes	Yes	Yes	Yes
Auger Drill	84[1]	Yes	No	No	No
Excavator	81	Yes	Yes	Yes	Yes
Roller	80	Yes	Yes	Yes	Yes
Concrete mixer	79	Yes	Yes	Yes	Yes
Crane, mobile	81	Yes	Yes	Yes	Yes
Bulldozer	82	Yes	No	No	No
Paver	77	Yes	No	No	No
Backhoe	78	Yes	Yes	Yes	Yes

Source: Federal Highway Administration (FHWA), 2006.
[1] Noise level from auger drill is reported for engine noise only. Auguring can also generate noise from shaking the bit to remove sticky soils.

As can be seen from Table 4-4, all equipment identified as likely to be used for SA1 would operate at less than 85 dBA L_{eq} at a distance of 50 feet except for the hoe ram. SMC 25.08.425C specifically addresses impact equipment, including pavement breakers, by establishing separate time restrictions and noise standards for such equipment. As indicated in Table 4-4, hoe rams operate at a maximum noise level of 90 dBA L_{max} at 50 feet, which would be below the maximum noise level restriction of 99 dBA L_{max} and would not exceed the daytime continuous noise level restriction of 90 dBA Leq. Therefore, construction activities at the substation site under SA1 are expected to comply with the restrictions of the SMC during daytime hours.

The work on the existing transmission line in Denny Way (to split the existing transmission line into two circuits and initially power the substation to provide network service to some customers) would likely need to occur at night. However, use of impact equipment, such as the hoe ram (see Table 4-4), would be restricted to 8 a.m. and 5 p.m. on weekdays and 9 a.m. to 5 p.m. on weekends and holidays. If project conditions necessitate nighttime work, City Light would obtain a variance to the City's noise ordinance which would dictate noise minimization strategies (identified as a mitigation measure in Section 4.5). Nighttime construction work would have the potential to result in sleep interference if conducted near residential receptors which would be a significant noise impact. Therefore, additional mitigation measures are identified in Section 4.5 to restrict, when feasible, certain types of nighttime construction activity when located within 500 feet of residential receptors to avoid this potentially significant noise impact.

Construction Vibration Impacts

The types of construction activities associated with propagation of groundborne vibration include use of hoe rams for demolishing large concrete structures and auger drilling for installing piles. Both of these activities would be needed to construct SA1.

The other types of equipment that would likely be used to construct SA1 (e.g., excavators, cranes) are not commonly associated with vibration impacts. Bulldozers, hoe rams and auger drills, if used, have been documented to generate vibration levels of 0.089 in/sec PPV and 87 VdB at 25 feet. The closest structures would be 20 feet from the project site (David Colwell Building and Feathered Friends). At this distance, vibration levels from a bulldozer, hoe ram, or an auger drill would be 0.12 in/sec PPV and 90 VdB. This vibration level would be below the recognized threshold for building damage to historic or older buildings of 0.2 in/sec PPV but exceed the human annoyance threshold of 80 VdB. The distance in which the vibration levels would drop below the human annoyance threshold is 40 feet. Therefore, a mitigation measure is identified in Section 4.5 to restrict certain types of construction activity to daytime hours when located within 40 feet of residential receptors. Because auger drilling within 40 feet of a sensitive receptor would only potentially occur for a limited number of days on the eastern portion of the project site closest to the nearest residential receptors, this would be a minor vibration impact during daytime hours and a moderate vibration impact during nighttime hours.

Substation Alternatives 2 (SA2) and 3 (SA3)

Construction Noise Impacts

Construction noise impacts for Substation Alternatives 2 and 3 (SA2 and SA3) would be the same as those described for SA1, except that the construction period would be 18 months (6 months less than with SA1). Pontius Avenue North would be vacated, and the existing pavement of this roadway and sidewalk would be broken up with a hoe ram to prepare the area for incorporation to the substation site.

Construction Vibration Impacts

Construction vibration impacts for SA2 and SA3 would be the same as those described for SA1, except that equipment associated with vibration impacts would also be used on Pontius Avenue North. The closest structure would be within 40 feet from the project site (The Brewster apartments). Similar to SA1, the vibration level would be below the recognized threshold for building damage to historic or older buildings but exceed the human annoyance threshold of 80 VdB. Therefore, a mitigation measure is identified in Section 4.5 to restrict certain types of construction activity to daytime hours when located within 40 feet of residential receptors to minimize construction vibration impacts.

4.2.2 Transmission Line Alternatives

Impacts Common to All Alternatives

Construction noise levels would be different for each transmission line alternative. The differences in potential construction impacts are described in the following sections.

The types of construction activities associated with propagation of groundborne vibration include hoe rams for demolishing large concrete structures. The maximum construction vibration impacts associated with hoe rams with any of the transmission line alternatives would be the same as those described for SA1, with no expected damage to structures and a minor to moderate impact with regard to human annoyance for receptors within approximately 40 feet. Therefore, a mitigation measure is identified in Section 4.5 to restrict certain types of construction activity to daytime hours when located within 40 feet of residential receptors. Construction vibration levels would be the same for all transmission alternatives, so no additional discussion of vibration impacts is included below.

Transmission Line Alternative 1 (TL1)

Construction of TL1 would involve most the construction equipment indicated in Table 4-4, although not all of the equipment identified would operate throughout the 3-year construction period. It is anticipated that a given block would be under construction over a 5-week period.

There are few sensitive receptors along the TL1 route. Upper-story residential units at Stewart Street and Minor Avenue and on 5th Avenue at Weller Street could be as close as 20 feet from construction activity and exposed to construction noise for a 5-week period. As indicated in Table 4-4, all equipment identified to be used for this alternative would operate at less than the SMC specified noise level of 85 dBA at a reference distance of 50 feet, with the exception of the hoe ram used for breaking concrete. However, SMC 25.08.425C specifically addresses impact equipment, including pavement breakers, by establishing separate time restrictions and noise standards for such equipment. As indicated in Table 4-4, hoe rams (operating at a maximum noise level of 90 dBA Lmax at 50 feet, below the maximum noise level restriction of 99 dBA Lmax) would not exceed the continuous noise level restriction of 90 dBA Leq. Consequently, construction activities along the TL1 route are expected to comply with the restrictions of the SMC during daytime hours.

The potential exists for nighttime construction work to be conducted to avoid significant traffic impacts, particularly through the downtown area. If project conditions necessitate nighttime work, City Light would obtain a variance to the City's noise ordinance which would dictate noise minimization strategies (identified as a mitigation measure in Section 4.5). Nighttime construction work would have the potential to result in sleep interference if conducted near residential receptors which would be a significant noise impact. Therefore, additional mitigation measures are identified in Section 4.5 to restrict, when feasible, certain types of nighttime construction activity when located within 500 feet of residential receptors to avoid this potentially significant noise impact.

Transmission Line Alternative 2 (TL2)

Under TL2, transmission lines would be installed in the existing DSTT for approximately 53 percent of its route. For this alternative, less noisy equipment would be required than with TL1 and TL3 (excavator and pavement breaker use would be reduced), and much of the noisy activity would be shielded from aboveground receptors. Because construction could only occur when the DSTT is closed, station users would not be affected. Sound Transit and King County maintenance or security personnel may occasionally be exposed to elevated noise levels from construction within the DSTT but would be restricted from entering active construction areas where construction noise may approach Occupational Safety and Health Administration restrictions regarding hearing conservation.

Transmission Line Alternative 3 (TL3)

The types of equipment and construction timing would be the same as described for TL1, although there are a larger number of sensitive receptors along the TL3 route than the TL1 or TL2 routes, and the potential exists for a greater number of people to be affected by construction noise. The sensitive receptors include upper-story residential units at Stewart Street and Minor Avenue, on 5th Avenue

South at South Weller Street, and along South Dearborn Street, and a combination of residences and healthcare facilities along 10th Avenue South and 7th Avenue, adjacent to I-5. As with TL1, noise levels would not exceed the restrictions of the SMC during daytime hours. If project conditions necessitate nighttime work, City Light would obtain a variance to the City's noise ordinance which would dictate noise minimization strategies (identified as a mitigation measure in Section 4.5). Nighttime construction work would have the potential to result in sleep interference if conducted near residential receptors, which would be a significant noise impact. Therefore, a measure is identified in Section 4.5 to restrict, when feasible, certain types of nighttime construction activity when located within 500 feet of residential receptors to mitigate this potentially significant noise impact.

4.2.3 Broad Street Substation Inductor Options

Broad Street Substation Inductor Option 1 (BI1)

The proposed Broad Street Substation inductor and associated equipment under Option 1 (BI1) would be installed in the Broad Street right-of-way and installation of the equipment would require excavation of up to 2,300 cubic yards of material. Construction equipment and operations associated with this activity were assumed to be similar to that used for substation construction. The distance to the nearest sensitive receptor would be approximately 500 feet. Consequently, construction activities at the Broad Street Substation Annex site are expected to comply with the restrictions of the City's Noise Ordinance and would not have a significant noise impact. The SMC restrictions that limit noise exposure during nighttime hours and limit certain construction impact equipment would help to minimize construction noise.

Maximum construction vibration impacts would be the same as those described for SA1, with no expected damage to structures. Since the nearest sensitive receptors are located more than 40 feet from the site, vibration levels would be below the human annoyance threshold of 80 VdB.

Broad Street Substation Inductor Option 2 (BI2)

With Broad Street Substation Inductor Option 2 (BI2), the inductor and associated equipment would be installed near the Broad Street Substation, near the southeast corner of Taylor Avenue and Harrison Street. Installation of the series inductor equipment would require excavation of up to 2,000 cubic yards of material, slightly less than with Bl1. The distance to the nearest sensitive receptor would be approximately 200 feet. Consequently, similar to BI1, construction of the Broad Street Substation site under BI2 is expected to comply with the restrictions of the City's Noise Ordinance and would not have a significant noise impact. The restrictions of the ordinance would limit noise exposure during noise-sensitive hours.

Maximum construction vibration impacts would be the same as those described for BI1.

4.2.4 Distribution System

Construction of the Phase 1 Build-out and Future Build-out areas would involve the construction equipment indicated in Table 4-4. Not all of the equipment identified in Table 4-4 would operate throughout the construction period. It is anticipated that a given block would be under construction over an approximately 2-month period. Construction of the Phase 1 Build-out and Future Build-out areas would occur in the South Lake Union area and be installed as needed.

There are sensitive receptors scattered throughout both the Phase 1 Build-out area and the Future Build-out area of the distribution system. Approximately 6 percent of the land uses in the Phase 1 Build-out area are residential and 7 percent of the land uses in the Future Build-out area are residential or mixed use residential. Most are upper-story residential units, many of which would be as close as 20 feet to construction activity and exposed to construction noise over an approximately 2-month period. For these receptors, similar to the discussion under TL1, potential construction noise impacts would not be significant during daytime hours because of the restrictions in the City's Noise Ordinance, the type of equipment proposed for construction, and the BMPs identified in Section 4.5, Mitigation Measures.

The potential also exists for nighttime construction work to be conducted to avoid significant traffic impacts. If project conditions necessitate nighttime work, City Light would obtain a variance to the City's noise ordinance which would dictate noise minimization strategies (identified as a mitigation measure in Section 4.5). Night-time construction work near residential receptors would have the potential to result in sleep interference which would be a significant noise impact. Therefore, a measure is identified in Section 4.5 to restrict, when feasible, certain types of nighttime construction activity when located within 500 feet of residential receptors to mitigate this potentially significant noise impact.

Maximum construction vibration impacts would be the same as those described for all transmission line alternatives in Section 4.2.2 above.

4.3 Operational Impacts

4.3.1 Substation Alternatives

Impacts Common to All Alternatives

Operation of substation equipment under all three substation alternatives would result in occasional impulsive noise events (load tap changer operations of transformers to regulate voltage and tie-breaker noise of switching equipment), the duration of which would typically be less than 2 seconds and the frequency of which would range from daily to monthly. Because noise levels from such events are not specified in equipment design, monitoring of impulsive noise events at existing substations was conducted to estimate the magnitude of noise they typically generate.

- Tap changer noise results in a maximum noise level of 65 dBA L_{max} at 25 feet.
- Tie-breaker noise results in a maximum noise level of 77 dBA L_{max} at 25 feet.
- Gas-insulated switchgear impulsive noise can generate a maximum noise level of 81 dBA L_{max} at 25 feet.

Assessing Operational Noise Impacts

The potential noise increase from transformers; inductors; heating, ventilation, and air conditioning (HVAC) equipment; and a backup generator at the proposed Denny Substation was estimated by modeling attenuated noise levels at the sensitive receptors surrounding the substation site, following noise specifications provided by City Light (using SoundPLAN version 7.2, a three-dimensional sound propagation modeling software program). Equipment location and orientation were accounted for in each substation alternative, as were the presence of proposed screening walls.

Significance assessment considered both the restrictions of the SMC in terms of an applicable exterior noise limit as well as whether noise levels would increase perceptibly over existing ambient noise levels as measured during nighttime hours.

Because of their short duration and relative infrequency, impulsive noise events would not have a meaningful effect on the hourly equivalent noise level, which is the basis for standards of the City's Noise Ordinance. Therefore, these events would not result in a violation of the City's Noise Ordinance standards. These noise levels can be characterized as similar to a car door slam and other existing short-term, maximum noise levels in the substation area that commonly exceed 90 dBA L_{max}.

Addition of Decibel Levels

The human ear perceives sound in a non-linear fashion; hence, the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. A doubling of sound energy translated into a 3 dBA increase. However, in terms of human perception, a 3 dBA increase is a barely perceptible increase while a10 dBA increase is perceived as a doubling of loudness.

Operation of all three substation alternatives would also include occasional use of trucks and other heavy equipment for maintenance activities. These activities would be infrequent but would typically include vehicle engine noise and backup signals required for safety purposes. This type of noise could be noticeable to adjacent residents, especially if it occurs during nighttime hours. Scheduled maintenance would typically occur during the day, but on rare occasions some such activities may extend into nighttime. BMPs to minimize this type of noise are discussed in Section 4.5, Mitigation Measures. One standard type of mitigation measure for this impact is use of ambient-sensitive broadband backup alarms on vehicles. City Light's fleet already employs these devices.

Substation Alternative 1 (SA1)

Sound emitters associated with the substation over the life of its operation would include inductors, transformers, transformer cooling fans, air-handling equipment, and a backup stationary generator. Under SA1, all air-handling equipment and switchgear would be in the basement and surrounded by concrete, which would attenuate equipment noise except for at-grade exhaust louvers. Transformers, a control room, and the backup generator would be on the street level. Exterior sound specifications for this equipment were provided by City Light and were accounted for in the noise modeling. Ceramic fire walls would partially enclose transformers on the site and were also included in the modeling. The noise modeling for SA1 assumes that noise from the equipment on the basement level would not significantly contribute to the overall noise levels because of the attenuation provided by the earth surrounding the basement. Although the backup generator, outside of emergency conditions, would be operated monthly for just 10 to 20 minutes for maintenance purposes, the noise analysis conservatively adds generator noise to the project totals from all sources when assessing impacts.

The analysis of SA1 assumes the presence of a screen wall around the substation yard. Based on information about likely materials provided by the designers, the wall was assumed to be a solid material such as 18-gauge steel. Two wall heights were assumed: a "high" wall and a "low" wall. (See Chapter 3, Aesthetics, for a discussion of these wall heights.)

The cumulative noise contribution from all project sources under SA1 at sensitive receptors surrounding the proposed project site, assuming the presence of a high screen wall or a low screen wall, were determined. These contributions conservatively assume that all equipment would operate simultaneously at the full-load sound rating as a worst-case analysis. As a practical matter, the backup generator would only operate monthly for maintenance purposes, outside of emergency conditions. (During emergency conditions, the generator could be required to run 24 hours a day until full power is restored, and it is unlikely that all substation equipment would be operating under such conditions.) Additionally, transformer cooling fans would be unlikely to operate at night.

The results were compared to assess consistency of substation operations with the restrictions of the City's Noise Ordinance. Table 4-5 compares the modeling results for all three substation alternatives under worst-case screening scenarios for the nearest receptors.

Table 4-5. Maximum Operational Noise Contributions

Receptor Location (see Figure 4-1)	Noise Levels in dBA				
	Cumulative Substation Contribution	Applicable Noise Ordinance Standard	Average Existing Nighttime Hourly Leq	Resultant Nighttime Noise Level	Increase over Existing Nighttime Hourly Leq
Substation Alternative 1 (SA1) – Low Screen Wall Scenario					
David Colwell building – rooftop (Location 2 in Figure 4-1)	**61**	60	65	66	1
SCCA – roof deck (Location 4 in Figure 4-1)	56	60	62	63	1
Alley 24 – roof deck (Location 3 in Figure 4-1)	56	60	62	63	1
The Brewster apartments – top story (Location 5 in Figure 4-1)	50	60	64	64	<1
Mirabella Seattle Retirement Community – top level (Location 6 in Figure 4-1)	54	60	65	65	<1
Substation Alternative 2 (SA2) – Perimeter Screen Wall Scenario					
David Colwell building – Rooftop (Location 2 in Figure 4-1)	**61**	60	65	66	1
Alley 24 – roof deck (Location 3 in Figure 4-1)	59	60	62	64	2
SCCA – roof deck (Location 4 in Figure 4-1)	58	60	62	63	1
The Brewster apartments – top story (Location 5 in Figure 4-1)	57	60	64	65	1
Mirabella Seattle Retirement Community – top level (Location 6 in Figure 4-1)	56	60	65	66	1
Substation Alternative 3 (SA3) – Low Screen Wall Scenario					
David Colwell building – rooftop (Location 2 in Figure 4-1)	59	60	65	66	1
Alley 24 – roof deck (Location 3 in Figure 4-1)	56	60	62	63	1
SCCA – roof deck (Location 4 in Figure 4-1)	56	60	62	63	1
The Brewster apartments – top story (Location 5 in Figure 4-1)	53	60	64	64	<1
Mirabella Seattle Retirement Community – top level (Location 6 in Figure 4-1)	55	60	65	65	<1

Source: Rosen et al., 2014
Bold values exceed the applicable noise ordinance standard.
dBA = A-weighted decibels; Leq = equivalent sound level; SCCA = Seattle Cancer Care Alliance

Without mitigation, operation of SA1 with the low screen wall scenario would occasionally exceed the noise ordinance restrictions for commercial areas by up to 1 dBA at one elevated receptor location (above ground level at the David Colwell building), as shown in Table 4-5. This low screen wall version of SA1 would comply with the City's Noise Ordinance requirements everywhere else around the substation site. The primary sources contributing to noise levels at the David Colwell building would be the 26-kilovolt (kV) air-handling equipment on the maintenance building and the backup generator (which would only operate sporadically). Mitigation for this minor impact is identified in Section 4.5, Mitigation Measures.

However, while the alternative could technically exceed the allowable noise limit at one location, this alternative would not result in a significant increase over existing ambient noise levels in general. During nighttime hours, the greatest increase in sound levels over existing hourly nighttime noise levels would be 1 dBA, which would not be perceptible at any of the modeled locations.

Noise contributions at the David Colwell building under SA1 with a high screen wall would not exceed the ordinance noise limit and would therefore comply with the City's Noise Ordinance restrictions, as well as not perceptibly increasing ambient noise in the area.

Substation Alternative 2 (SA2)

The analysis of SA2 operations assumes the presence of a screen wall around the project site. The wall was assumed to be a solid material such as 18-gauge steel. In SA2, the exterior walls would include a perimeter screen wall and a superstructure placed above the perimeter screen wall (see Figure 2-9 in Chapter 2, Description of Project and Alternatives). The sides of the superstructure would not extend to the ground but instead end at the elevation of the top of the perimeter screen wall. In addition to the perimeter screen, the walls of this superstructure would act as sound barriers and reflectors.

The cumulative noise contribution from all project sources at sensitive receptors surrounding the proposed project site under SA2, assuming the presence of a perimeter screen wall with and without the superstructure, were determined.

Without mitigation, operation of SA2 either with or without the superstructure would occasionally exceed the noise ordinance restrictions for commercial areas by up to 1 dBA at one elevated receptor location (above ground level at the David Colwell building), as shown in Table 4-5. Both of these SA2 scenarios would comply with the City's Noise Ordinance requirements everywhere else around the substation site. The primary sources contributing to noise levels at the David Colwell building would be the 26-kV air-handling equipment in the maintenance building and the backup generator (which would only operate sporadically). Mitigation for this minor impact is identified in Section 4.5, Mitigation Measures.

Additionally, the greatest increase over existing hourly nighttime noise levels would be 2 dBA, which would not be perceptible at any of the modeled locations. This would be considered a less-than-significant operational noise impact. If generator maintenance operations are restricted to daytime hours, the resultant nighttime noise increases would be further reduced.

Substation Alternative 3 (SA3)

The analysis of SA3 assumes the presence of a screen wall around the substation yard. As with SA2, the wall is assumed to be a solid material such as 18-gauge steel. Two wall heights were assumed: a high wall and a low wall.

The cumulative noise contribution from all project sources under SA3 at sensitive receptors surrounding the proposed project site, assuming the presence of a high screen wall and a low screen wall, were determined. The resultant noise contributions at all receptor locations for both wall heights would be below the City's Noise Ordinance standards by 3 to 15 dBA, as indicated in Table 4-5. Additionally, no receptors would experience a noticeable increase in nighttime hourly noise levels (no more than 1 dBA) under SA3 with either screen wall height. If generator maintenance operations are restricted to daytime hours, the resultant nighttime noise increases would be further reduced.

4.3.2 Transmission Line Alternatives

Potential operational impacts would be the same under all transmission line alternatives. Operation of an overhead line with any of the transmission line alternatives would generate random crackling or hissing noise associated with corona discharge, which occurs under high voltages. Corona discharge occurs when the voltage of the line exceeds the insulating capability of air. Corona discharge is higher on misty days because the air has a lower insulating ability when wet. Also, particles such as dust or water droplets that might come in contact with a conductor tend to increase corona discharge. Therefore, the potential for noise from corona discharge is greatest during wet weather.

The only potentially overhead portions of the transmission line would be south of South Royal Brougham Way in an area composed entirely of commercial and industrial land uses. The sound generated by a 115-kV transmission line during adverse weather conditions such as fog or rain can be between 30 dBA and 40 dBA at 90 feet from the conductor (CPUC, 2005), which equates to an L_{dn} range of between 36 and 46 dBA L_{dn}. The lines are likely to be 150 feet overhead, so the sound levels at ground level would be lower. The sound generated by a 230-kV line during wet weather conditions would produce noise levels of approximately 46.6 dBA to 49.6 dBA at ground level within the right-of-way (PG&E, 2010). In the context of the SODO (South of Downtown) area, these are not considered adverse impacts because they would not be noticeable in the high noise environment.

4.3.3 Broad Street Substation Inductor Options

Broad Street Substation Inductor Option 1 (BI1)

Under BI1, the proposed inductor and associated equipment would be installed in the Broad Street right-of-way north of the annex, west of Taylor Avenue North. According to project engineers, similar to the Denny Substation alternatives, inductors are assumed to have an as-built design noise rating of 65 dBA as measured at 1 meter (3.3 feet) from the noise equipment.

The land uses surrounding the Broad Street Substation are primarily office, retail, and lodging. There is a single residential apartment building on Thomas Street, approximately 500 feet east of the Broad Street Substation Annex where the inductors would be installed. Two-dimensional noise modeling indicates that, at this distance, operational noise from an inductor would be reduced to 38 dBA L_{eq}, which is substantially below the existing monitored noise level of 62 dBA L_{eq}, and would not result in a measureable increase in ambient noise levels. Consequently, operational noise impacts of the improvements to the Broad Street Substation would not be noticeable under BI1.

Broad Street Substation Inductor Option 2 (BI2)

Impacts under BI2 would be the same as those described for BI1 except that operational noise from the inductor would be further reduced because the inductor would be shielded from the residential apartment building on Thomas Street by a masonry wall and intervening structures.

4.3.4 Distribution System

This completely underground component of the proposed project would not generate any operational noise in either the Phase 1 Build-out area or the Future Build-out area. In the rare event that line maintenance were to be required, which would likely occur at night to avoid traffic impacts, there could be temporary construction noise impacts similar to those described in Section 4.2.4.

4.4 Impacts of No Action Alternative

With no new substation, transmission line, or additional network service under the No Action Alternative, the only component of the proposed project that would be constructed would be the inductors. Installing an inductor at the Denny Substation site would likely require short-term work in the right-of-way to split the existing underground transmission line into two lines. Construction noise and vibration impacts would be the same as those described for the hoe ram under Section 4.2.1. Construction noise and vibration impacts associated with installation of the inductor at the Broad Street Substation or Annex would be the same as those described in Section 4.2.3. Construction of these inductors would not result in significant noise or vibration impacts. When operational, these facilities would not generate a perceptible noise impact.

Additional underground distribution lines between Broad Street and Union Street Substations may be installed under the No Action Alternative. This would result in construction noise impacts similar to those described in Section 4.2.4, with no significant impacts expected.

4.5 Mitigation Measures

The construction and operational noise impacts that the Denny Substation Project might pose would be avoided or reduced by implementing both general and specific mitigation measures.

4.5.1 General Avoidance and Minimization Measures Common to all Alternatives

Construction Noise

Although construction-related noise would comply with the restrictions of SMC 25.08.425, City Light will implement BMPs to minimize construction noise in the vicinity of the substation, transmission line route, Broad Street Substation inductor installation, and distribution system. Specifically, City Light's contractors will be required to comply with the following measures as a condition of the construction contract:

1. Equipment and trucks used for project construction must employ the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible).
2. Impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction must be hydraulically or electrically powered to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used.
3. Stationary noise sources must be located as far from adjacent receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures to provide the greatest degree of equivalent noise reduction. The contractor

will also be required to use the on-site electrical power source at the substation to power some equipment and help limit generator use where possible during construction.

4. Building owners and occupants within 500 feet of construction areas must be notified at least 1 week prior to operation of impact equipment such as hoe rams or large-scale concrete breakers. This notification shall identify the best estimate of start and finish dates and hours of potential operation.
5. If a noise variance is needed for nighttime construction, specific measures to minimize the period of high noise levels would be developed in consultation with the City of Seattle Department of Planning and Development. The variance could include limitations on use of specific equipment, timing, or other restrictions to minimize impacts based on a specific construction plan.
6. Use of hoe rams, auger drills and large bulldozers within 40 feet of residential uses must be restricted to daytime hours, as feasible, to reduce potential vibration annoyance impacts.
7. City Light's fleet of vehicles is being switched over to Broadband "Whitenoise" ambient noise sensitive back up alarms that emit a deeper tone, directionally. Any City Light or contractor vehicles visiting the construction site would have these new alarms or would switch off backup alarms and replace with spotters while at the site.

Generator Operations

To mitigate operational impacts during nighttime hours, maintenance operations of the backup generator would be conducted during the day and not exceed 30 minutes for each occurrence or occur more than once a week.

City of Seattle Noise Ordinance Compliance

Noise modeling conducted for this analysis was also performed to identify whether equipment with lower-noise rating would be required to meet the restrictions of the City's Noise Ordinance for any of the proposed substation alternatives.

4.5.2 Specific Mitigation Measures

Construction Mitigation for Substation and Transmission Line Alternatives and Distribution System

Should the project require nighttime construction for substation construction or transmission line or distribution system installation to avoid traffic impacts, use of concrete breakers and other impact equipment during nighttime hours within 500 feet of a residence or lodging facility should be avoided to the extent feasible.

Operational Mitigation Common to All Substation Alternatives

In order to minimize noise annoyance from backup signals during routine maintenance operations, City Light would schedule routine maintenance during the daytime hours, to the extent practicable.

Operational Mitigation – Substation Alternative 1 (SA1)

To reduce equipment noise at the eastern border of the proposed SA1 substation site, City Light would do the following, to the extent practicable:

1. Construct SA1 with the high screen wall.
2. Relocate the backup generator to the basement (with appropriate exhaust ventilation).
3. Install heating, ventilation, and air conditioning (HVAC) equipment on the rooftop of the control room with a noise rating of 70 dBA or less at 1 meter (3.3 feet).
4. Install sound insulation jackets (such as QBS Blankets) around HVAC equipment on the rooftop of the control room capable of achieving a 2 dBA reduction.

Operational Mitigation – Substation Alternative 2 (SA2)

Implementation of one of the following measures would reduce equipment noise at the eastern border of the proposed SA2 substation site to levels allowed by the City's Noise Ordinance:

1. Relocate the backup generator so that it is farther than 60 feet from the nearest property.
2. Install HVAC equipment on the rooftop of the control room with a noise rating of 70 dBA or less at 1 meter.
3. Install sound insulation jackets around HVAC equipment on the rooftop of the control room capable of achieving a 2 dBA reduction.

Operational Mitigation – Substation Alternative 3 (SA3)

No operational mitigation for noise would be required for SA3 because modeling indicates that equipment would operate within the restrictions of the SMC and resultant noise level increases would not be noticeable during nighttime hours.

4.6 Unavoidable Significant Adverse Impacts

There would be no unavoidable significant impacts with regard to construction-related or operational noise or vibration from any of the proposed alternatives. If nighttime construction activity is required, such as to avoid significant transportation impacts, the degree of impact would depend on the duration and intensity of nighttime noise. Significant impacts could result if high noise generating activities such as use of a hoe-ram for breaking concrete were to be necessary within 500 feet of a residence, lodging facility or similar sensitive use. It has not been determined that any such high nighttime noise activity near sensitive uses would be necessary. If it was found to be necessary, City Light would be required to apply for and obtain a noise variance and demonstrate what measures were taken to minimize such impacts in its final design of the project.

Chapter 5: ENVIRONMENTAL HEALTH – ELECTRIC AND MAGNETIC FIELDS

5.1 Affected Environment

The topic of electric and magnetic fields (EMF) is included in this Draft EIS to address concerns about the potential health effects of exposure to power-frequency EMF. Significant adverse impacts from exposure to EMF as a result of the Denny Substation Project are not anticipated.

Although electric fields can be easily shielded by conducting objects, such as buildings, magnetic fields generated by electrical equipment and appliances cannot be shielded by such objects. In the absence of observed health effects from environmental electric fields, scientific research on potential health effects has focused on magnetic fields. This chapter, likewise, focuses on the magnetic field component of EMF. In describing EMF associated with the proposed project, this chapter focuses only on the power-frequency EMF inherent in the project, (that is, EMF associated with transmission and distribution of 60 hertz [Hz] electric power)[1].

This section includes information on EMF fundamentals as background for the discussion of potential health effects. The scope and findings of studies published by organizations that continue to examine the possible health effects from power-frequency EMF are also described.

Existing magnetic fields near the Denny Substation site and transmission line alternatives routes are documented in this section. The distribution system and Broad Street Substation inductor project components would have magnetic fields similar to those identified for the Denny Substation site, and were therefore not separately measured.

EMF Key Findings

The potential for electric and magnetic field (EMF) health effects has been studied extensively for decades. There is substantial agreement among experts that there are no confirmed adverse health impacts from 60 hertz (Hz) EMF exposure.

Scientific evidence remains inconclusive on risk of childhood leukemia in homes with stronger magnetic fields and research on this topic continues.

Guidelines and standards developed for limiting EMF exposure are based on known biological effects from very high fields, such as occur in some occupations.

The Denny Substation Project will increase EMF within localized areas surrounding the project electrical facilities. These fields will fall significantly below limits in EMF exposure guidelines and standards.

No adverse health impacts are known from power-frequency EMF. It follows that none will result from the project. This includes no unavoidable significant environmental impacts under SEPA.

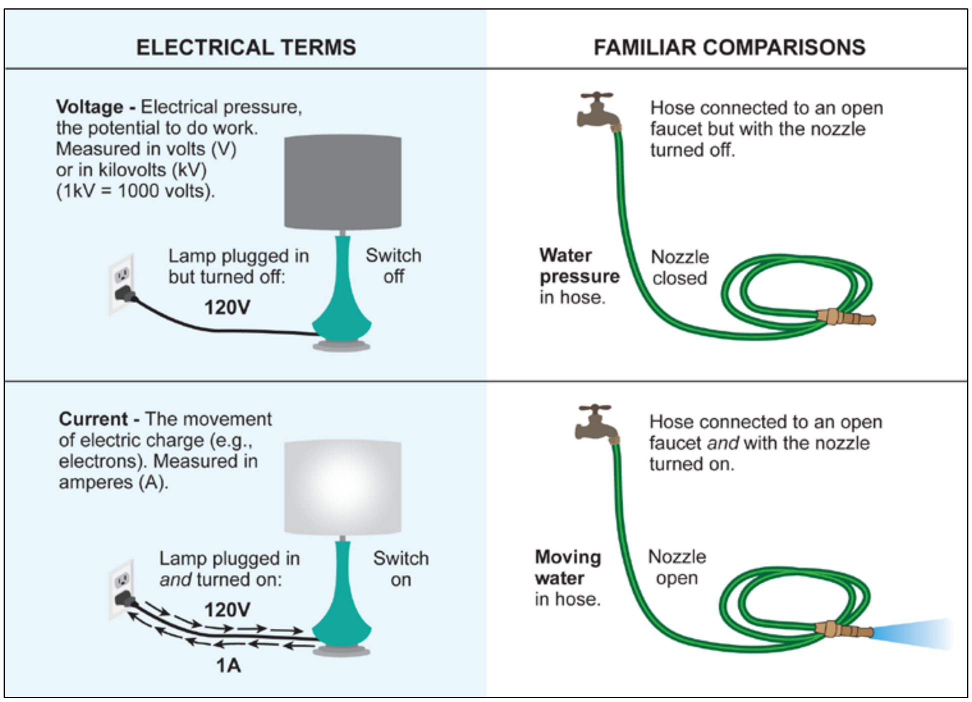
[1] The term EMF in this chapter refers to electric and magnetic fields at extreme low frequencies (ELF). EMF can be used in a much broader sense as well, encompassing electromagnetic fields with low or high frequencies. In the ELF range, electric and magnetic fields are not coupled or interrelated the same way that they are at higher frequencies. This is why the term is described as “electric and magnetic fields” and not “electromagnetic fields.”

5.1.1 Electric and Magnetic Fields (EMF) Fundamentals

Power lines, electrical wiring, and appliances are all surrounded by EMFs, as also occurs with other manmade and natural sources of electrical and magnetic energy. Electric fields and magnetic fields have different origins and distinctive properties. Electric field strength is related to the voltage in use, and magnetic field strength is related to current flow, measured in amperes (see Figure 5-1). Whereas voltage on electrical lines remains relatively constant, the amount of current (amperes), and therefore magnetic field strength, varies with the amount of electrical power being used at any moment (see Figure 5-2).Electric power is the product of the applied voltage and the current. Electric fields are easily shielded or weakened by conducting objects; however, magnetic fields are not. Distance from an electrical source is an essential factor in assessing EMF exposure because the strength of EMFs (both electric and magnetic fields) decreases rapidly with distance from the source (see Figure 5-3).

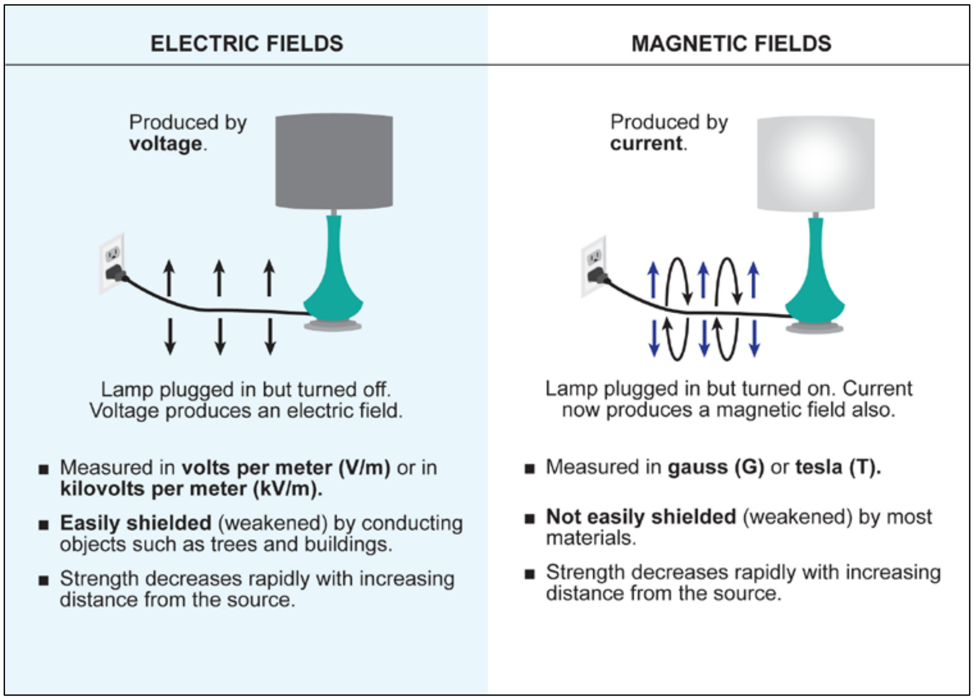
Magnetic fields very close to electrical appliances and power tools are often much stronger than those near other sources, such as magnetic fields directly under power lines; however, the fields surrounding appliances and electric motors decrease in strength with distance more quickly than power line fields because of the confined wiring configuration and resulting cancellation of opposing fields. (Magnetic fields are commonly measured in milligauss [mG] or gauss [G], and microtesla [µT] or tesla [T]. The tables in this chapter are in milligauss, gauss or both. One gauss = 1,000 milligauss. For non-magnetic materials such as air, one tesla is equivalent to 10,000 gauss.)

Figure 5-1. Electrical Terms



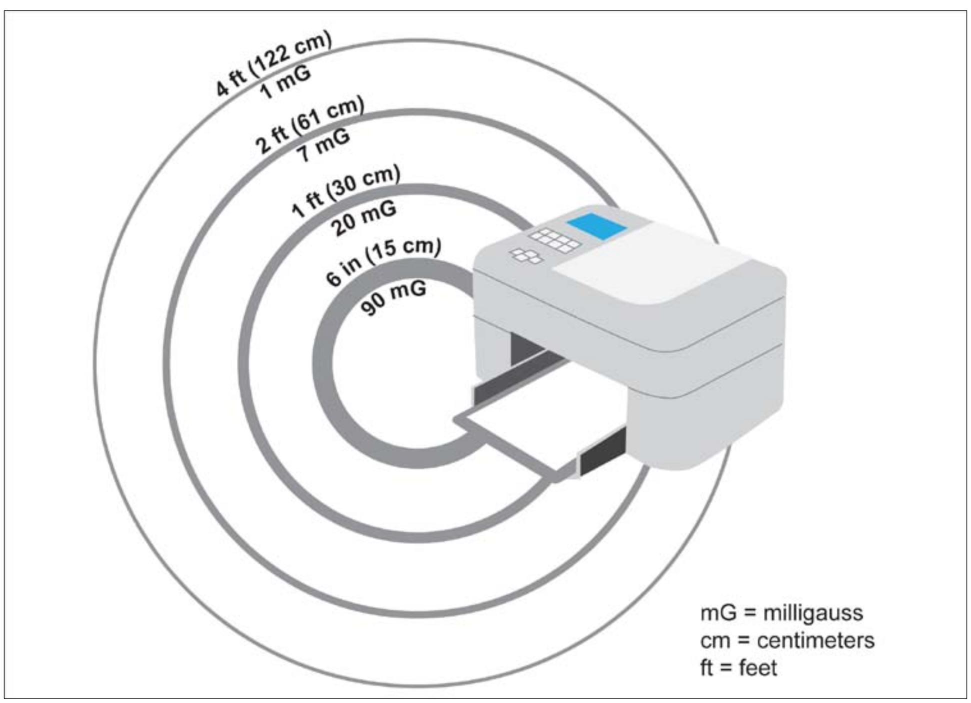
Source: NIEHS, 2002

Figure 5-2. Electric and Magnetic Fields Produced by Voltage and Current



Source: NIEHS, 2002

Figure 5-3. Magnetic Field Strength Decreases with Distance



Source: NIEHS, 2002

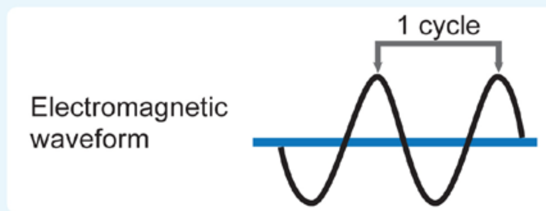
Electric fields and magnetic fields are characterized by their frequency, wavelength, and amplitude (strength). Figure 5-4 shows the waveform of an alternating electric or magnetic field. In one complete cycle the field switches from one polarity to the opposite and back to the first polarity during a time interval called the period. The frequency of the field describes the number of cycles that occur in one second and is measured in hertz (Hz). Wavelength, which is of little interest at power frequencies, is for any alternating field the distance between a peak on the wave and the next peak of the same polarity.

Electricity generation, transmission, and use in North America is almost entirely at 60 cycles per second, or 60 Hz, a frequency that falls in the extremely low frequency (ELF) range of 3 to 3,000 Hz at the low-end of the overall frequency spectrum.

At the high end of the overall frequency spectrum is ionizing radiation, such as x-rays and gamma rays, that fall into a broad frequency range, for which a billion-billion Hz is typical. In the middle of the spectrum (less than one million to billions of cycles per second) are the radio-frequency fields used for television, radio, cell phones, and microwaves.

Figure 5-4. Frequency and Wavelength

Frequency is measured in **hertz (Hz)**.
1 Hz = 1 cycle per second.



Examples

Source	Frequency	Wavelength
Power line (North America)	60 Hz	3100 miles (5000 km)
Power line (Europe and most other locations)	50 Hz	3750 miles (6000 km)

Source: NIEHS, 2002

Most people in the United States are exposed to magnetic fields that average less than 2 milligauss (mG) in strength, although exposures for each individual vary. Average magnetic field levels within rooms have been found to be approximately 1 mG based on several large surveys, while in the immediate area of appliances, the measured values ranged from 9–20 mG (Severson et al., 1988; Silva et al., 1988). An EPRI study of 992 homes reported the average residential magnetic field value at 0.9 mG (Zaffanella, 1993). City Light was one of 25 electric utilities that participated in this nationwide residential measurement program.

Table 5-1 lists the median magnetic field levels in mG generated by electrical appliances typically found in households. The strength of the magnetic field does not depend simply on the complexity, size, or power of the appliance. Large appliances often have weaker magnetic fields than small devices.

Table 5-1. Median Magnetic Fields (mG) Generated by Household Appliances

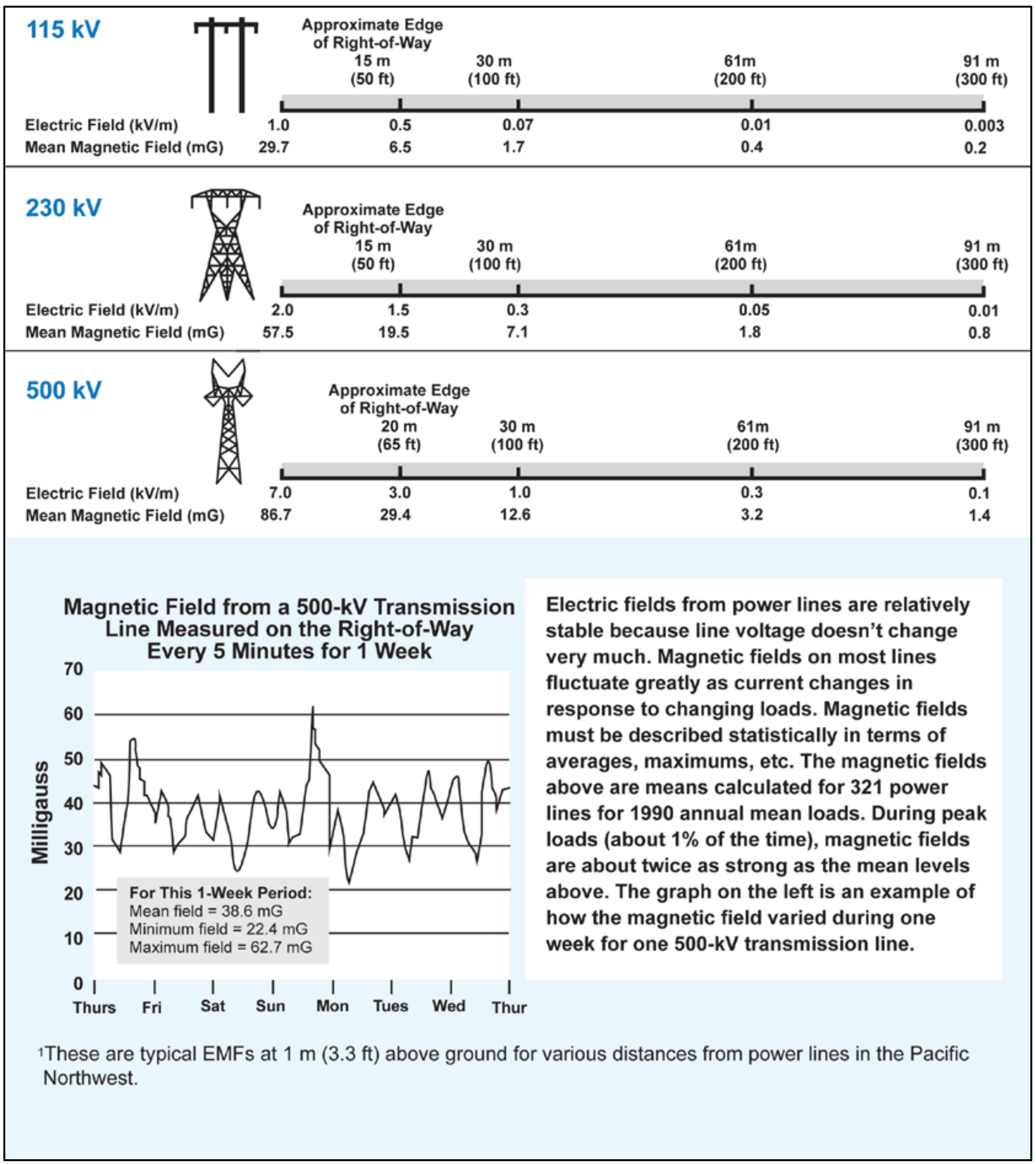
Appliance	Distance from Source		Appliance	Distance from Source	
	6 inches	4 feet		6 inches	4 feet
Bathroom Sources			**Kitchen Sources**		
Hair dryers	300	-	Blenders	70	-
Electric shavers	100	-	Can openers	600	2
Family Room Sources			Coffee makers	7	-
Ceiling fans	3	-	Dishwashers	20	-
Window air conditioners	3	-	Food processers	30	-
Televisions[1]	7	-	Garbage disposals	80	-
Bedroom Sources			Microwave ovens[2]	200	2
Digital clock[3]	1	-	Mixers	100	-
Baby monitor	6	-	Electric ovens	9	-
Laundry/Utility Services			Electric ranges	30	-
Dryer	3	-	Refrigerators	2	-
Washing machine	20	-	Toasters	10	-
Iron	8	-	**Workshop**		
Portable heaters	100	-	Battery chargers	30	-
Vacuum cleaner	300	1	Drills	150	-
			Power saws	200	-

Source: EMF in Your Environment, U.S. Environmental Protection Agency, 1992, as cited in NIEHS, 2002.

Notes:
mG means milligauss
Dash (-) means that the magnetic field at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.
[1] Some appliances produce both 60Hz and higher frequency fields. For example, CRT-based televisions produce fields at 10,000–30,000 Hz (10-30 kHz) as well as 60-Hz fields.
[2] Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the appliance that is at a much higher frequency (about 2.45 billion hertz). Users are shielded from the higher frequency fields but not from the 60-Hz fields.
[3] Most digital clocks have low magnetic fields. In the example in this table, the clocks are electrically powered using alternating current, as are all the appliances described in these tables.

Typical magnetic field levels for overhead transmission lines are shown in Figure 5-5. Overhead transmission (and distribution) lines produce higher magnetic fields than underground lines, given equal amounts of current (amperes), as a result of the much closer spacing of conductors and the metal conduit sometimes used in underground construction. The distance at which magnetic fields from transmission lines become indistinguishable from typical background levels differs for different lines, depending on the arrangement and spacing, distance above ground, and amount of current (amperes). While there has been some success with "passive shield loops" and other powerline configurations, it is very difficult to shield magnetic fields from overhead lines. However, some field reduction and cancellation is possible using designs with certain conductor arrangements and spacing. (Increasing the operating voltage to deliver the same amount of electrical power would require less amperage and also result in a reduced magnetic field.)

Figure 5-5. Typical EMF Levels for Overhead Power Transmission Lines[1]



Source: Bonneville Power Administration, 1994, as cited in NIEHS, 2002

5.1.2 Existing EMF in Project Area

Substation Alternatives

According to a report prepared by Enertech Consultants, baseline magnetic field measurements were conducted along the sidewalks, alleys, and streets adjacent to the Denny Substation site on Thursday, September 12, 2013 (Enertech Consultants, 2014). Electric field measurements were not taken because electric fields can be easily shielded by conducting objects and are not the focus of this chapter. Readings were taken late in the morning and in the evening to characterize potential variability between morning and evening electrical use. Sources of magnetic fields near the Denny Substation site include underground and overhead distribution risers, underground and overhead distribution circuits, underground service vaults and splice boxes, the underground East Pine-Broad 115-kilovolt (kV) transmission line, and electrical equipment within existing buildings.

Long-term (24-hour) stationary magnetic field measurements were also conducted at five locations near the Denny Substation site to characterize magnetic field variability over time. Meters were placed at ground level and continuously recorded magnetic fields from Thursday, September 12, 2013, to Friday, September 13, 2013. Sources of magnetic fields include internal building sources, underground distribution feeders, and service vaults (The existing underground 115-kV transmission line has little influence on measurements at these locations). Figure 5-6 shows the locations where baseline measurements were conducted.

Identifying the Affected Environment

To evaluate changes in magnetic fields that would occur as a result of the Denny Substation project, City Light retained Enertech Consultants to measure existing magnetic fields near the Denny Substation site and transmission line alternative routes (Enertech Consultants, 2014). Analysis of this information, along with review of City Light engineering drawings and power system load data were used to report on existing or baseline conditions within the project study area.

Information on electric and magnetic field (EMF) science and exposure guidelines included in this chapter was provided by Asher Sheppard, PhD (2013) who also reviewed Chapter 5. Dr. Sheppard is an independent scientist specializing in EMF.

City Light provided Enertech Consultants with information on the existing electrical infrastructure, including electrical load at the time of the measurements, to enable relating the data to total load capacity possible. The overall loading of the City Light electrical system when the magnetic field measurements were performed was significantly higher (by 28 percent) than the average load in 2013.

The sidewalk measurements document existing magnetic field levels resulting from City Light transmission and distribution feeders around the property and other sources. In general, morning measurement values were slightly higher than those recorded in the evening. Numerous sources, including those described above, were present that contributed to the overall magnetic field environment.

Figure 5-6. Magnetic Field Measurement Locations at Denny Substation Site

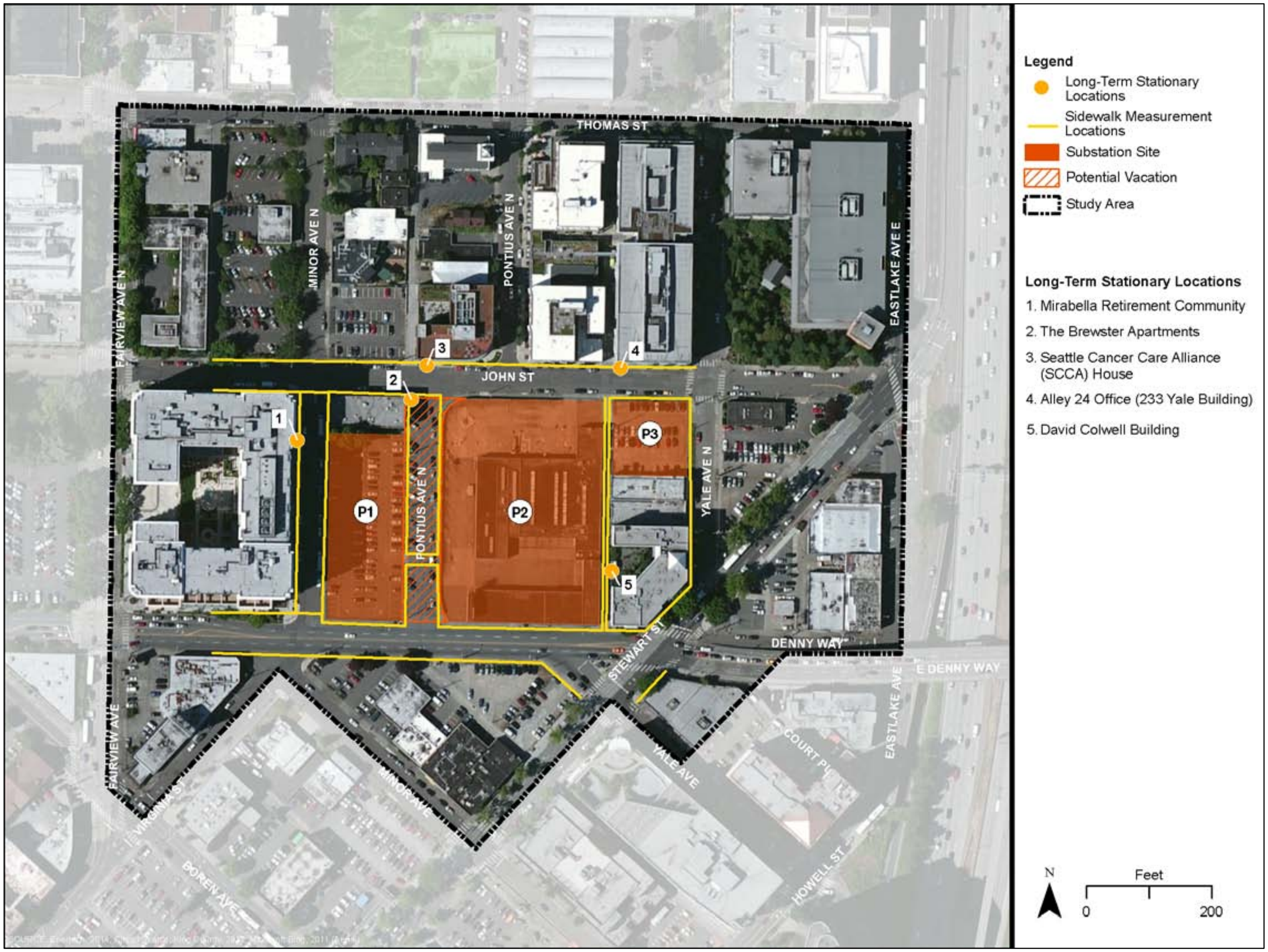


Table 5-2 provides an overall summary of both the sidewalk measurements and stationary measurements where meters were left in specific locations overnight. As shown, existing magnetic field levels ranged from as low as 0.1 mG to 14.6 mG, depending on location.

Table 5-2. Summary of Measured Magnetic Field Levels at Neighborhood Sidewalk Locations and Stationary Neighborhood Locations

Facility Description	Sidewalk Measurements		Stationary Measurements	
	Location	Range of Measured Magnetic Field (mG)[1]	Location	Range of Measured Magnetic Field (mG)
Mirabella Seattle Retirement Community	John Street	0.8 – 14.6	#1	0.5 – 3.0
	Minor Avenue North	0.1 – 1.4		
	Denny Way	0.2 – 1.2		
The Brewster apartments	Pontius Avenue North	1.3 – 4.1	#2	1.5 – 5.6
	John Street	0.5 – 4.0		
	Minor Avenue North	0.3 – 1.4		
Seattle Cancer Care Alliance (SCCA) House	John Street	0.2 – 5.7	#3	1.6 – 5.5
Alley 24 Office (233 Yale Building)	John Street	0.3 – 3.8	#4	1.6 – 3.9
David Colwell building	Alley	0.2 – 11.3	#5	3.1 – 11.3
	Denny Way	0.2 – 2.6		
	Stewart Street	0.2 – 0.6		
	Yale Avenue	0.1 – 3.5		
Parking lots	John Street	0.5 – 7.1	N/A	
Parking lots/retail	Denny Way	0.2 – 2.6		

[1] Includes both morning and evening measurements.

A computer model of the area surrounding the proposed Denny Substation was created to calculate magnetic fields from existing overhead and underground transmission and distribution circuits. Figure 5-7 shows the resulting magnetic field contour map. These calculations are estimates of magnetic field strength based on City Light plan and profile drawings, combined with the site baseline measurement results collected on Thursday, September 12, 2013. These calculations represent point estimates for the day of site measurements; distribution feeder loads have both diurnal and seasonal variations.

Figure 5-7. Magnetic Field Contour Map Based on the Measurements at the Denny Substation Site

Source: Enertech, 2014

Transmission Line Alternatives

Baseline magnetic field measurements were conducted in September 2013 at selected locations along the transmission line alternatives routes. Magnetic field sources included internal building sources and overhead and underground street sources. Measurements were typically performed along the sidewalks up to the edge of buildings and by crossing the streets from one side of the street to the other along the route alignment. Transmission line baseline measurements were conducted at 1 meter (3.28 feet) above ground level in accordance with appropriate Institute of Electrical and Electronics Engineers (IEEE) standards (IEEE 644-1994). The locations of the baseline measurements are shown in Figure 5-8.

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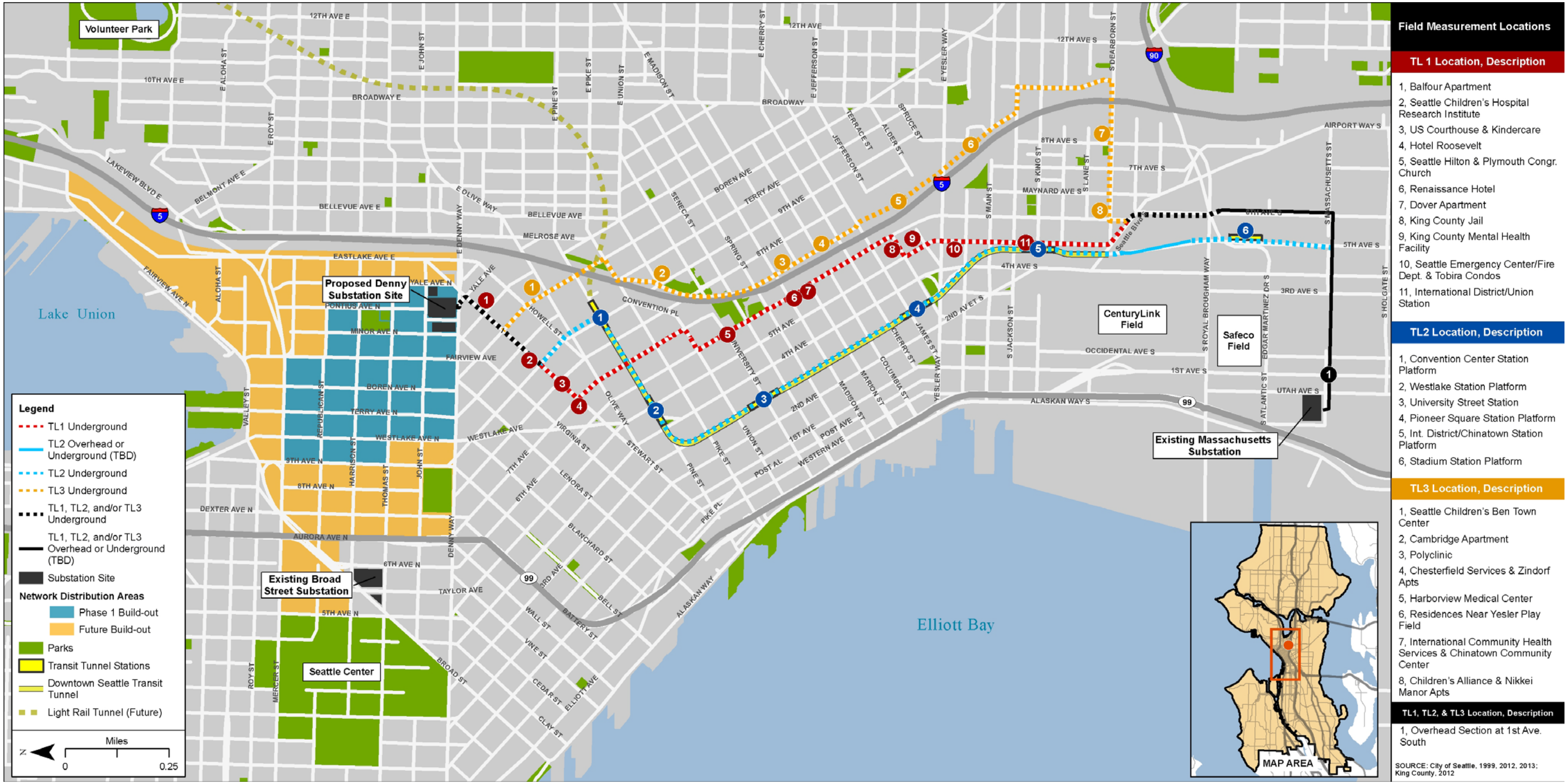
Figure 5-8. Magnetic Field Measurement Locations Along Transmission Line Alternative Routes



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Numerous magnetic field sources were present at the various route locations. Sources included internal building sources as well as underground street sources, and overhead sources at the south end. As presented in Table 5-3, measured field levels ranged from as low as 0.0 mG (hospital parking lot) to as high as 25.3 mG (next to an apartment building). Where multiple measurement profiles across streets were performed for a particular route location, the position of the profile measurements within the block can affect the measured magnetic field. For some cases, elevated field readings were present near a building at one location but absent near the same building at another location. Similarly, the magnitude of the field strength crossing the street at one location may be significantly different while crossing the same street at another location farther down the street. These reported magnetic field levels represent a limited sampling of possible magnetic field levels that may be encountered at each of these route locations, although they demonstrate the variability that exists due to specific location and proximity to electrical sources.

Table 5-3. Summary of Measured Magnetic Fields - Transmission Line Alternatives 1, 2 and 3 (TL1, TL2 and TL3)

TL1 Route Locations and Measurement Data – 9/13/2013			
Location	**Description**	**Time**	**Range (mG)**
1	Balfour Apartment Building	8:11 – 8:13 AM	0.2 – 25.3
2	Seattle Children’s Hospital Research Institute	8:18 – 8:21 AM	0.2 – 1.5
3	U.S. Courthouse and KinderCare	8:24 – 8:30 AM	0.2 – 11.2
4	Hotel Roosevelt	8:39 – 8:45 AM	0.3 – 1.9
5	Seattle Hilton and Plymouth Congregational Church	9:11 – 9:16 AM	0.3 – 2.4
6	Renaissance Hotel	9:04 – 9:06 AM	0.2 – 1.5
7	Dover Apartment Building	9:00 – 9:02 AM	0.2 – 1.5
8	King County Jail	8:53 – 8:55 AM	0.3 – 0.5
9	King County Mental Health Facility	9:25 – 9:29 AM	1.9 – 9.0
10	Seattle Emergency Center/Fire Department and Tobira Condos	9:33 – 9:36 AM	0.3 – 16.3
11	International District/Union Station	9:39 – 9:40 AM	0.6 – 6.0
TL2 Route Locations and Measurement Data – 9/13/2013			
Location	**Description**	**Time**	**Range (mG)**
1	Convention Center Station platform	11:34 – 11:48 AM	0.0 – 2.1
2	Westlake Station platform	11:19 – 11:20 AM	0.1 – 0.4
3	University Street Station platform	11:06 – 11:12 AM	0.0 – 0.7
4	Pioneer Square Station platform	10:50 – 10:56 AM	0.0 – 2.5
5	International District/Chinatown Station platform	10:24 – 10:31 AM	0.0 – 3.7
6	Stadium Station platform	10:38 – 10:39 AM	0.2 – 1.0

TL3 Route Locations and Measurement Data – 9/12/2013			
Location	**Description**	**Time**	**Range (mG)**
1	Seattle Children's Ben Town Center	3:19 – 3:23 PM	0.0 – 1.0
2	Cambridge Apartment Building	3:33 – 3:34 PM	0.5 – 1.9
3	Polyclinic	3:38 – 3:39 PM	0.4 – 0.8
4	Chesterfield Services and Zindorf Apts.	3:42 – 3:43 PM	0.2 – 0.9
5	Harborview Medical Center	3:53 – 3:57 PM	0.0 – 3.7
6	Residences Near Yesler Play Field	4:02 – 4:04 PM	0.2 – 3.0
7	International Community Health Services and Chinatown Community Center	4:14 – 4:17 PM	0.4 – 6.7
8	Children's Alliance and Nikkei Manor Apartments	4:21 – 4:24 PM	0.3 – 2.5
TL1, TL2, and TL3 Route Locations and Measurement Data – 9/12/2013			
Location	**Description**	**Time**	**Range (mG)**
1	Overhead Section at 1st Avenue South	4:39 – 4:41 PM	5.1 – 15.9

5.1.3 Scientific Research on Power Frequency EMF and Human Health

Based on the information compiled by Asher Sheppard, PhD (2013), this section describes the general scope and findings of scientific studies and literature reviews published through July 2013 by scientists and health based organizations that examined, and others that continue to examine the possible health effects from power-frequency EMF. Earlier research and assessments were made by various U.S. agencies and groups, notably the National Institute of Environmental Health Science (NIEHS). In later years the World Health Organization (WHO), Advisory Group on Non-Ionizing Radiation of the Health Protection Agency (HPA) of the U.K. and International Agency for Research on Cancer (IARC) have been prominent contributors to health risk assessments.

Background

Over the last 40 years, hundreds of scientific studies have been carried out around the world to determine whether exposure to EMF can have harmful health effects. In order to draw valid scientific conclusions, the same or similar results must be seen by different investigators, who may employ different scientific approaches addressing the same question.

Study of the possibility of adverse health effects from EMF associated with electric power systems began in the early 1960s as electric power systems moved to higher transmission line voltages of 345 kV and above. Research initially was focused on effects of strong electric fields to which workers could be exposed. By the 1980s, public and scientific interest shifted to weak magnetic fields, the area in which ELF EMF research continues to date. While research on both electric and magnetic fields has answered many questions and brought consensus on certain topics, there is still uncertainty as a result of contradictory and inconclusive research results.

Research Methods

A number of scientific methods and topics in biology, human disease, biophysics, and engineering feed into answering questions bearing on public health. Research falls into these general categories:

- Epidemiology
- Laboratory studies of humans, animals, tissues, and cells
- Theoretical analyses

Epidemiology is the study of patterns and possible causes of diseases in human populations. Epidemiologists study short-term health conditions such as outbreaks of food poisoning as well as long-term diseases such as cancer and heart disease. Results of these studies are reported in terms of statistical associations between various factors and disease. Epidemiological studies often drive public health discussion and risk assessment because the research directly concerns humans.

Epidemiology has the significant challenge of determining whether statistical findings reflect a true causal association or whether other factors (notably, confounders) are involved. To a non-expert the language of epidemiology can appear more precise and definitive than it is. A "statistically significant" finding only shows a probability that the finding occurred above a certain level of chance, and regardless of statistical probability, a positive association does not itself provide proof of a cause and effect relationship. Typically, supplemental data are needed from multiple epidemiologic approaches and other study methods before a causal relationship can be established. The other study methods that bear on whether an agent such as EMF causes disease include clinical studies of humans and laboratory studies with animals, biological tissue, and cells.

A recurrent feature of EMF science is that effects tend to be small and difficult to reproduce even after undertaking considerable effort to match experimental conditions. This is an important limitation that prevents drawing firm conclusions. It is particularly noteworthy that there has been difficulty in replicating animal studies that have reported adverse effects. Taken together with the inconclusive nature of the epidemiological research, there is consequently a high level of skepticism among many scientists that the positive associations of some epidemiological analyses are "real," that is, scientifically valid, and therefore there remains considerable doubt about the role, if any, environmental ELF magnetic fields play in human health. Doubt also is promoted by quantitative studies of the known biological and biophysical interactions of ELF magnetic fields with living organisms. These studies indicate that environmental ELF fields are too weak to produce effects in cells, tissues, organs, animals, or humans.

Ongoing Research and Unresolved Issues

There is still work underway to find answers to questions about EMF and possible health effects. Some examples include:

- Research on childhood leukemia – Large studies continue, with one being conducted in California sponsored by the Electric Power Research Institute.
- Research on co-carcinogenesis – Do one or more agents, such as EMF plus a biochemical, environmental chemical, or physical agent act together to exacerbate the growth and expansion of tumor cells, while alone one such agent may not have an effect?
- Research on neurodegenerative diseases – There are conflicting findings on a connection between neurodegenerative diseases, particularly amyotrophic lateral sclerosis (ALS), and

magnetic fields, though there is no known mechanism for such an effect. Worker studies are in progress to examine the possibility that frequent electric shock may increase the risk of ALS rather than EMF exposure.

- Research on EMF interference with implanted medical devices – Longstanding research has concerned possible interference with the functioning of implanted devices such as cardiac pacemakers, which is of most concern within occupational environments. However, certain devices in use close to very high-voltage electric fields remain a potential concern for the general public. Exposure guidelines have been developed for workers, and manufacturer data sheets provide limitations on device performance during EMF exposure. Work is continuing to develop laboratory bench testing and a more precise understanding of EMF tolerances of these devices.

5.1.4 Summary of Findings by Scientific Groups and Health Organizations

Conclusions on public impacts of exposure cannot be obtained from a single study or a small number of studies but require a considerable body of evidence placed in the context of biological knowledge obtained from laboratory experiments and physical principles. To meet the challenge of fairly assessing the information, public health analysts assemble evidence from the entire body of science using established measures and techniques. The methods of the "Weight of the Evidence for Carcinogenicity" developed by the U.S. Environmental Protection Agency (U.S. EPA) (2005), and a method developed for the IARC Monographs Program (IARC, 2006) are prominent mainstream approaches for risk assessment. IARC is an agency of the WHO and draws upon top research scientists throughout the world. Both U.S. EPA and IARC methodologies have been used by other agencies worldwide and have been adapted for assessing diseases other than cancer.

After more than 40 years of research, unresolved questions about ELF magnetic field exposure and childhood leukemia that surfaced in 1979 (Wertheimer and Leeper, 1979) continue to drive risk assessment. This is indicated by publications, comments, and conclusions from various scientific bodies:

- IARC (2002) conducted an extensive review of the literature in epidemiology, animal, and cell laboratory studies and a review of biophysical principles. Their conclusion was that power frequency magnetic fields fell into the category of "possible carcinogens" based on "limited evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to childhood leukemia." For leukemia and all other cancers among adult populations (both residential and occupational), evidence was not considered sufficient to support classification of EMF as a possible causal factor. For more information go to: http://monographs.iarc.fr/ENG/Monographs/vol80/index.php.

- IARC's conclusions and classifications closely resemble those of an earlier NIEHS evaluation that found that ELF magnetic fields were possible carcinogens. NIEHS drew this conclusion based on the "limited evidence" from childhood epidemiology and evidence concerning one type of adult leukemia among workers exposed occupationally. For more information go to: http://www.niehs.nih.gov/health/assets/docs_a_e/emf1.pdf. (NIEHS, 1998).

- In response to inquiries on The Health Council of the Netherlands's interpretation of research on possible health effects from power-frequency EMF (The Health Council of the Netherlands, 2008), this organization offered the following perspective:

  "Epidemiological studies showed an increased risk of leukaemia among children living in locations where the field strength was higher than 0.3–0.4 microtesla (µT). However no indications of a causal mechanism have been found in experimental research. The possibility cannot be excluded that a factor other than exposure to a low-frequency magnetic field could explain the association found in epidemiological research.” For more information go to: http://www.gezondheidsraad.nl/en/publications/high-voltage-power-lines-0.

- The Health Protection Agency (HPA) of the United Kingdom has published opinions on EMF human health effects in recent years. The last full HPA report on power-frequency EMF was in 2001. “At present there is insufficient new information that would justify the development of an update to the 2001 report, although it will be needed at some point in the future” (HPA, 2013).
- The most recent update to the European Union position prepared by the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR, 2009) presented conclusions similar to those above.

5.1.5 Exposure Guidelines

Guidelines and standards developed for limiting power-frequency EMF exposure are shown in Tables 5-4, 5-5, and 5-6. These guidelines provide context for understanding the estimates of magnetic fields calculated for the Denny Substation project. These guidelines are generally accepted to protect the health of workers or workers and the general public based on expert review of the available science. The guidelines cited here were published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP); the American Council of Governmental Industrial Hygienists (ACGIH), which is concerned about workers in the United States; and the International Committee on Electromagnetic Safety (ICES), operating under the oversight and rules of the IEEE Standards Association (hence sometimes referred to as the IEEE guidelines).

Table 5-4. Summary of ICNIRP Exposure Guidelines

Exposure (60 Hz)	Magnetic Field Maximums
Occupational	10 G (10,000 mG)
General public	2.00 G (2,000 mG)

G = gauss; Hz = hertz; ICNIRP = International Commission on Non-Ionizing Radiation Protection; mG = milligauss
Source: ICNIRP, 2010

Table 5-5. Summary of ACGIH Exposure Guidelines

Exposure (60 Hz)	Magnetic Field Threshold Limit Values
Occupational exposure should not exceed:	10 G (10,000 mG)
Prudence dictates the use of protective clothing above.	—
Exposure of workers with cardiac pacemakers should not exceed:	1 G (1,000 mG)

ACGIH = American Council of Governmental Industrial Hygienists; G = gauss; Hz = hertz; mG = milligauss
Source: ACGIH, 2009

Table 5-6. IEEE Exposure Levels for 60 Hz Magnetic Fields

Exposure (60 Hz)	Magnetic Field Maximums
General public should not exceed:	9,040 mG (9.04 Gauss)
Controlled environments should not exceed:	27,100 mG (27.1 Gauss)

G = gauss; Hz = hertz; IEEE = Institute of Electrical and Electronics Engineers; mG = milligauss
Source: IEEE, 2002

Two states (Florida and New York) also have standards for magnetic fields from overhead transmission lines. The foundation of these standards was to make the field levels from new overhead power lines similar to those from existing overhead lines. Table 5-7 presents a summary of the state standards for magnetic fields (NIEHS and NIH, 2002).

Table 5-7. State Transmission Line Magnetic Field Standards and Guidelines

State	Magnetic Field at ROW Edge
Florida	150 mG (max load)[1] 200 mG (max load)[2] 250 mG (max load)[3]
New York	200 mG (max load)

[1] For lines of 69-230 kV
[2] For >230 and ≤500 kV lines
[3] For >230 and 500 kV lines on certain existing ROW
ROW = right-of-way (or in Florida standard, certain additional areas adjoining the right-of-way)

5.3 Characterization of Existing and Future Magnetic Field Levels

5.3.1 Substation Alternatives

Substation Modeling and Comparison of Fields to Existing Conditions

Power frequency (60 Hz electric power) magnetic field calculations were performed using computer software called EMF Workstation 2012, to generally characterize changes in magnetic field levels that could occur with the Denny Substation Project (Enertech Consultants, 2014). (See the Enertech Report for additional information about the software.) The analysis covered three stages of electrical build out and load: an initial stage following substation completion in 2017, addition of the new transmission line in 2018, and addition of 26 kV distribution circuits and a fourth transmission line, with an approximation of maximum electrical load at some point in the future.

This evaluation was based upon information from the 30 percent substation electrical design, specific equipment type and specifications, and electrical load estimates for the three stages of substation development. The electrical layouts for all substation alternatives would be very similar and Substation Alternative 3 (SA3) was used as a proxy for all alternatives since its electrical and equipment design is the most advanced of the three alternatives. EMF in urban environments is complex due to the presence of multiple sources and potential current-carrying conductors other than electrical cables such as water pipes.

Assessing Future Magnetic Fields

Enertech estimated the likely future magnetic fields associated with the operation of the Denny Substation, new distribution feeders, and transmission line using computer models. The models looked at future conditions at three development phases after the substation and transmission line would be energized. For estimating future conditions, Enertech used software (EMF Workstation 2012) developed for modeling magnetic fields, and engineering design data from City Light and Power Engineers.

This section also discusses the potential for EMF associated with the transmission line to interfere with transit equipment and operations within the Downtown Seattle Transit Tunnel under Transmission Line Alternative 2 (TL2).

The calculations for the substation area were fairly complex, involving modeling of substation equipment and transmission and distribution lines. The results of the modeling convey the scale of magnetic field changes as a result of the project, and provide an approximation not an exact prediction of future conditions. The calculations contain assumptions about the electrical load, which varies throughout the day and through the seasons.

Key assumptions used in constructing the substation (and transmission) model scenarios are provided in Appendix H, Electric and Magnetic Fields Supplemental Information.

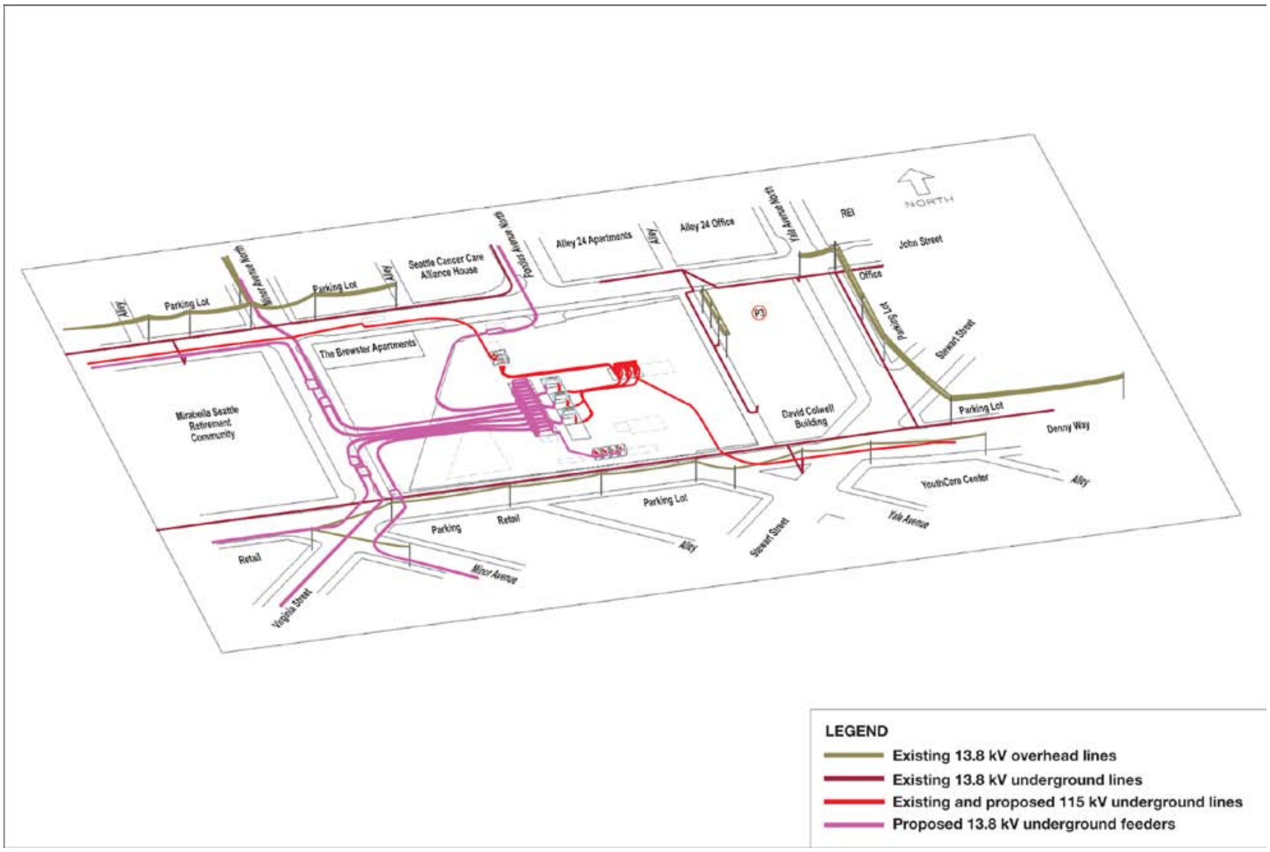
Change in Field Conditions Common to All Substation Alternatives

Magnetic field calculations were modeled for three different phases of the substation to show the changes in field conditions over time. Calculations for each design phase were modeled based on the locations of distribution feeders and transmission line routes and substation equipment locations and/or specifications, and an assumed substation electrical load, with the understanding that any changes to the substation design could affect the calculated magnetic field results from those modeled. For more detail about the assumptions used for the modeling of each design phase (including a specific list of substation equipment), see Appendix H, Electric and Magnetic Fields Supplemental Information.

2017 – Initial Substation Design Phase

For the 2017 design phase, Enertech included new network distribution feeders, the existing East Pine-Broad transmission line (see below) as reconfigured, substation equipment that would be included in the initial stage of development in 2017 and an assumed electrical load of 50 megavolt ampere (MVA). This model included the splitting of the existing East Pine-Broad 115-kV underground transmission line into two separate lines (to create the East Pine-Denny (EP-DN) and Denny-Broad (DN-BR) 115-kV underground transmission line circuits). Figure 5-9 presents a perspective view of the 2017 substation equipment layout used to model magnetic fields.

Figure 5-9. Perspective View of the Equipment Layout for Proposed Denny Substation in 2017

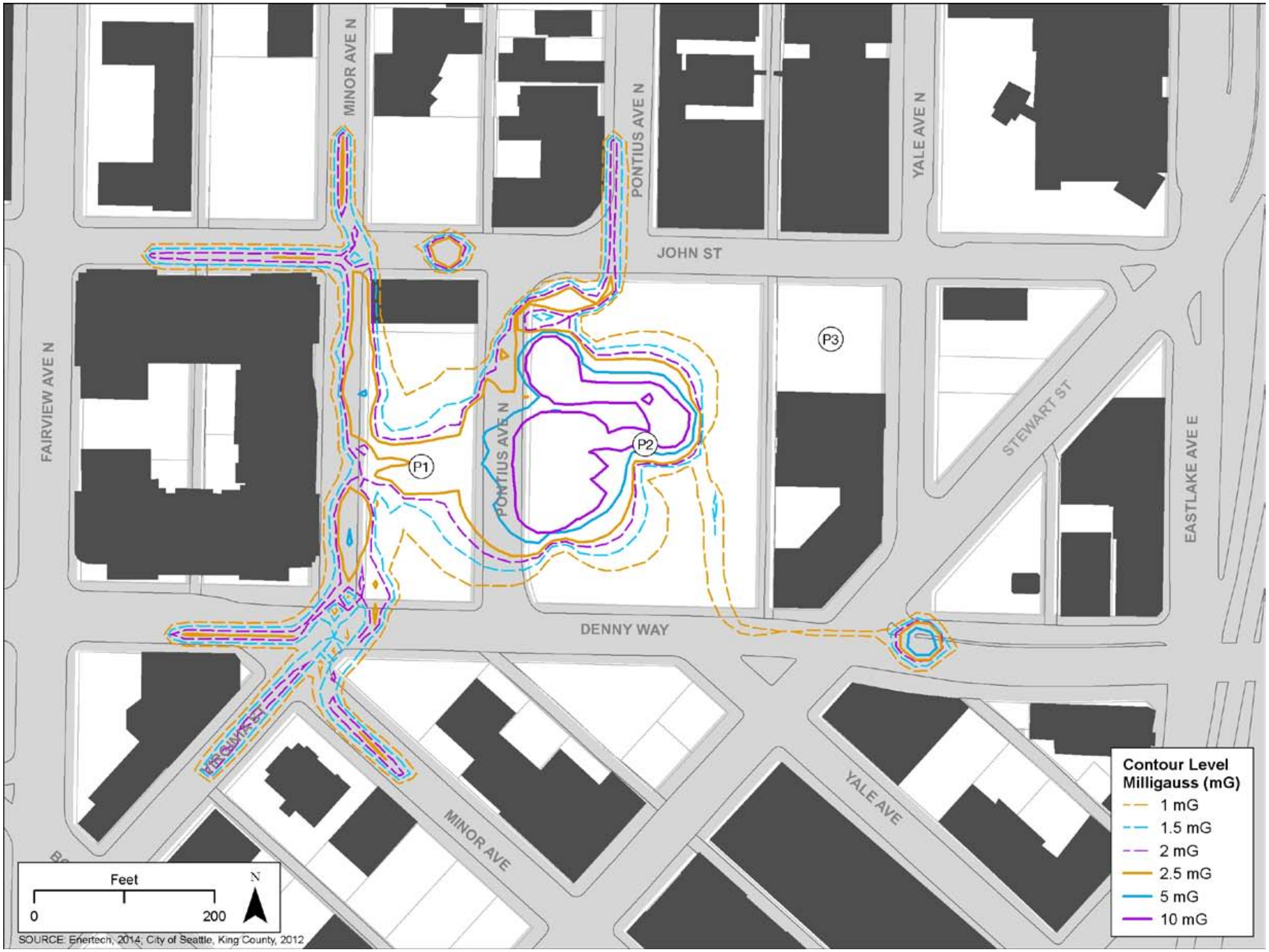


Source: Enertech, 2014

Magnetic field calculations were then performed for the immediate vicinity of the proposed substation and neighboring buildings. A contour map (Figure 5-10) was created to illustrate the results of the calculated magnetic field levels in the vicinity of the substation. Contour levels of 1 mG, 1.5 mG, 2 mG, 2.5 mG, 5 mG, and 10 mG are shown in Figure 5-10.

The Enertech report presents detailed load flow diagrams, circuit duct diagrams, and other related information used in the development of this computer model and corresponding magnetic field results, and more detailed contour maps of the calculated magnetic field levels.

Figure 5-10. Calculated Magnetic Field Contour Map for Proposed Denny Substation in 2017 (50 MVA)

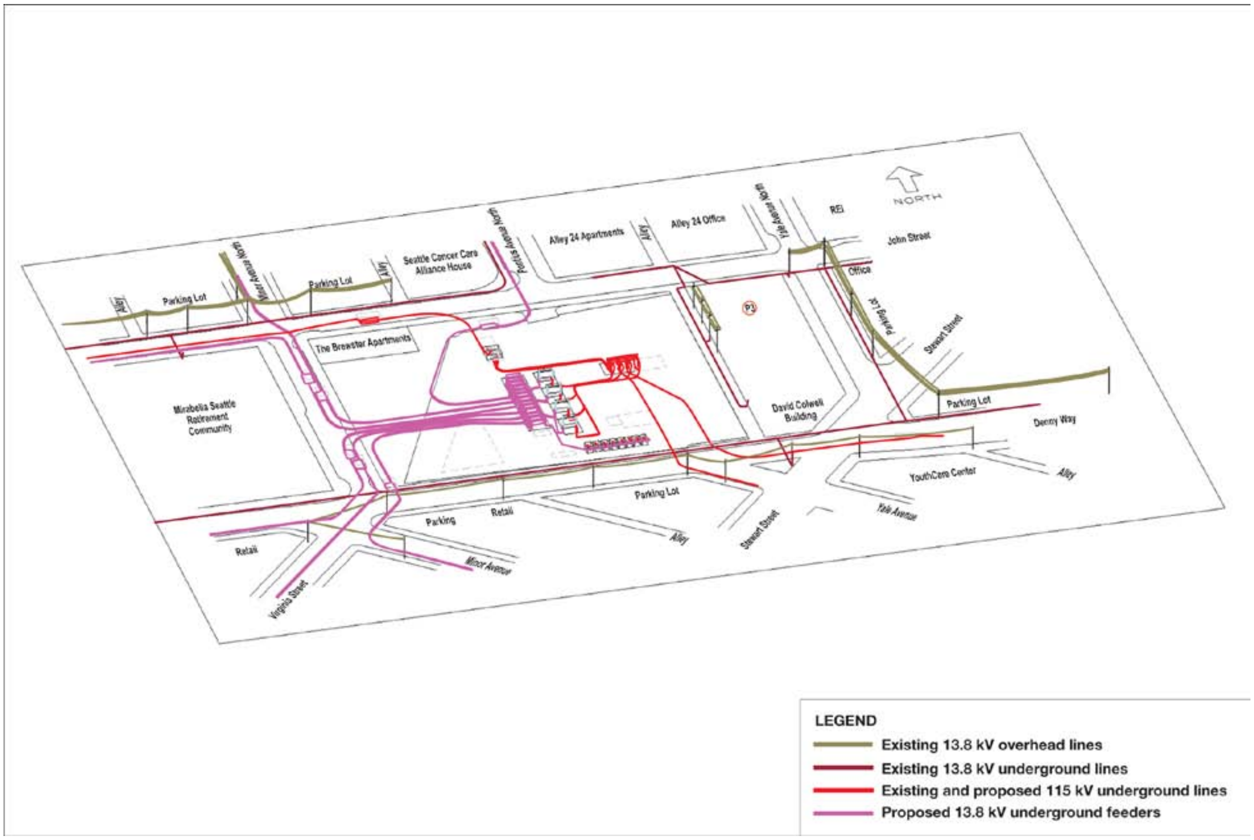


2020 – Upgraded Substation Design Phase

Using the 2017 substation computer model, Enertech modified the model to include anticipated changes and additions to the substation that would occur by 2020. This model included the addition of the proposed Denny-Massachusetts 115-kV underground transmission line, distribution feeders, switchgear bays, a transformer, and capacitor banks.

The projected 2020 loading of the substation is 125 MVA. Figure 5-11 shows a perspective view of the substation equipment layout based on a diagram of the 2020 computer model.

Figure 5-11. Perspective View of the Equipment Layout for Proposed Denny Substation in 2020



Source: Enertech, 2014

Figure 5-12 is a contour map that shows the magnetic field calculation results created for the immediate vicinity around the proposed substation and neighboring buildings.

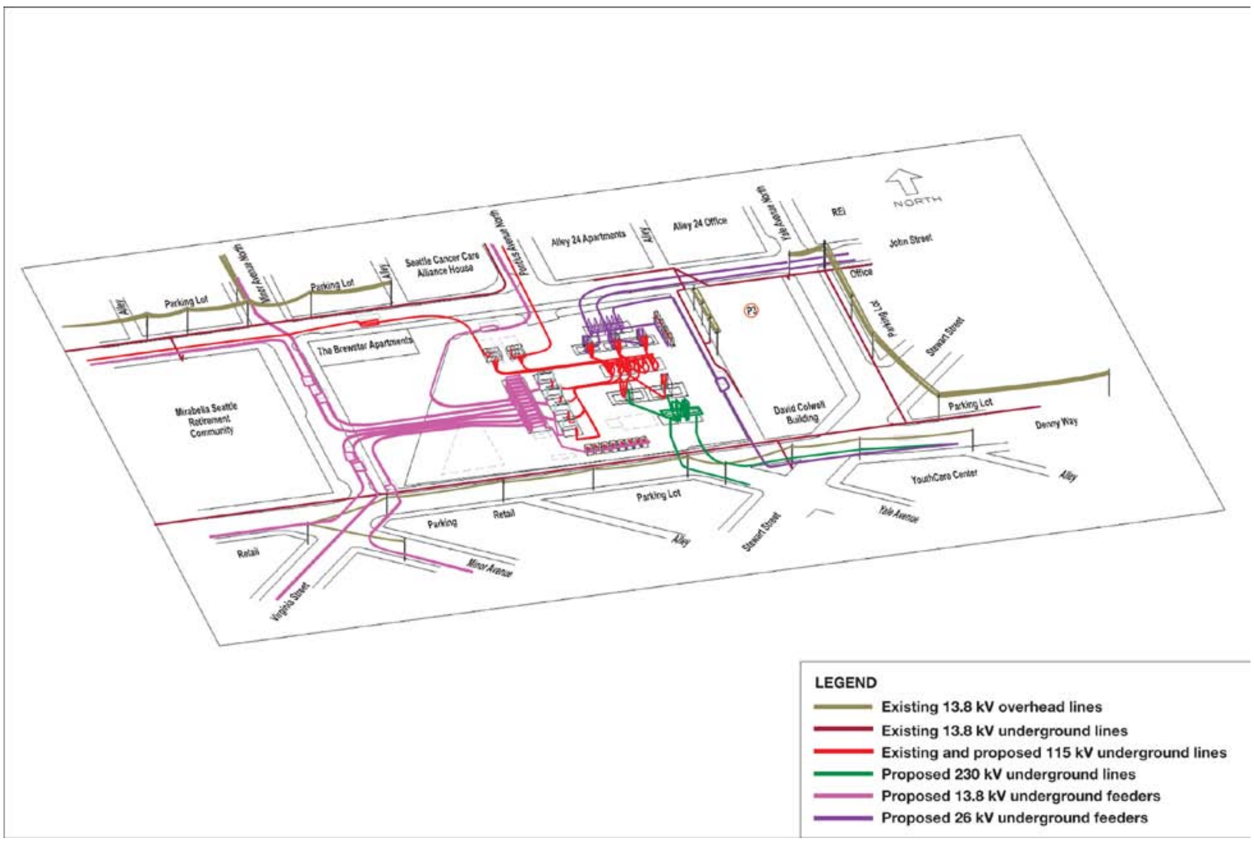
Figure 5-12. Calculated Magnetic Field Contour Map for Proposed Denny Substation in 2020 (125 MVA)

2035 – Ultimate Substation Design Phase

Utilizing the 2020 substation computer model, Enertech modified the model to include anticipated changes and additions to the Denny Substation that would occur by 2035. This model included the Denny-Massachusetts underground transmission line upgraded from 115-kV to 230 kV, the EP-DN underground transmission line upgraded from 115-kV to 230 kV, the addition of the new Denny-Canal 115-kV underground transmission line; and additional distribution feeders, an inductor, switchgear bays, transformers, and capacitor banks.

The projected 2035 loading of the substation is 405 MVA, with 225 MVA designated for the 13.8-kV distribution circuits and 180 MVA designated for the 26-kV distribution circuits. Figure 5-13 shows the perspective view for 2035 Denny Substation equipment layout based on diagrams of the 2035 computer model.

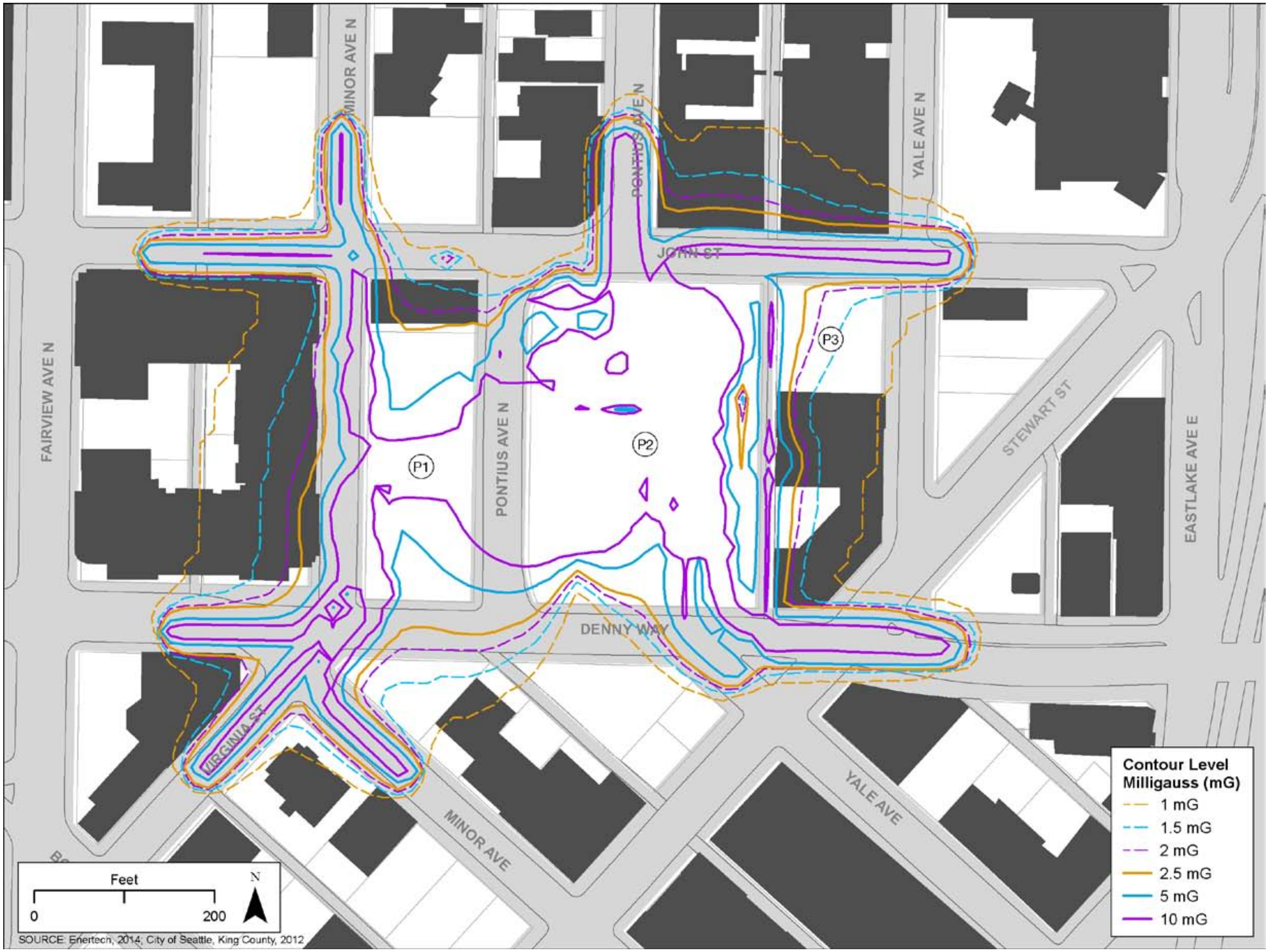
Figure 5-13. Perspective View of the Equipment Layout for Proposed Denny Substation in 2035



Source: Enertech, 2014

A contour map of the magnetic field calculation results created for the Denny Substation vicinity is presented in Figure 5-14.

Figure 5-14. Calculated Magnetic Field Contour Map for Proposed Denny Substation in 2035 (405 MVA)



Summary of Substation Modeling Results

Table 5-8 presents a summary of projected magnetic field levels from the Denny Substation based on the computer modeling results. The results show magnetic field changes at 1-meter (3.28-feet) above ground level within streets, and at the edges of neighboring buildings surrounding the proposed substation site. The model results do not incorporate existing field levels, only the field levels resulting from the project. While direct measurement provides the most reliable means of characterizing existing conditions, measured and calculated values cannot simply be added together. This is because measured values are the result of all existing sources of EMF, as well as other features below the ground and within structures that are not known and thus cannot be added to the model. However, the model results represent a conservative estimate of future fields from the project and provide a rough basis for looking at fields from the project in the context of the existing conditions (measurements) for this urban environment.

Table 5-8. Summary of Projected Magnetic Field from the Project at Building Edge Locations Based on Computer Modeling Results

Facility Description	Calculated Magnetic Field (mG)		
	2017 Design (50 MVA)	2020 Design (125 MVA)	2035 Design (405 MVA)
Mirabella Seattle Retirement Facility	0.5	1 – 2	1 – 5
The Brewster apartment building	0.5–2	1 – 5	2 – 10
Seattle Cancer Care Alliance House	0-1	1 – 3	1 – 5
Alley24 Apartment Building	0	0-0.5	2 – 5
David Colwell building	0.5	0.5 – 1	4 – 15

mG = milligauss; MVA = megavolt ampere
All values are calculated at 1 meter (3.28 feet) above the ground.

For the 2017 design phase, magnetic field increases would be relatively low (1 mG or less) within most neighboring buildings and areas in the immediate vicinity of the substation due to the new substation equipment and changes to the existing transmission line. Magnetic fields in portions of the street and sidewalk locations (where the new underground 13.8-kV distribution feeders would be routed) would increase from existing levels, but would be primarily contained within the streets and sidewalks themselves. Along Minor Avenue North, where the majority of the underground 13.8-kV distribution feeders would be routed, magnetic field levels would increase slightly at the edge of some neighboring buildings (for example, along the eastern edge of The Brewster apartment building, magnetic fields would increase by about 0.5 to 2 mG). Along Pontius Avenue North, north of John Street, magnetic field levels would increase in the street areas, but only by about 1 mG or less at the outside edge of the Seattle Cancer Care Alliance (SCCA) building.

For the 2020 design phase, the magnetic field levels would be higher than the 2017 levels in areas in the vicinity of the underground 13.8-kV distribution feeders since the distribution feeders would have doubled in number, and each feeder would be operating at a higher load. Along Minor Avenue North, magnetic field levels would increase slightly at the edge of most neighboring buildings (for example, along the building edge of The Brewster apartment building, field levels of about 2 mG from the 2017 model would increase to about 5 mG). Along Pontius Avenue North, north of John Street, magnetic field levels would increase along the edge of the SCCA building (from 2017 levels of about 1 mG to about 2.5 mG at the closest building edge). Magnetic field levels would also increase slightly along the neighboring building edge east of the substation, due to the addition of the proposed Denny-Massachusetts 115-kV underground transmission line, and associated substation equipment (increases of about 1 mG at some building edges).

For the 2035 design phase, the 2020 magnetic field levels would increase compared to the 2020 design phase in areas where underground 13.8-kV and 26-kV distribution feeders would be located. For this model, the number of 13.8-kV distribution feeders would increase along the three southern routes, as well as have an almost 50 percent loading increase from the 2017 load values. Along Minor Avenue North, magnetic field levels would increase within most neighboring buildings (for example, along the edge of The Brewster apartment building, field levels of about 5 mG from the 2020 model would increase further to approximately 10 mG). Magnetic field levels at the neighboring building edge, the Mirabella Seattle Retirement Community building, would increase from 2020 levels of about 2 mG to around 5 mG at some locations. Along Pontius Avenue North, north of John Street, magnetic field levels at the SCCA building would increase to about 5 mG at the closest building edge (with lower field levels extending farther into the building areas). Magnetic field levels would also increase along John Street and the eastern alley between John Street and Denny Way from the introduction of 26-kV underground distribution feeders in these areas. The magnetic field at the edge of the neighboring building east of the substation, the David Colwell building, and those buildings north of John Street (the two Alley 24 apartment buildings) would increase to about 5 mG in some areas due to these additional 26-kV underground distribution feeders. Near the new 26-kV manhole within the eastern alley, magnetic field levels at the closest building edge would approach 15 mG.

The magnetic field values shown above represent anticipated increases in existing power-frequency magnetic fields, within localized areas near the proposed Denny Substation project electrical facilities. Such fields have not been found to have adverse health impacts and fall below limits in EMF exposure standards and guidelines.

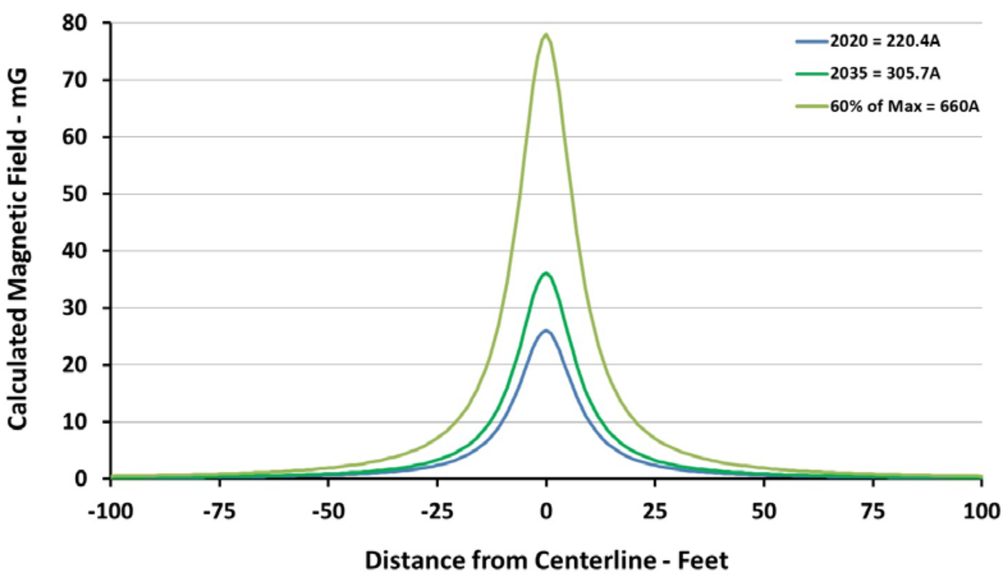
However, the fact that there is continuing scientific study of possible health effects of EMF means monitoring the research and interpretation of research results by experts will continue to be an important aspect of City Light work.

5.3.2 Transmission Line Alternatives

Transmission Modeling and Comparison of Fields to Existing Conditions

Enertech performed computer modeling for two generic sections of the proposed transmission line. These generic sections do not apply to any one specific location, but rather apply generally to any of the overall line alternative routes. Modeling for the transmission line involved a singular linear source of EMF and was less complex than substation modeling. Results of transmission calculations are expected to be within 5–10 percent of actual values for the load given. The configuration of a transmission line (and therefore its calculated magnetic field) may vary throughout its route. However, such configuration changes typically comprise a small percentage of the overall line route. Modeling was performed for the underground line design, which is proposed to be used along the majority of the transmission line route, and for the overhead line design, which is proposed for a relatively small portion of the route near the Massachusetts Substation. For each generic section, Enertech performed magnetic field calculations for three projected loading conditions: (1) 2020 loading of 220.4 amperes to represent initial load when the line is energized, (2) 2035 loading of 305.7 amperes to represent average load conditions, and (3) a peak load of 660 amperes. Calculated magnetic field levels were computed as a function of distance away from centerline of the transmission line circuit[2]. Appendix E of the Enertech report presents the transmission line geometry information and detailed calculation results for the proposed transmission line. For the underground line design, computer modeling was performed for the proposed minimum depth of 3 feet and for a projected maximum depth of 8 feet (projected depths along portions of the three proposed transmission line routes). Figure 5-15 presents the calculated magnetic field lateral profile for a minimum depth of 3 feet, while Figure 5-16 presents a similar graph for a depth of 8 feet. At the time this analysis was completed, it was unknown whether the new transmission line would use cross-linked polyethylene (XLPE) technology or be of the high-pressure fluid filled (HPFF) variety, so both were assessed._Sections of new HPFF 115-kV transmission lines were assumed to have a depth of 8 feet. Sections of new XLPE 115-kV and 230-kV transmission lines were generally assumed to enter the Denny Substation site at a depth of 10 feet and maintain that depth at the site. 115-kV HPFF transmission lines assume a 75 percent magnetic field shielding reduction due to the steel pipe enclosure surrounding the three individual phase conductors.

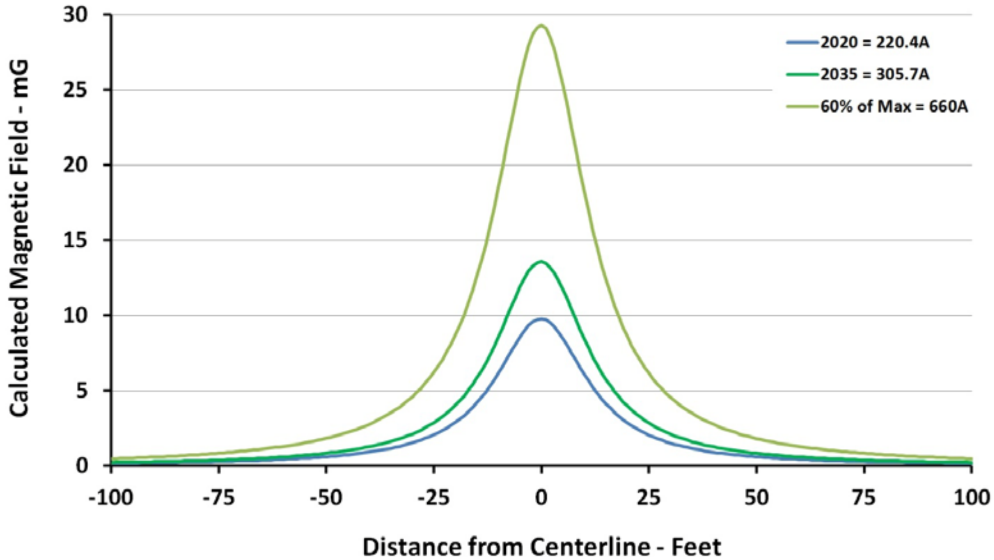
Figure 5-15. Calculated Magnetic Field Profile for Proposed Underground Transmission Line Design (Depth = 3 feet)



Source: Enertech, 2014

[2] For the overhead line, the centerline is the center of the transmission pole. For the underground line, the centerline is the center of the underground duct bank.

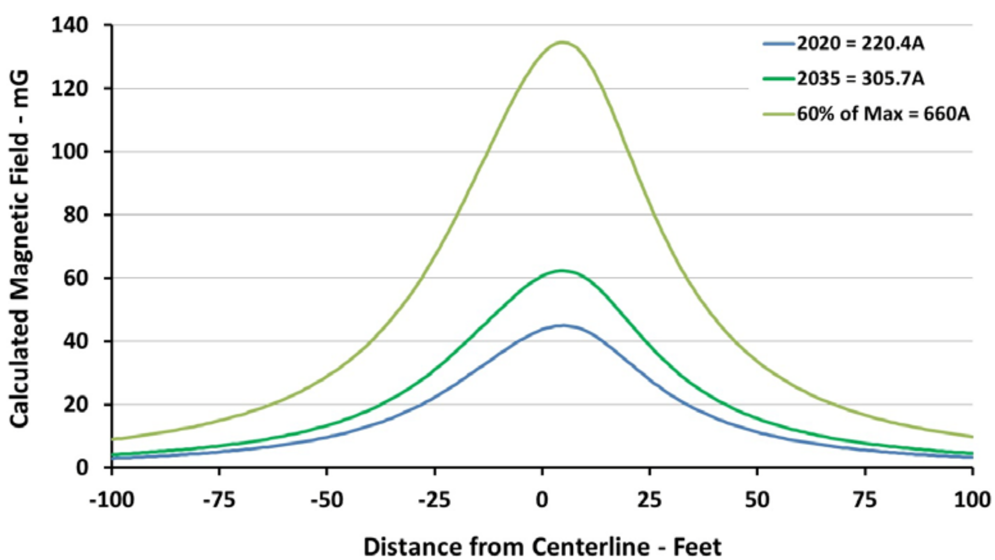
Figure 5-16. Calculated Magnetic Field Profile for Underground Transmission Line Design (Depth = 8 feet)



Source: Enertech, 2014

For the overhead line design, computer modeling was performed for the proposed minimum ground clearance of the overhead conductors. The overhead line design assumed the lowest possible transmission line ground clearance (22.4 feet, at the midpoint between poles) so that the modeling results convey the highest possible magnetic fields at one meter (3.28 feet) above the ground. Transmission pole heights have not been determined at this time and are expected to vary in height from pole to pole. Figure 5-17 presents the calculated magnetic field lateral profile for the overhead design and for each of the three different electrical load cases modeled.

Figure 5-17. Calculated Magnetic Field Profile for Overhead Transmission Line Design



Source: Enertech, 2014

Table 5-9 presents a comparison of the magnetic field calculation results for the underground and overhead transmission line design configurations. As shown in Table 5-9, magnetic field levels would be higher for the overhead (3–134.7 mG) than for the underground (0.02–78 mG) design because of the separation of the phase conductors. The maximum magnetic field for the overhead design would occur at 5 feet from centerline (rather than at centerline) due to the delta (triangular) phase configuration (see Appendix E of the Enertech report). Magnetic field levels at 100 feet from centerline would be higher for the overhead design (3–9.7 mG) than for the underground design (0.2–0.5 mG). As shown in Table 5-9, the magnetic field for the underground design would be lower as depth below ground level increases. The values shown for the underground line depths represent magnetic field levels on the ground above the transmission line.

Table 5-9. Calculated Magnetic Field Levels for Overhead and Underground Transmission Line

Distance from Centerline (Feet)[1]	Calculated Magnetic Field (mG)								
	Overhead Line Design			Underground Line Design					
	Min Ground Clearance			8-foot Depth			3-foot Depth		
	2020 (220.4A)	2035 (305.7A)	60% of Max (660A)	2020 (220.4A)	2035 (305.7A)	60% of Max (660A)	2020 (220.4A)	2035 (305.7A)	60% of Max (660A)
-100	3.0	4.1	8.9	0.2	0.2	0.5	0.2	0.2	0.5
-90	3.6	5.0	10.8	0.2	0.3	0.6	0.2	0.3	0.6
-80	4.4	6.2	13.3	0.3	0.4	0.8	0.3	0.4	0.8
-70	5.6	7.8	16.8	0.3	0.5	1.0	0.3	0.5	1.0
-60	7.2	10.0	21.7	0.4	0.6	1.3	0.5	0.6	1.3
-50	9.7	13.4	28.9	0.6	0.9	1.8	0.6	0.9	1.9
-40	13.3	18.4	39.7	0.9	1.3	2.8	1.0	1.4	3.0
-30	18.7	26.0	56.1	1.5	2.1	4.6	1.7	2.4	5.1
-20	26.6	36.8	79.5	2.9	4.0	8.7	3.6	5.0	10.7
-10	36.0	49.9	107.7	6.2	8.6	18.5	10.2	14.1	30.5
-5	40.4	56.0	120.9	8.6	11.9	25.7	18.9	26.2	56.6
0	43.7	60.6	130.9	9.8	13.6	29.3	26.1	36.1	78.0
5	45.0	62.4	134.7	8.5	11.7	25.4	18.4	25.5	55.1
10	43.3	60.1	129.8	6.1	8.4	18.2	9.9	13.8	29.7
20	33.4	46.3	100.0	2.9	4.0	8.6	3.5	4.9	10.5
30	23.0	31.9	68.8	1.5	2.1	4.6	1.7	2.3	5.1
40	15.8	21.9	47.3	0.9	1.3	2.8	1.0	1.4	2.9
50	11.2	15.6	33.6	0.6	0.9	1.8	0.6	0.9	1.9
60	8.3	11.5	24.8	0.4	0.6	1.3	0.5	0.6	1.3
70	6.3	8.8	18.9	0.3	0.5	1.0	0.3	0.5	1.0
80	4.9	6.9	14.8	0.3	0.3	0.7	0.3	0.4	0.8
90	4.0	5.5	11.9	0.2	0.3	0.6	0.2	0.3	0.6
100	3.3	4.5	9.7	0.2	0.2	0.5	0.2	0.2	0.5

A = ampere; mG = milligauss

[1] For the overhead line, the centerline is the center of the transmission pole. For the underground line, the centerline is the center of the underground duct bank. All values are calculated at 1 meter (3.28 feet) above the ground.

Similar to the substation alternatives, the magnetic field values shown above represent anticipated changes in existing power-frequency magnetic fields as a result of the proposed Denny-Massachusetts transmission line. Such fields have not been found to have adverse health impacts and fall below limits in EMF exposure standards and guidelines. However, the fact that there is continuing scientific study of possible health effects of EMF means monitoring the research and interpretation of research results by experts will continue to be an important aspect of City Light work.

Transmission Line Alternative 2 (TL2)

Electromagnetic interference (EMI) occurs when the electromagnetic fields produced by an electrical source adversely affect operation of another electrical device. EMI may be caused by a source that intentionally radiates electromagnetic fields (e.g., television or radio broadcast signals or a hand-held walkie-talkie). EMI may also result from a source with incidental power-frequency (60 Hz electric power) EMF emissions (e.g., electric motors, lighting, or power cables). Existing equipment within the Downtown Seattle Transit Tunnel (DSTT) uses electromagnetic energy and EMF at various frequencies to provide power supply, communications, track operations and other functions to ensure the safety of people and vehicles. The frequency range used in operations ranges from direct current (0 Hz) to 60 Hz (power frequency) and extends up to, and including, microwave frequencies near 1 Gigahertz (GHz).

Generally, power-frequency EMF such as from electrical distribution and transmission lines is not found to cause EMI with equipment operating at much higher radio or microwave frequencies (Silva, 2014). However, this is something that must be carefully evaluated based on the engineering details of all operations and equipment. If TL2 were pursued by City Light, the engineering team would obtain the expertise of an EMI specialist to evaluate each system and its components in relation to any power-frequency EMF anticipated from the proposed transmission line and placement in the tunnel.

This requires using standard engineering calculations and protocols for evaluating equipment susceptibility. The analysis would be designed to determine if there is any sensitive equipment susceptible to EMI from the proposed transmission line, and if so, what the specific immunity levels are. Table H-1 in Appendix H, Electric and Magnetic Fields Supplemental Information, provides a list of existing DSTT systems, equipment and general specifications. Sometimes manufacturer equipment specifications are sufficient to rule out possible EMI with some equipment. Magnetic field calculations prepared by Enertech for this chapter on transmission line EMF would contribute to this analysis. In addition, the DSTT would already have ambient EMF since it is an electrified rail system. Part of this evaluation would also include considering engineering measures to reduce transmission line EMF if necessary.

The importance of this topic can be emphasized by using tunnel track circuits as an example. In the DSTT they generally operate in the ELF (extremely-low-frequency) range of the electromagnetic spectrum. A track circuit is an electrical device used to detect the absence or presence of a vehicle on rail tracks and control relevant signals to avoid collision of moving vehicles. Interference with normal operation could result in false signals causing operational malfunctions. However, malfunctions to signaling are designed for a "fail safe" mode, meaning if something were to fail, the default setting would err on the side of safety. For example, if a sensor signaling whether a train is present or not malfunctions, it typically defaults to an indication that a train is present (rather than absent) to avoid a collision. Therefore, possible collision of vehicles and injury to people is considered unlikely. Track circuits (in this case) operate within a frequency range closer to 60 Hz than other system components in the tunnel (e.g., bus detection antennas operate in the 915 megahertz (MHz) range) Each component has electromagnetic immunity levels that vary. However, in general, track circuit equipment used on electrified railways has a higher level of EMI immunity than does equipment used on non-electrified rail systems.

5.3.3 No Action Alternative

Changes to magnetic fields associated with installation of inductors and distribution feeders would be minimal. Existing EMF conditions at the Denny Substation site would continue.

5.4 Engineering and Design Measures that Minimize EMF

The following design features of the Denny Substation Project would minimize magnetic fields:

1. Locating substation equipment centrally within the substation site whenever feasible and away from the substation perimeter.
2. Using GIS substation equipment.
3. Installing underground (rather than overhead) transmission and distribution circuits where proposed.
4. Where possible, locate underground distribution feeders centrally within streets and next to the substation (away from nearby neighborhood buildings and their sidewalks).
5. Group underground distribution feeder routes by voltage into centralized locations at the Denny Substation site.
6. As the project is built out, locate underground distribution circuits in the lowest possible duct.
7. Arrange underground three-phase distribution conductors together within ducts.
8. Analyze timing and consider increasing Denny-Massachusetts transmission line operating voltage from 115 to 230 kV earlier in build-out

No adverse impacts are anticipated to environmental health from EMF exposure; therefore, no specific mitigation measures are proposed. City Light would continue to monitor scientific research on EMF and health, providing information to customers throughout this and other SEPA review of proposed projects.

Changes in research findings could be relevant for new and existing electrical equipment and facilities.

5.5 Unavoidable Significant Adverse Impacts

No adverse impacts are confirmed or likely to exist from power-frequency EMF at the levels of public exposure from the Denny Substation Project. It follows that no unavoidable significant impacts under SEPA would occur.

Chapter 6: ENVIRONMENTAL HEALTH – HAZARDOUS MATERIALS

6.1 Affected Environment

For environmental health–hazardous materials, the assessment of the affected environment began with an investigation of the environmental setting (i.e., soil types, landforms, and surface and groundwater conditions) that form the project sites. This investigation was combined with an inventory of sites known or thought to be contaminated, both on and in the vicinity of the project area where excavations would occur. These sites were identified in reports developed for remediation of the proposed Denny Substation site (Aspect, 2008; Aspect, 2014), as well as in the Phase I environmental site assessments completed for the transmission line alternatives, distribution system, and Broad Street Substation inductor options (Power Engineers, 2013; Aspect, 2013a, 2013b, respectively). The information in this chapter was derived from these five sources unless noted otherwise.

Hazardous Materials Key Findings

Hazardous materials associated with soil and groundwater in the project vicinity are primarily petroleum products, solvents, and heavy metals. They are expected to be encountered during excavations required for substation site development and along installation routes of the transmission lines and distribution systems. Contamination would be remediated to meet cleanup standards, leaving sites cleaner than conditions prior to construction.

Hazardous materials used during project construction (e.g., petroleum, paint, asphalt tack) and operations (e.g., petroleum, paint, pesticides, batteries) would be handled in accordance with best management practices to prevent, contain, and clean up any spills or releases.

No unavoidable significant adverse impacts to environmental health from hazardous materials are anticipated.

The sites of potential concern identified in these reports were compiled through the review of regulatory databases, review of historical information, and visual site reconnaissance (generally based on American Society for Testing and Materials International Standard E 1527-05 for conducting a Phase I Environmental Site Assessment).

An initial screening of the identified sites was conducted to eliminate those that would pose little or no risk. This screening process resulted in a subset of sites of low, moderate, and high concern that were further evaluated to determine their potential effects on the proposed project. These sites of low, moderate, and high concern were defined as follows.

Low Impact Sites:

- Historical records identify operations that might have resulted in the release of contaminants, but the distance from the project would result in a relatively low impact on the project.
- Remedial actions have been performed for contaminants other than total petroleum hydrocarbons (TPHs), and no contamination is documented or suspected to exist above 15 feet below the ground surface (bgs) in the right-of-way.

- TPHs are the main constituents of concern, and no contamination is documented or suspected to exist above 15 feet bgs in the right-of-way.

Moderate Impact Sites:

- Historical records identify operations existed for less than 20 years that might have resulted in the release of contaminants that would have an impact on the project.
- No remedial actions have been performed for contaminants other than TPHs, and no contamination is documented or suspected to exist above 15 feet bgs in the right-of-way.
- TPHs are the main constituents of concern, and contamination is documented or suspected to exist above 15 feet bgs in the right-of-way.
- Remedial actions have been performed for contaminants other than TPHs, and contamination is still documented or suspected to exist above 15 feet bgs in the right-of-way.

High Impact Sites:

- Historical records identify operations existed for more than 20 years that might have resulted in the release of contaminants that would have an impact on the project.
- No remedial actions have been performed for contaminants other than TPHs, and contamination is documented or suspected to exist above 15 feet bgs in the right-of-way.

This section describes City Light's understanding of hazardous materials that would likely be present at the various project component sites when construction would commence on the proposed project.

6.1.1 Substation Alternatives

The study area for the substation alternatives includes Parcels 1, 2, and 3 and the surrounding area (see Figure 2-5 in Chapter 2, Description of Project and Alternatives).

Geology and Hydrogeology

The subsurface soils at and near the substation site generally consist of approximately 4 feet to 10 feet of fill over thin glacial till deposits (Vashon till). These soil units lie over interbedded deposits from rivers and streams (fluvial deposits) and lakes (lacustrine deposits) formed between periods of glaciation. An older glacial deposit (Pre-Fraser glacial till) is below the interbedded deposits.

Groundwater occurs sporadically across the proposed substation site as perched water zones within sand or silty sand layers that are not necessarily continuous across the site. Depth to water ranges between 7 feet and 38 feet bgs. This large range is due to the presence of multiple-layered, perched water zones, and water in permeable backfill materials around underground storage tanks (USTs) and surrounding subsurface utilities.

Across the entire substation site, groundwater elevations are highest near the northwest corner of Parcel 2, near the location of former USTs. Groundwater appears to flow north and west from this area. Along the west side of Parcel 2, groundwater flows west toward Pontius Avenue North. At the north end of the parcel, groundwater flows north toward John Street.

On-site and Nearby Contaminant Sources

A bus maintenance facility operated on Parcel 2 for more than 60 years, with chemical uses that included fueling, parts washing, vehicle maintenance, vehicle washing, painting, and paint removal.

Remediation of the property was completed in 2013; however, residual contamination remains at some locations on Parcel 2, thus posing potential environmental health risks to people who might be exposed to affected soils and groundwater, primarily construction workers (see Figure I-1 in Appendix I, Hazardous Materials Supplemental Information). This parcel and adjacent street right-of-way remain a potentially high concern or high impact site because while Parcel 2 was a bus maintenance facility, it was significantly contaminated by a range of pollutants from activities described above. The primary suspected sources of soil and/or groundwater contamination are:

- USTs and associated piping and dispensers located on the north and northwestern portion of the parcel that contained diesel and gasoline
- A grease rack formerly located in the west-central portion of the parcel
- USTs containing waste oil formerly located on the southwestern portion of the parcel

Parcels 1 and 3 have been used for residences and parking. No sources of contamination have been discovered on these properties; however, it is possible that former residences used heating oil USTs that might still be in place.

Known contamination across the street from the substation site on the north side of John Street might have been associated with former USTs on the property now occupied by Seattle Cancer Care Alliance. These USTs were removed during development of that property, but contaminated soil was left along the property boundary next to John Street.

Chemicals of Concern

On the Parcel 2 portion of the proposed substation site, historical releases of hazardous materials from vehicle maintenance resulted in soil and groundwater conditions exceeding the Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A and B cleanup levels, including:

- Gasoline-range petroleum hydrocarbons (TPH-G) – TPH-G was found in the northern portion of the parcel near the former USTs location. Floating gasoline "free product" was measured in two monitoring wells up to a maximum thickness of approximately 1 foot. Limited off-property migration of petroleum contaminants has occurred through backfill of the combined sewer and stormwater utility line. The sewer line explorations revealed TPH-G that exceeded MTCA Method A cleanup levels in soil between two monitoring wells with identified groundwater contamination.
- Diesel-range petroleum hydrocarbons (TPH-D) – TPH-D was found in the northwestern portion of the parcel near the former USTs location. Floating diesel product was measured in four monitoring wells up to a maximum thickness of 3 feet.

MTCA

The Model Toxics Control Act (MTCA) enacted state regulations that set strict cleanup standards to ensure that the quality of cleanup and protection of human health and the environment are not compromised. MTCA Method A Standards are considered adequate for residential use of a property after cleanup.

Free Product

Free product refers to a liquid contaminant present in soil, groundwater, or surface water as a separate layer. Free product may float on top of water or sink until obstructed by dense soil, depending on its density relative to water.

- Oil-range petroleum hydrocarbons (TPH-O) – TPH-O was found around the former waste oil USTs in the southern portion of parcel, near the former grease rack in the center of the parcel, and in the northwest corner of the parcel. Sampling indicated high concentrations of TPH-O near former hydraulic lifts in the eastern and southern portions of the parcel.
- Volatile organic compounds (VOCs) associated with petroleum, including benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene – Of these VOCs, benzene was detected the most often above cleanup levels. Benzene was found in the same general area as TPH-G, in the northern portion of Parcel 2 and in the John Street right-of-way, but was generally more widespread both horizontally and vertically. Benzene-contaminated groundwater and soil extended northwest to the north side of John Street.
- VOCs associated with waste oil, parts washing, and/or paint stripping, including perchloroethene (PCE) – PCE is generally located near the waste oil tanks. PCE was also detected in one soil sample near the former parts washing area on the parcel.

Two other chemicals, acetone and 2-butanone, are associated with parts washing or paint stripping. These two chemicals were detected in soil and groundwater at concentrations below applicable cleanup levels. Acetone and 2-butanone occur throughout Parcel 2, but were most commonly found near the former paint shop. The highest concentrations of these two chemicals were measured near the former waste oil tanks.

Remediation at the Denny Substation Site

The following site remediation has been conducted on and adjacent to the proposed Denny Substation site:

- Demolition of site structures, including removal of sumps, piping, USTs, and hazardous building materials on Parcel 2
- Excavation of soil exceeding MTCA Method A cleanup levels on Parcel 2 and in the adjacent Pontius Avenue North right-of-way
- Excavation of soil containing free petroleum product in the adjacent John Street right-of-way
- Removal of free product and contaminated groundwater encountered during excavation of contaminated soil
- Confirmation soil sampling and groundwater monitoring

In a few areas on and surrounding Parcel 2, contaminated soil above cleanup levels was left in place because of limitations of the installed shoring system, including the following:

- John Street right-of-way – Soil concentrations of TPH-G and/or benzene in the John Street right-of-way exceeded cleanup levels along the excavation sidewall and floor.
- Eastern side of the site – Soil concentrations of benzene on-site along the alley right of-way exceeded cleanup levels on the excavation floor.
- Southeast corner of the site – An area containing hydraulic oil above cleanup levels in soil was identified adjacent to Denny Way, outside the shoring wall limits, extending at least 15 feet deep.

The extent of free product within the John Street right-of-way was limited to the south side of the street adjacent to the proposed substation site. Removal of this free product, followed by monitored natural attenuation of residual materials, is expected to meet the requirements of MTCA.

6.1.2 Transmission Line Alternatives

The study area for the transmission line alternatives (the shallow soils in street rights-of-way where the duct banks and vaults would be installed, and where pole foundations would be placed if overhead lines are used in the South of Downtown (SODO) area) was broken into northern, central, and southern segments of the proposed routes to allow mapping at a scale helpful to readers (see Figure I-2 in Appendix I, Hazardous Materials Supplemental Information). An assessment of historical and current land uses for these segments shows that the northern and central segments of the study area have been used for a wide range of commercial, retail, residential, light industrial, transportation, and other activities, while the southern segment has primarily been used for general industrial and transportation purposes.

Elements Common to All Transmission Line Alternatives

<u>Geology and Hydrogeology</u>

Artificial fill thicknesses for the northern portion of the transmission line study area for all transmission line alternatives generally range from 4 feet to 10 feet, consisting of silty sand and sandy silt with some gravel and scattered brick fragments. In addition, both Vashon glacial deposits (1 to 10 million years old) and pre-Olympia age (3 to 50 million years old) glacial and non-glacial deposits are present north of Pike Street. Perched groundwater levels similar to what is found at the substation site (which generally range from 7 feet to 38 feet bgs) are expected throughout much of the northern segment of the study area; however, the occurrence and flow directions of the perched groundwater are expected to be highly variable. The regional groundwater level in the northern segment of the transmission line study area is expected to be at depths ranging between 70 feet and 80 feet bgs.

Artificial fill thicknesses for the central segment of the study area (between Pike and Jefferson Streets) generally range from 30 feet to 50 feet; however, glacial and non-glacial deposits also can be present near the surface. The occurrence of perched groundwater can be highly variable; site investigations conducted near 8th Avenue and Olive Way indicated perched groundwater was not encountered down to a depth of 35 feet bgs. However, site investigations near 6th Avenue and University Street farther south in the central segment of the study area indicated perched groundwater at a depth of approximately 30 feet bgs. Regional groundwater in the central segment of the study area is expected to be significantly deeper, with a depth of about 150 feet bgs in the vicinity of Lenora Street, generally corresponding to an increase in the ground surface elevation.

Farther to the south of Jefferson Street there is a greater presence of recent beach, peat, and tideflat deposits composed of sand, silt, and organics that range in thickness from 30 feet to 90 feet, including up to 50 feet of artificial fill. The lower portion of the fill appears to have been hydraulically placed and consists of clean to silty, fine to medium sand, with abundant organic material and little refuse or debris. The upper portion of the fill generally includes refuse and wood debris, such as sawdust and creosote-treated piles. This material was likely dumped and/or sluiced into place in the early 1900s as part of the Jackson and Dearborn Street Regrades. Below these recent deposits are approximately 80 feet to 100 feet of glacial deposits consisting of silt, sand, and gravel. Perched groundwater south of Yesler Way is likely to be slightly more prevalent than to the north, but still variable. Historical investigations found perched groundwater between depths of 16 feet to 22 feet bgs south of Dearborn Street and 14 feet bgs farther to the south along 6th Avenue South. Regional groundwater in the southern segment of the study area was generally encountered at a depth of between 30 feet and 50 feet bgs. The regional groundwater flow direction in this area is generally to the west, toward Elliot Bay and Puget Sound.

Contaminant Sources

Sites are identified as either having been documented with a release of contaminants or identified as potentially contaminated based on historical activities, such as being formerly used for bulk petroleum storage, a foundry, or a machine shop. Two of the databases reviewed for potential contaminated sites identify gas stations and cleaners/laundries (assumed dry cleaners) that historically existed at addresses listed in City of Seattle (City) directories. Sanborn fire insurance maps also identify these uses. These former gas station and dry cleaner sites have not been characterized but have a high likelihood of contamination due to the nature of their historical operations. For each alternative evaluated below, all sites identified in the study area are categorized for each segment as having a potential low, moderate, or high impact, as defined in Section 6.1.

Transmission Line Alternative 1 (TL1) Contaminant Sources

The affected environment for the transmission line under Transmission Line Alternative 1 (TL1) would extend approximately 8 feet deep for the duct bank and 15 feet deep for vault installation.

A total of 74 known or potentially contaminated properties along the route have the potential to have low, moderate, or high impacts (see Figures I-3, I-4, and I-5 in Appendix I, Hazardous Materials Supplemental Information). Of these 74 properties, 16 had confirmed releases of hazardous substances to groundwater and 19 had confirmed releases to soil associated with historical operations. Of the 16 sites with releases to groundwater, 8 appear to have had contamination migrating off-site, 5 appear to have had contamination restricted to the properties of origin, and 3 cannot be determined from available documentation. Impacts to the TL1 route right-of-way would be most likely associated with sites exhibiting off-site migration. Eight of the nineteen sites with confirmed hazardous substances to soil appear to also have extended into City rights-of-way.

Twenty-seven historical gas station and three historical dry cleaner sites were identified on properties adjacent to the TL1 alignment (one high impact site in the central segment of the study area included both a gas station and a dry cleaner).

Table 6-1 provides a summary of the 74 known or potentially contaminated properties within one to two blocks (i.e., 600 feet) of the TL1 alignment identified with high, moderate, or low potential to have an impact on the proposed project.

Table 6-1. Summary of Transmission Line Alternative 1 (TL1) Known or Potentially Contaminated Properties

Study Area Segment	High Impact Sites		Moderate Impact Sites		Low Impact Sites	
	Release Reported	No Release Reported	Release Reported	No Release Reported	Release Reported	No Release Reported
North	2	4 (2) [1]	9	1 (1)	4	0
Central	0	9 (9) [1]	7	1 (1)	2	11 (10)
South	0	8 (3)	8	0	5	3 (1) [1]
Total	**2**	**21 (14) [2]**	**24**	**2 (2)**	**11**	**14 (11) [1]**

Notes: Numbers in parentheses reflect historical gas stations that have not been characterized. Numbers in brackets reflect historical dry cleaners that have not been characterized.

There are many more moderate and low Impact than high impact reported release sites, which indicates that most releases were minor, already cleaned up, or some distance from the alignment construction area. There were, however, more potential high impact sites associated with historical petroleum-based or dry cleaner operations immediately adjacent to the alignment.

Transmission Line Alternative 2 (TL2) Contaminant Sources

For Transmission Line Alternative 2 (TL2) only those portions of the transmission line outside of the Downtown Seattle Transit Tunnel (DSTT) would require excavation in soil. Within the DSTT, the transmission line would either be secured on hangers on the side of the tunnel or installed in existing concrete slabs in the station areas, where the potential for encountering contamination is very low.

Outside of the DSTT, a total of 45 known or potentially contaminated properties along the TL2 route have the potential to have low, moderate, or high impact (see Figures I-6, I-7, and I-8 in Appendix I, Hazardous Materials Supplemental Information). Of these 45 properties, 14 had confirmed releases of hazardous substances to groundwater and 15 had confirmed releases to soil associated with historical operations. Of the 14 sites with releases to groundwater, 7 appear to have had contamination migrating off-site, 5 appear to have had contamination restricted to the properties of origin, and 2 cannot be determined from available documentation. Impacts to the route right-of-way would be most likely associated with sites exhibiting off-site migration. Two of the fifteen sites with confirmed hazardous substances to soil appear to also have extended into City rights-of-way.

Sixteen historical gas station and three historical dry cleaner sites were identified on properties immediately adjacent to the alignment (one high impact site included both a gas station and dry cleaner in the central segment study area).

Table 6-2 summarizes the 45 known or potentially contaminated properties within one to two blocks (i.e., 600 feet) of the TL2 alignment identified with high, moderate, or low potential to have an impact on the proposed project.

Table 6-2. Summary of Transmission Line Alternative 2 (TL2) Known or Potentially Contaminated Properties

Study Area Segment	High Impact Sites		Moderate Impact Sites		Low Impact Sites	
	Release Reported	No Release Reported	Release Reported	No Release Reported	Release Reported	No Release Reported
North	2	4 (2) [1]	7	1 (1)	2	0
Central	0	2 (2) [1]	3	0	5	1 (1)
South	0	6 (2)	4	0	6	2 (1) [1]
Total	**2**	**12 (6) [2]**	**14**	**1 (1)**	**13**	**3 (2) [1]**

Notes: Numbers in parentheses reflect historical gas stations that have not been characterized. Numbers in brackets reflect historical dry cleaners that have not been characterized.

There are many more moderate and low impact than high impact reported release sites, which indicates that most releases were minor, already cleaned up, or some distance from the alignment construction area. There were, however, more potential high impact sites associated with historical petroleum-based or dry cleaner operations immediately adjacent to the alignment, as compared to TL1.

Transmission Line Alternative 3 (TL3) Contaminant Sources

The transmission line under Transmission Line Alternative 3 (TL3) would include the same construction-related concerns as TL1, discussed above.

A total of 47 known or potentially contaminated properties along the TL3 route have the potential to have low, moderate, or high impacts (see Figures I-9, I-10, and I-11 in Appendix I, Hazardous Materials Supplemental Information). Of these 47 properties, 19 had confirmed releases of hazardous substances to groundwater and 12 had confirmed releases to soil associated with historical operations. Of the 19 sites with releases to groundwater, 7 appear to have had contamination migrating off-site, 7 appear to have had contamination restricted to the properties of origin, and 5 cannot be determined from available documentation. Impacts to the route right-of-way would be most likely associated with sites exhibiting off-site migration. Three of the twelve sites with confirmed hazardous substances to soil appear to also have extended into City rights-of-way.

Ten historical gas station and one historical dry cleaner sites were identified on properties immediately adjacent to the alignment.

Table 6-3 provides a summary of the 47 known or potentially contaminated properties within one to two blocks (i.e., 600 feet) of the TL3 alignment identified with high, moderate, or low potential to impact the proposed project.

Table 6-3. Summary of Transmission Line Alternative 3 (TL3) Known or Potentially Contaminated Properties

Study Area Segment	High Impact Sites		Moderate Impact Sites		Low Impact Sites	
	Release Reported	No Release Reported	Release Reported	No Release Reported	Release Reported	No Release Reported
North	2	5 (2) [1]	9	1 (1)	1	0
Central	0	1 (1)	0	1 (1)	1	3 (2)
South	1	5 (2)	9	0	6	2 (1)
Total	**3**	**11 (5) [1]**	**18**	**2 (2)**	**8**	**5 (3)**

Notes: Numbers in parentheses reflect historical gas stations that have not been characterized. Numbers in brackets reflect historical dry cleaners that have not been characterized.

There are many more moderate and low Impact than high impact reported release sites, which indicates that most releases were minor, already cleaned up, or some distance from the alignment construction area. There were, however, slightly more potential high impact sites associated with historical petroleum-based or dry cleaner operations immediately adjacent to the alignment, as compared to TL1.

6.1.3 Broad Street Substation Inductor Options

City Light proposes to install new equipment outside of the existing Broad Street Substation, either at the substation annex (Broad Street Substation Inductor Option 1 [BI1]) or at the substation itself (Broad Street Substation Inductor Option 2 [BI2]). The affected environment for the new inductor would extend over an area approximately 50 feet long by 20 feet wide and 20 feet deep, where the basement of the facility would be constructed.

Geology and Hydrogeology

Geologic conditions in the Broad Street Substation vicinity are similar to those of the Denny Substation site alternatives discussed above in Section 6.1.1.

The presence of fine-grained glacial deposits in the vicinity of the Broad Street Substation can result in the occurrence of perched groundwater. Perched groundwater was encountered in several borings immediately north of the substation at depths ranging from 27 feet to 52 feet bgs; however, this is below the expected excavation depth of 20 feet for installation of the inductor and associated equipment.

The deeper regional aquifer was encountered in several borings immediately north of the Broad Street Substation at depths ranging from 65 feet to 87 feet bgs. This is significantly below the expected excavation depth for installation of the inductor and associated equipment. Regional groundwater flow direction is expected to mirror topography, which is toward Lake Union.

Contaminant Sources

A total of 52 known or potentially contaminated properties within two blocks (i.e., 600 feet) of the existing Broad Street Substation were evaluated for potential impacts to the proposed project (see Figure I-12 in Appendix I, Hazardous Materials Supplemental Information). Of these properties, three have the potential to have an impact on installation of the inductor and associated equipment along the Broad Street right-of-way. Specific detail about these sites, including chemicals of concern, is listed in Appendix I, Hazardous Materials Supplemental Information. Fourteen properties located near the Broad Street Substation were determined as not likely to affect the project based on past clean-up efforts, their location hydrologically down- or cross-gradient from the substation, or being situated too far away.

6.1.4 Distribution System

Distribution lines would be installed underground north of the proposed Denny Substation site by trenching within the City's rights-of-way. The affected environment therefore generally extends between approximately 7 feet and 18 feet deep, similar to that described for TL1. Land use in the affected area is primarily commercial, retail, and light industrial activities.

Geology and Hydrogeology

Geologic conditions across the distribution system are similar to those of the Denny Substation site alternatives discussed above in Section 6.1.1. The geologic units encountered during site work at Parcel 2 of the proposed Denny Substation site are generally expected to exist across the surrounding distribution system areas, with varying amounts of fill near the surface underlain by dense to very dense gravelly, silty sand (Vashon till) and interbedded hard silts, clays, sandy silts, and dense sands to depths of around 65 feet bgs.

Perched groundwater levels generally ranged from 7 feet to 38 feet bgs at Parcel 2. Similar perched groundwater levels are expected throughout the distribution system area; however, the occurrence of perched groundwater is likely variable due to the discontinuous nature of the fine-grained glacial deposits. Based on the relatively shallow excavation depth of the distribution feeders (ranging from 7 feet to 18 feet bgs) and the associated vaults (up to 14 feet bgs), significant perched groundwater is not expected to be encountered. Regional groundwater is expected to be well below the excavation depth of the distribution feeders and duct banks.

Contaminant Sources

A total of 61 known or potentially contaminated properties in the distribution system area were evaluated for potential impacts to the proposed project (see Figure I-13 in Appendix I, Hazardous Materials Supplemental Information). Of these properties, 39 have the potential to have low, moderate, or high impact. Of the 39 potentially affected properties, 27 have had confirmed releases of hazardous substances to soil associated with historical operations. Of these 27 sites, complete or partial cleanup actions and/or investigation results indicate that affected soil has been removed or is restricted to a localized area within the property boundary at 8 sites. A total of 19 of these 27 sites have confirmed or suspected hazardous substances in soil in the surrounding City rights-of-way.

Historical and regulatory records reviews indicate that there are seven properties that have had confirmed releases of hazardous substance to groundwater in the distribution system area. Three of these sites have had cleanup actions and/or investigation results, which indicates that the affected groundwater has been removed, is restricted within the site boundary, or is found in relatively deep groundwater. The remaining four properties have confirmed or suspected impacts on shallow groundwater.

Chemicals of Concern

The petroleum hydrocarbons and related VOCs described earlier in Section 6.1.1 can be expected to exist at multiple locations within the distribution system area. As noted above in Section 6.1.3, other hazardous substances associated with dry cleaners (e.g., PCE, trichloroethylene), parts cleaning solvents (e.g., acetone, methyl ethyl ketone), polycyclic aromatic hydrocarbons (PAHs), and heavy metals (e.g., lead, arsenic, cadmium, and chromium) have been reported at sites identified as sources.

6.2 Construction Impacts

Construction impacts considered in this section are those that could occur if existing contaminated media (e.g., soil, groundwater) were disturbed and hazardous materials were released during project construction (e.g., spills, poor containment practices).

When assessing potential impacts related to site contamination, not only the number of sites but also the type of hazardous material that could potentially be encountered is of concern. Petroleum releases, for instance, would be relatively simple to address, based on the relatively low toxicity and standard protocols developed for contaminant removal and disposal. Releases from operations such as dry cleaners would be more difficult to address because of higher toxicity of the contaminants, and their potential designation as hazardous waste would require special handling and disposal protocols, at higher cost.

The number of sites in each category by alternative can be compared to determine the relative risks associated with each alternative. In all cases, removal of residual soil and groundwater contamination would result in a long-term environmental benefit.

6.2.1 Substation Alternatives

Impacts Common to All Alternatives

All substation alternatives would involve excavation of soil in areas where previous uses have contaminated the soil with hazardous materials. Most of the contaminated soil and petroleum product floating on top of groundwater would be removed prior to initiating substation construction. There are no adjacent high impact sites associated with the substation alternatives, but Parcel 2 of the substation continues to be considered a high impact site.

Workers are trained to recognize signs of contamination and minimize exposure to contaminated material for themselves and people in the vicinity of the construction site. Contaminated soil would be stockpiled on-site prior to disposal or loaded into trucks for transport directly to a permitted disposal facility.

Project construction would require the use of hazardous materials typically employed in construction and paving work (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires). Cement, paint, asphalt tar, paving oils, and tack would also be used in construction of structures and hardscapes. Any possible leaks from vehicles and accidental fuel spills would likely be limited in volume because City construction contracts do not allow refueling on-site and large quantities of fuel would not be on-site. This type of localized spill would be expected to affect soils, but not groundwater.

Substation Alternative 1 (SA1)

During excavation of the approximately 45-foot-deep basement under Substation Alternative 1 (SA1), dewatering would be required. Groundwater removed from the surrounding soils would require storage and treatment prior to discharge to the sewer system. Any contaminated soil above MTCA Method A cleanup standards left in place following the completed remediation project would be excavated to accommodate construction of subsurface structures. Because SA1 would have the deepest substructure of any of the alternatives, it would require the greatest amount of removal of additional contaminated soil, and therefore also provide the greatest long-term environmental benefit.

Substation Alternatives 2 (SA2) and 3 (SA3)

During project construction of Substation Alternatives 2 or 3 (SA2 or SA3), contaminated soil and groundwater would be less likely to be encountered because no basement would be constructed. The quantity of contaminated soil to be trucked off-site to a permitted disposal facility would therefore also be less than with SA1.

6.2.2 Transmission Line Alternatives

For each of the transmission line alternatives, City Light would perform precharacterization of soil prior to construction in some areas (including, at a minimum, areas adjacent to high impact sites). City Light would excavate contaminated soil, where discovered, within the proposed trenches for the transmission line. Contaminated soil would most likely be loaded directly into trucks, either for transport to a staging location managed by the City or directly to a permitted disposal facility (a lack of available space along the transmission line route would likely preclude stockpiling along the route in any event). In some cases, contaminated groundwater may require removal, storage, and treatment prior to discharge to the sewer system or transport to an off-site treatment facility. If excavated contaminated material were temporarily kept on-site for any period of time, it would be placed in a lined facility and covered and secured when not actively being treated.

Project construction would require the use of hazardous materials typically employed in construction and paving work (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires). Cement, paint, asphalt tar, paving oils, and tack would also be used in construction of structures and hardscapes. Leaks from vehicles and fueling spills likely would be limited in volume and affect soils, not groundwater.

Workers are trained to recognize signs of contamination and minimize their exposure and people in the vicinity of the construction site's exposure to contaminated material. High impact sites are those where long-term historical practices have, or may have, led to releases of contaminants; where remedial actions, if performed, have only addressed petroleum releases; and where contamination is documented or suspected to exist in the top 15 feet bgs. These are the sites that have the highest probability of affecting transmission line installation. To compare the likelihood of encountering high impact sites, Table 6-4 provides the numbers of these sites for the three transmission line alternatives routes. This is one measure of distinguishing impacts among the alternatives.

Comparison of Transmission Line Alternatives

Table 6-4 provides a summary of known or potentially contaminated properties. Table 6-4 focuses on those properties designated as high impact. These sites would have the highest probability of affecting transmission line installation. The actual number of sites within the study area for all transmission line alternatives is an estimate because most sites are identified as potentially contaminated and, therefore, would need full evaluation to confirm levels of contamination.

The specific sites that Table 6-4 summarizes are listed in Appendix I, Hazardous Materials Supplemental Information, along with chemicals of concern.

Table 6-4. Summary of High Impact Sites or Potentially Contaminated Properties within Transmission Line Alternatives Study Area

	Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)
Total number of sites	74	45	47
High impact sites	23	14	14
High impact historical gas station sites	14	6	5
High impact historical dry cleaner sites	2	2	1

TL2 and TL3 pass by a comparable number of potentially contaminated high impact sites. TL1 passes by two to three times as many historical gas station sites as the other two alternative routes, thereby posing the highest potential risk for encountering contamination. TL2 poses a higher potential risk than TL3 for difficulty in managing complex contamination associated with both the additional historical dry cleaner site and the Union Station manufactured gas plant site, assuming all have affected the construction zone. If releases at the Seattle City ESD site along the TL3 route have affected the construction zone, petroleum products would be the chemicals of concern. (For more detail about these specific sites, see Appendix I, Hazardous Materials Supplemental Information.) The greatest environmental benefit could be gained by selecting TL1 because the potential for encountering and removing contamination would be the highest with this alternative.

6.2.3 Broad Street Substation Inductor Options

The general construction issues identified for the transmission line alternatives would apply to both Broad Street Substation inductor options. Space for stockpiling would be available at the substation site and, if stockpiles are used, they would be managed in the same way described above for the transmission line. BI1 is near one high impact site and BI2 is near two high impact sites, including a former dry cleaner site. BI2 poses a higher potential risk than BI1 for difficulty in managing complex contamination associated with both the historical dry cleaner site and the service station. (For more detail about these specific sites, see Appendix I, Hazardous Materials Supplemental Information.)

6.2.4 Distribution System

The general construction issues identified for the transmission line alternatives would apply to distribution system construction.

6.3 Operational Impacts

Operational impacts considered in this section are those that could occur from chemical spills associated with day-to-day operations or from failing utility equipment. Any on-site contamination encountered during construction would have been cleaned up to appropriate levels during the construction phase and would no longer constitute a concern during operations, assuming recontamination from adjacent areas is low.

6.3.1 Substation Alternatives

The expected impacts related to hazardous materials would be the same for all substation alternatives. It is likely that VOC contamination would remain beneath the Denny Way right-of-way; however, given the fact that the Denny Substation site generally has been cleaned to residential standards (see Section 6.1.1), no areas of potential vapor intrusion concern have been identified for the site proper.

Operation of the proposed project would require the use of some hazardous materials needed to operate and maintain site structures and the surrounding hardscape and landscape (e.g., gasoline, paint, pesticides, equipment oils, sulfur hexafluoride, and batteries). Long-term groundwater monitoring has begun following remediation of Parcel 2 and will continue for 8 years, or as needed.

Equipment such as transformers and some circuit breakers contain breakable parts that also might contain insulating oil (no oil-containing PCBs would be used). Parts that are easily damaged by moving equipment, such as cooling radiators, might leak. Fires can occur where an electrical failure ignites oil that has leaked. Due to the high-voltage energy that flows through a substation, the proximity of workers and tools to equipment could induce electrical arcs.

By its very nature, the electrical equipment that will be included in the substation, including transformers and switching equipment, carries some risk of overheating and catching on fire, thus posing a risk to workers on-site and a very slight risk to people outside the site. Reasonable measures are included to protect equipment, but there is always a risk of equipment failure. The Denny Substation under any of the substation alternatives would include both standard and special features that would help abate this type of risk. The standard features include switchgear/circuit breakers that would cut off power flow almost instantaneously if equipment begins to experience a fault. Special features include firewalls adjacent to power transformers, a deluge fire sprinkler system with the inductors, and extra high-speed fault detection systems. These features and systems would reduce the risk that a fire could spread laterally, would help suppress a fire, and would possibly extinguish a fire. City Light also provides regular safety training for its staff to recognize potential problems and minimize risk of equipment failure and fires. As evidence of the efficacy of these measures, City Light has never had a fire break out in a transformer at one of its substations (Raj, 2014).

6.3.2 Transmission Line Alternatives

No operations would be associated with power transmission along the transmission line. If line maintenance were needed, that work could involve excavation, but it is assumed that contaminated soil would have been removed during installation, regardless of the alternative selected, and no impact would occur. As with construction, equipment used during maintenance activities could experience leaks or fuel spills, which would be addressed as discussed in Section 6.2.2.

6.3.3 Broad Street Substation Inductor Options

Operation of the project would require the use of hazardous materials needed to operate and maintain site structures, and the surrounding hardscape and landscape (e.g., gasoline, paint, pesticides, equipment oils, sulfur hexafluoride within electrical equipment, and batteries).

By its very nature, the electrical switching equipment carries a risk of overheating and catching on fire, thus posing a risk to workers on-site and a very slight risk to people outside the site. As described above under Section 6.3.1, standard and special features that would help abate this type of risk are included for the Broad Street Substation inductor options.

6.3.4 Distribution System

No operations would be associated with operation of the electrical distribution system. As with the transmission line, if line maintenance were needed, that work could involve excavation, but it is assumed that contaminated soil would have been removed during installation and no impact would occur. As with construction, equipment used during maintenance activities could experience leaks or fuel spills, which would be addressed as discussed in Section 6.2.

6.4 Impacts of No Action Alternative

While constructing other facilities to help carry the electrical load for the South Lake Union Area and to install required system inductors, hazardous materials would be encountered between the Broad Street and Union Street Substations, with impacts similar to TL1. The hazardous materials typically employed in construction and paving work for inductor and underground distribution line installation (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires) could potentially release to the environment. As with the substation alternatives, City Light would continue groundwater monitoring at the remediated Denny Substation site.

Under the No Action Alternative, operational impacts would not occur. The hazardous materials associated with operation of the Denny Substation, transmission line and distribution system would not be in use, thus the risk of accidental release would be slightly lower than if these facilities were built.

6.5 Mitigation Measures

The construction and operational environmental health impacts from hazardous materials that the Denny Substation Project might pose would be avoided or reduced by implementing general mitigation measures.

6.5.1 General Avoidance and Minimization Measures Common to all Alternatives

Mitigation measures common to all project alternatives and options that City Light would implement include the following:

- Provide contamination-related information in the construction contract identifying locations and types of known contamination.
- Require training for field staff to identify contamination when encountered in the field.
- Prepare and implement a Health and Safety Plan that addresses work with contaminated soil and water.
- Prepare and implement a Temporary Erosion and Sediment Control Plan that addresses prevention of wind and stormwater dispersion of contaminated soil, including best management practices included in the City's Stormwater, Grading, and Drainage Control Code and the Washington State Department of Transportation Highway Runoff Manual.
- Prepare and implement a Spill Prevention, Control, and Countermeasures Plan to prevent releases of hazardous materials used or encountered during project construction.
- Prepare and implement a Hazardous Materials and Contaminated Media Management Plan that addresses anticipated and unanticipated contaminated soil, groundwater, and surface water during construction, and that also addresses management of materials that contain pollutants with concentrations below cleanup levels.
- Identify and coordinate truck haul routes with public transportation (transit and schools), other planned City utility work and event traffic control.
- For sites known to be contaminated, prior to construction, develop a cost-effective remediation plan and determine disposal requirements (including whether significant groundwater dewatering may be necessary).
- Conduct targeted characterization of soils prior to construction at identified high- and moderate- impact site locations to reduce the risk of unanticipated discovery that could cause significant risk or delay.
- Provide regular safety training for substation maintenance staff to recognize and minimize potential risk of equipment failure and fires.
- Select plantings that minimize the need for pesticides.
- Prevent or minimize the spread of contaminated media remaining in place.
- Allow for long-term monitoring to assess progress of cleanup actions.

- Incorporate standard safety design elements (e.g., fencing, guards, and signage) for newly installed equipment that poses hazards associated with use of chemicals or physical danger (e.g., electrical shock). Communicate operational safety measures to staff to minimize consequences of human error and equipment failure using maintenance checklists, operations manuals, and training. Enact safety protocols during equipment change-out to address de-energizing the work area, moving heavy equipment within the substation, and protecting equipment containing liquids.

For project activities with the potential to encounter contamination because of their proximity to likely or known contaminated sites discussed in Section 6.1, City Light would conduct the following design or construction measures to mitigate for potential impacts:

- Conduct soil, groundwater, and surface water quality monitoring during construction using a combination of screening (real-time) and laboratory techniques.
- Consider designing the project where feasible to avoid intercepting known soil and/or groundwater contamination, especially with vault placement.

Where project activities would intercept known contamination, City Light would design and construct the project to incorporate the following:

- Minimize the amount of contaminated media encountered, disturbed, or removed, where feasible.
- Coordinate with any remedial activities adjacent to the construction site to ensure project work is compatible with and does not adversely affect those remedial activities, and to minimize cleanup and construction costs. Remove contaminated media on the project site that the completed project would render inaccessible or that has the potential to migrate along buried utilities (e.g., sewer, water, drainage pipes).
- Address potential vapor intrusion where VOCs are left in place beneath planned enclosed spaces (e.g., buildings on the substation site, and vaults for the transmission and distribution systems).

6.5.2 Specific Mitigation Measures

With implementation of the avoidance and minimization measures described in Section 6.5.1 above, no adverse impacts to environmental health from hazardous materials are expected. Therefore, no specific mitigation measures are required or proposed.

6.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to environmental health from hazardous materials are anticipated.

Chapter 7: TRANSPORTATION

7.1 Affected Environment

To describe the affected environment for transportation, all of the different facilities and services that constitute the transportation system, their operational characteristics, and any constraints they currently have were identified and described. The facilities considered are area streets and intersections, alleys, driveways, Interstate-5 (I-5) freeway and ramps, parking lots and spaces, sidewalks and other pedestrian facilities such as crosswalks, bus routes and stops, and light rail and train facilities. The following sections describe these system components along with their operating characteristics in each portion of the project area[1].

7.1.1 Transportation Characteristics within Study Area

The study area for this transportation analysis includes all roadways, nonmotorized facilities, and transit facilities located adjacent to the proposed substation site, as well as those areas where the transmission line and the distribution system in the Phase 1 Build-out and Future Build-out areas would be built within roadway rights-of-way (see Figure 2-1, Chapter 2 Description of Project and Alternatives).

Roadway System

All roadways in Seattle have designated functional classifications, which depend on the types of trips the roadways serve and the relative levels of traffic volumes they carry. Each roadway within the transportation study area has been designated as a Principal Arterial, Minor Arterial, Collector, Local Access Street, or Alley. These functional classifications represent varying levels of emphasis on mobility and access. Higher classes (e.g.,

Transportation Key Findings

Transportation impacts during construction would include temporary roadway lane and sidewalk narrowings or closures adjacent to construction activities. Closures could disrupt traffic flow and access, reduce on-street parking, and/or require detours of traffic.

The greatest impact from substation construction would be the full or partial closure of Denny Way for 4–6 weeks. Street closures would be coordinated with the Seattle Department of Transportation (SDOT) to minimize traffic disruption and avoid significant adverse impacts to transportation. Construction of TL1 and TL3 would affect on-ramps and off-ramps to I-5 and would have to occur at off- peak times to avoid significant adverse impacts. Temporary closures to install TL2 in the Downtown Seattle Transit Tunnel (DSTT) could be significant unless mitigation is provided.

Permanent closure of Pontius Avenue North with SA2 or SA3 would not adversely affect traffic or pedestrian flow, but it would eliminate on-street parking along the segment. When completed, all other roads and sidewalks would be restored, and the project would generate very little traffic; so only minor operational transportation impacts are expected.

[1] This chapter summarizes the affected environment and construction and operational impacts for transportation, as described in more detail in the Denny Substation Project Transportation Discipline Report (Heffron Transportation, 2014).

arterials) provide a high degree of mobility and have more limited access to adjacent land uses while accommodating higher traffic volumes at higher speeds. Lower classes (e.g., local access streets and alleys) provide a high degree of access to adjacent land and are not intended to serve through-traffic and thus carry lower traffic volumes at lower speeds. Collector arterials generally provide a more balanced emphasis on traffic mobility and access to land uses. The City of Seattle (City) designates some of Seattle's arterial streets as Major Truck Streets, which accommodate substantial freight movement through the city and connect to major freight traffic generators (City of Seattle, 2005).

The study area roadways provide varying levels of access to adjacent properties and include numerous intersections with alleys and driveways. The numbers and characteristics of driveways and alleys that intersect with each study area roadway segment are described in the Transportation Discipline Report.

Identifying the Affected Environment

The transportation affected environment for the Denny Substation Project includes existing facilities and services to support all travel within the transportation study area, including roadways, transit, and nonmotorized facilities. Roadway classifications, which describe the intended function of each roadway, and average daily traffic volumes, were obtained from Seattle Department of Transportation (SDOT).

Characteristics, including sidewalks, bicycle facilities, on-street parking, bus stop locations, transit facilities, and intersecting alleys and driveways, were identified through field observation. The locations of bicycle facilities were further confirmed through review of the City's bicycling guide map. Bus routes were confirmed through review of local transit agencies' route maps.

Parking

In the South Lake Union, Denny Triangle, Central Business District (CBD), and South of Downtown (SODO) neighborhoods, public parking is typically provided on-street and metered with parking stations, where drivers are required to pay for parking of various durations. Metered parking has time limits that vary between 2 hours and 10 hours (or 3 minutes to 30 minutes in loading zones). Private parking for residential, commercial, industrial, and institutional development is typically provided in off-street surface lots or garages. In the South Lake Union, Denny Triangle, CBD, and SODO neighborhoods, there is typically a charge to park in parking garages or surface lots.

Transit

Transit service in the transportation study area is provided by bus, streetcars, light rail, and commuter rail. Bus transit service is primarily provided by King County Metro Transit (Metro) and Sound Transit (with some routes operated by Pierce Transit). Snohomish County's Community Transit also provides limited bus service to and from Seattle; typically during the weekday commute periods (King County Metro Transit, 2013; Sound Transit, 2013; Community Transit, 2013).

Sound Transit operates Link light rail service with routes operating between downtown Seattle and Sea-Tac Airport, with stops in the Stadium, SODO, Beacon Hill, Mount Baker, Columbia City, Othello, Rainier Beach, and Tukwila neighborhoods, with additional extensions to the north and east planned for completion by 2021. The South Lake Union Streetcar provides fixed-guideway service between South Lake Union and downtown Seattle. Construction has begun on the First Hill Streetcar, which is planned to add service between Capitol Hill, First Hill, and downtown Seattle beginning in 2014 (Seattle Streetcar, 2013).

Sound Transit also operates a rail yard at the south end of the project study area (to the west of 3rd Avenue South, adjacent to South Massachusetts Street) where Sounder commuter trains are stored, maintained, and repaired. The rail yard is adjacent to the BNSF Railway mainline that Sound Transit uses for its service north to Everett and south to Tacoma. Combined, the rail yard is about 500 feet wide and includes a total of 14 mainline and storage tracks. In addition to commuter rail service, the BNSF Railway mainline supports frequent freight service and Amtrak passenger service.

Nonmotorized Facilities

Streets in the Denny Triangle, CBD, SODO, and South Lake Union neighborhoods generally have completed sidewalk networks. Signalized intersections typically include marked crosswalks with pedestrian signals. Marked crosswalks are provided at some stop-controlled intersections and mid-block locations. All intersections that do not have marked crosswalks are still considered to be legal pedestrian crossings.

In addition to sidewalks, nonmotorized facilities include painted on-street bicycle lanes and roadway lanes that are marked with sharrows (a shared-lane pavement marking that is placed in the roadway lane) indicating that motorists should share the lane with bicyclists. Some roadways without bicycle pavement markings are designated as bicycle routes that may be either signed or unsigned (City of Seattle, 2011).

The South Lake Union, Denny Triangle, CBD, and SODO neighborhoods have high levels of pedestrian and bicycle activity generated by the high-density land uses in these areas. The mix of residential and commercial development encourage pedestrian and bicycle travel between different land uses within these areas. Automobile ownership rates among residents in these areas are lower than average for Seattle, and an above average proportion of people are likely to travel via nonmotorized modes or to walk or bicycle to and from transit stops. People who drive and park in these areas are likely to stay parked in one spot and walk between destinations within the area.

7.1.2 Substation Alternatives

The transportation study area for all substation alternatives consists of the roadways adjacent to the substation site—Denny Way to the south, Minor Avenue North to the west, John Street to the north, and Yale Avenue North to the east—as well as Pontius Avenue North, which traverses the site. For parking assessment, parking in the broader South Lake Union and Denny Triangle area was considered, because the parking spaces adjacent to the substation site make up only part of the total parking supply that serves these neighborhoods.

Denny Way is a principal arterial that carries about 22,000 vehicles per day and serves Metro Route 8. The other adjacent roadways are local access streets that carry about 1,000 to 3,000 vehicles per day. All streets in the substation study area have sidewalks on both sides and no marked bicycle facilities. Table 4-1 in the Transportation Discipline Report provides detailed description of the existing transportation network characteristics of the study area roadways for the substation alternatives, including functional classifications of each street, average daily traffic (ADT) volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

About 31 block faces (single sides of blocks) located throughout the South Lake Union neighborhood, with a total of about 212 parking spaces (Snyder, 2014), make up restricted parking zone (RPZ) 24, including segments of Minor Avenue North, Pontius Avenue North, and John Street adjacent to the proposed Denny Substation site. Residents in the South Lake Union neighborhood may purchase an annual permit for RPZ 24. The RPZ allows permit holders to park without additional charge, and they are not restricted to the metered parking time limits in the blocks designated for RPZ users (City of Seattle, 2013).

Pontius Avenue North adjacent to the substation site has approximately 37 on-street parking spaces—22 angle spaces on the west side of the street and about 15 parallel parking spaces on the east side. Parking along this street is regulated by pay stations with a 2-hour time limit from 8 a.m. to 6 p.m., which indicates it is intended for short-term parking use during the day. The angle spaces on the west side of the street are included in RPZ 24. A midday parking occupancy count was conducted on Tuesday, December 4, 2012. On the west side of the street, 16 of 22 spaces were occupied, and on the east side 11 of 15 spaces were occupied, which reflects an overall average occupancy of 73 percent.

The City has a target occupancy of 70 to 85 percent for on-street paid parking, by which one to two parking spaces are available along each block face under typical conditions. The Seattle Department of Transportation (SDOT) continually aggregates and analyzes data from on-street parking studies and documents the results in annual reports. If the data in a neighborhood show average occupancies greater than 70 to 85 percent, the City may adjust on-street parking parameters for the neighborhood, which can include increasing the hourly price or reducing the allowable time limits. If the data show that on-street parking occupancy is lower than its targets, the City may reduce the hourly price or increase the allowable time limits.

The SDOT's most recent study of the neighborhood compiled data collected in 2013. In the South Lake Union neighborhood, the average occupancy in the 2-hour spaces was 81 percent during the weekday (between 8:00 a.m. and 6:00 p.m.) and 72 percent in the evening (around 7:00 p.m.). For 10-hour spaces, the average occupancy was 95 percent during the weekday and 55 percent in the evening. The data showed that in the southeast portion of the South Lake Union neighborhood where the substation site is located, average weekday occupancy is generally greater than 70 percent and exceeds 85 percent along most block faces in the area. On weekday evenings, the data indicate lower average occupancy, with several block faces lower than 70 percent (Transpo Group, 2013). For the Denny Triangle neighborhood (adjacent to the site, south of Denny Way), the average occupancy was 64 percent during the weekday and 66 percent in the evening. Average weekday occupancy along several block faces was less than 70 percent. Signalized pedestrian crossings connect this area to the South Lake Union neighborhood at Fairview Avenue and Stewart Street.

Parcel 1 of the proposed substation site is a surface parking lot with 113 spaces now owned by City Light. This lot serves general demand in the area and is not associated with a specific use.

There are 12 other off-street paid public parking lots located within about 800 feet of the substation site that accommodate approximately 750 vehicles. In addition, the Alley 24 parking garage, located directly north of the substation site on John Street, accommodates public parking.

7.1.3 Transmission Line Alternatives

The transportation study area for the transmission line alternatives consists of the roadways and transit facilities along which the proposed transmission line alternatives routes would be constructed, either overhead or underground. The sections below summarize the key features of roadways that would be affected by transmission line construction. These tables list functional classifications of each street, ADT volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

Transmission Line Alternative 1 (TL1)

The study area for Transmission Line Alternative 1 (TL1) primarily consists of principal and minor arterials. Major streets in the TL1 study area include Stewart Street— a principal arterial with marked bicycle facilities and over 30 bus routes, that carries about 12,000 vehicles per day —and 5th Avenue, a minor arterial that carries about 6,000 vehicles per day and over 15 transit routes. All streets in the study area except South Massachusetts Street have continuous sidewalks on both sides.

The TL1 study area crosses the following major freeway access points in downtown Seattle:

- Northbound Interstate-5 (I-5) on-ramp at University Street
- Northbound I-5 off-ramp at Seneca Street
- Southbound I-5 on-ramp at Spring Street
- Southbound I-5 off-ramp at Marion Street
- Interstate-90 (I-90) off-ramp at South Dearborn Street and 5th Avenue South

The study area for TL1 also crosses the SODO busway, BNSF Railway mainline tracks, and Sound Transit's rail yard for its Sounder commuter trains, along the South Massachusetts Street corridor between Occidental Avenue South and 3rd Avenue South. It also includes the BNSF North Seattle International Gateway (SIG) Yard, which is an intermodal facility located directly south of the Massachusetts Substation. Trucks carry freight containers between trains at this facility and ships at the Port of Seattle. Access to the North SIG Yard is provided off of South Massachusetts Street.

Table 4-2 in the Transportation Discipline Report provides detailed description of the existing transportation network characteristics of the study area roadways for TL1, including functional classifications of each street, ADT volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

Transmission Line Alternative 2 (TL2)

The study area for Transmission Line Alternative 2 (TL2) primarily consists of the Downtown Seattle Transit Tunnel (DSTT), which operates from 5 a.m. to 1 a.m., Monday through Saturday, and from 6 a.m. to midnight on Sunday. There are five tunnel stations: Convention Place, Westlake, University Street, Pioneer Square, and International District. Sound Transit's Central Link light rail route operates through the tunnel along with 15 Metro bus routes and one Sound Transit bus route. North of the DSTT, the TL2 study area includes Stewart Street, a principal arterial with marked bicycle facilities that carries about 12,000 vehicles per day and over 30 bus routes. South of the DSTT, the study area for TL2 also crosses the SODO busway, BNSF Railway mainline tracks, and Sound Transit's rail yard for its Sounder commuter trains along the South Massachusetts Street corridor between Occidental Avenue South and 3rd Avenue South, and includes the South Massachusetts Street access to the BNSF North SIG Yard, similar to TL1. All streets in the study area except South Massachusetts Street have continuous sidewalks on both sides.

For the portion of the study area outside the DSTT, Table 4-3 in the Transportation Discipline Report provides detailed description of the existing transportation network characteristics of the study area roadways for TL2, including functional classifications of each street, ADT volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

Transmission Line Alternative 3 (TL3)

The study area for Transmission Line Alternative 3 (TL3) consists of a mix of principal arterials, collectors, and local access street. Major streets in the TL1 study area include Stewart Street—a principal arterial with marked bicycle facilities and over 30 bus routes, which carries about 12,000 vehicles per day —and Boren Avenue, a principal arterial with two bus routes, which carries about 20,000 vehicles per day. Although the TL3 route would pass through the intersection at Boren Avenue/Pine Street, most of that work could be done within the freeway overpass structure rather than requiring surface excavation. Farther south, the route would be along Hubbell Place, a street that provides local access, including truck access to the Washington State Convention Center. Between Madison and James Streets, the route would be along 7th Avenue, a frontage road that connects to I-5. The route would cross back to the west side of I-5 on South Dearborn Street. The TL3 study area crosses the following I-5 freeway access points in downtown Seattle:

- Northbound off-ramp at Madison Street
- Northbound on-ramp from Cherry Street
- Northbound off-ramp at James Street
- Southbound off-ramp to South Dearborn Street
- Northbound exit and on-ramps at South Dearborn Street

The study area for TL3 also crosses the SODO busway, BNSF Railway mainline tracks, and Sound Transit's rail yard for its Sounder commuter trains, along the South Massachusetts Street corridor between Occidental Avenue South and 3rd Avenue South, and includes the South Massachusetts Street access to the BNSF North SIG Yard, similar to TL1. All streets in the study area except South Massachusetts Street have continuous sidewalks on one or both sides.

Table 4-4 in the Transportation Discipline Report provides a detailed description of the existing transportation network characteristics of the study area roadways for TL3, including functional classifications of each street, ADT volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

7.1.4 Broad Street Substation Inductor Options

With either Broad Street Substation Inductor Option 1 (BI1) or 2 (BI2), the proposed inductor and associated equipment would be installed in the Broad Street right-of-way. This segment of roadway is scheduled to be eliminated from the street grid system as part of the new north portal for the Alaskan Way Viaduct Replacement Project (AWV Project). No other roadways are expected to be affected by construction at the Broad Street Substation.

7.1.5 Distribution System

The transportation study area for the distribution system consists of the roadways along which the proposed network distribution lines would be constructed underground.

Phase I Build-out Area

The study area for Phase 1 Build-out area consists of a mix of principal and minor arterials and local access streets. Major streets in the Phase 1 Build-out area primarily include Fairview Avenue, a principal arterial that carries about 22,000 vehicles per day and four transit routes, and Republican Street, a minor arterial that carries about 7,000 vehicles per day. All other roadways in the study area are local access streets that carry 1,000 to 3,000 vehicles per day. South Lake Union Streetcar tracks area located on Harrison Street between a streetcar storage facility and Terry Avenue North, and on Thomas Street between Fairview Avenue North and Terry Avenue North. All streets in the study area have continuous sidewalks on both sides. Table 4-5 in the Transportation Discipline Report provides detailed description of the existing transportation network characteristics of the study area roadways for the Phase 1 Build-out area, including functional classifications of each street, ADT volumes, transit characteristics, nonmotorized facility characteristics, and on-street parking.

Future Build-out Area

Roadway, transit, and nonmotorized characteristics in the Future Build-out area are similar to those within the Phase I Build-out area. The roadways in the Future Build-out area consist of a mix of principal arterials, minor arterials, and local access streets. Valley Street, Republican Street, 9th Avenue North (north of Republican Street), and Westlake Avenue North (north of Republican Street) are also classified as major truck streets. Streetcar tracks are located along Westlake Avenue North, Terry Avenue North, Valley Street (west of Eastlake Avenue), and Eastlake Avenue (east of Valley Street). Bicycle lanes are located along Dexter Avenue North and 9th Avenue North (south of Republican Street). A pedestrian pathway is adjacent to Lake Union, along Westlake Avenue North, Valley Street, and Eastlake Avenue North. Sidewalks are generally present along both sides of all streets located within the Future Build-out area. Metro bus routes are located along State Route (SR) 99, Dexter Avenue North, Westlake Avenue North, Fairview Avenue North, and Eastlake Avenue North.

7.1.6 Other Planned Infrastructure and Development Projects

Several major infrastructure and development projects will be constructed in the area affected by the distribution and transmission line systems. In accordance with Seattle Municipal Code (SMC) 15.32.050, SDOT regularly coordinates street improvement projects with utility projects to minimize the frequency of street openings and disruption to neighborhoods. This could include coordination with projects involving roadway trenching to install fiber optic cable in the roadway as part of the City’s ongoing effort to maintain and upgrade its fiber optic cable network. Ongoing coordination work amongst the various construction projects will be required.

Major infrastructure projects that are expected to be completed during the Denny Substation project construction period include the First Hill Streetcar (by 2014), Mercer West Project (by 2015), Sound Transit Link Extension to University of Washington (by 2016), AWV Project (by 2018), Sound Transit Link Extension to Northgate (by 2021), and South Transit Link Extension to Bellevue (target by 2021). There are also many planned development projects within the Denny Substation Project vicinity. Additional information about these planned infrastructure projects as well as large projects (more than 50,000 square feet of space) that are planned as of September 2013 is provided in Tables D-1 and D-2, and Figure D-1, Appendix D, Planned Infrastructure and Development Projects. The tables in Appendix D indicate the substantial number of projects that could be under construction concurrent to the distribution or transmission line systems and may require coordination for elements such as street use permits and staging areas. It is expected that permit applications will be submitted for additional projects prior to the time that the Denny Substation Project would be constructed. Prior to construction, City Light would coordinate with SDOT and the City of Seattle Department of Planning and Development (DPD) to confirm the full list of other planned infrastructure and development projects.

7.2 Construction Impacts

This section presents the transportation impacts that are expected to result during project construction if no mitigation measures were implemented by City Light. If mitigation specified as included in the project is not provided, many transportation impacts could be significant and are specifically identified as such below. Section 7.5, Mitigation Measures, describes the measures that would avoid, minimize, or otherwise mitigate the impacts identified in this section.

Assessing Construction Impacts

Potential construction transportation impacts were assessed by evaluating the location and duration of temporary narrowing or closures of roadways and sidewalks that would occur during underground placement of transmission and distribution lines, construction of the Denny Substation, and inductor installation at the Broad Street Substation or Annex, based upon project construction information provided by the City Light project design team. Evaluation of potential construction impacts included examination of roadway capacity restrictions, sidewalk restrictions, access to intersecting driveways and alleys, transit restrictions, parking restrictions, and truck trip and construction worker estimates.

7.2.1 Substation Alternatives

The following potential construction impacts are common to all three substation alternatives.

Roadway Capacity Restrictions

Construction of any of the three substation alternatives would likely result in temporary lane narrowings or closures on roadways adjacent to the Denny Substation site, both to construct the substation and to connect distribution and transmission lines to the substation. When project construction encroaches on the alley on the east side of the site, full access to the properties on the east side of the alley would need to be maintained. With mitigation described in Section 7.5 in place, roadway capacity restrictions would be considered to have minor to moderate impacts, depending on the traffic volumes traveling through the construction zone, which would vary by time of day and day of week.

The existing transmission lines located under Denny Way, Pontius Avenue North, and John Street would need to be split in order to connect the line to the new substation, thereby allowing the substation to provide network service to some customers after initial energization. The existing line is located in a pressurized, oil-filled pipe, which would require that a construction method known as a “freeze-plug” be used so that the line can be split. When the line is split to connect to the new substation, 24-hour access to the freeze plug would be required for approximately 4 to 6 weeks. Since Denny Way is a principal arterial that carries over 20,000 vehicles per day, partial or full closure during the transmission line connection process would result in major disruption to vehicular and nonmotorized traffic. Therefore, a mitigation measure is identified in Section 7.5 to coordinate with SDOT to determine the appropriate timing and method for constructing this element to avoid this potentially significant transportation impact. Full or partial closure would require that traffic be detoured, most likely via Bellevue Avenue East, East Pine Street, and Boren Avenue, including a detour of Metro Route 8. Traffic would also likely need to be detoured off of John Street east of Fairview Avenue North during that same period. With mitigation described in Section 7.5 in place, closure of Denny Way, Pontius Avenue North, and John Street would have minor to moderate impacts, depending on the traffic volumes that are detoured, which would vary by time of day, and day of week.

Sidewalk Restrictions

Construction of any of the three substation alternatives would likely result in temporary closures of sidewalks adjacent to the substation site while construction activities are underway. With pedestrian detours in place, sidewalk impacts would be minor to moderate, depending on the number of pedestrian generators located adjacent to the construction zone and level of pedestrian activity, which would vary by location, time of day, and day of week.

Transit Restrictions

With any of the three substation alternatives, construction adjacent to Denny Way could require temporary narrowing or closure of the sidewalk along Denny Way when construction activities are underway. This could result in a need to temporarily close or move the existing bus stop (serving Metro Route 8) adjacent to the substation site on the north side of Denny Way. Bus stop closure impacts would be minor to moderate, depending on the walking distance to the nearest alternative bus stop, which would typically be between one and three blocks.

Parking Restrictions

Construction of any of the three substation alternatives could result in temporary closures of parking lanes on roadways adjacent to the Denny Substation site, including 24 RPZ spaces on Pontius Avenue North, Minor Avenue North, and John Street, as well as the existing surface lots on Parcels 1 and 3. These parking closures could occur during construction of the substation and while distribution and transmission lines are being connected to the substation. Additional parking demand could also be generated by construction employees who work at the substation site. Temporary removal of on-street parking would have minor to moderate impacts, depending on the distance to other available parking in the area, which would vary by time of day and day of week.

Mobilization of Large Equipment to Substation Site

Construction of any of the three substation alternatives would require delivery of very large equipment such as transformers to the substation site, which would require overweight and/or oversized loads being carried on surface streets from either regional freeways or a waterside dock to the substation site. Carriers of all such loads would be required to obtain a permit from the City, and those traveling on state highways would also be required to obtain a permit from Washington State Department of Transportation (WSDOT). Overweight and oversized loads arriving via I-5 would likely be routed to use the Mercer Street southbound off-ramp, which has more clearance than other ramps into the site vicinity and is not on a structure. The City and WSDOT may also dictate the time of day that such loads can travel. Very large and very heavy loads often can only be transported between 12:00 a.m. and 5:00 a.m. under police escort. Because of such restrictions, transport of these loads is not expected to significantly impact traffic along the haul route.

Construction-generated Vehicle Trips

Trips would be generated by trucks traveling to and from the site to support construction activities, and also by construction workers commuting to and from the site. With Substation Alternative 1 (SA1) average construction-generated truck trips are expected to range from about 30 to 100 per day over the projected 24-month construction period. The highest average daily vehicle trips (approximately 100 one-way trips a day) are expected to occur during the first 6 months. With Substation Alternative 2 (SA2) and Substation Alternative 3 (SA3), average construction-generated truck trips are expected to range from about 50 to 74 trips per day over the projected 18-month construction period. The highest average daily vehicle trips (74 one-way trips per day) are expected to occur during the first 3 months of the construction period (Jonasson Consultants, LLC, 2013; Heffron Transportation, 2013). Truck traffic would be noticeable to residents and businesses adjacent to the construction site. However, with mitigation described in Section 7.5 in place, construction-generated vehicle trips are expected to have a minor impact on roadway operations.

7.2.2 Transmission Line Alternatives

Installation of the proposed transmission line alternatives would include underground and possible overhead elements. Installation beneath existing roadways would require excavation, construction, backfill, and pavement restoration within the roadway right-of-way. At least one traffic lane and possibly more would need to be closed for construction of each segment.

Construction of the overhead portion of the route (south of South Royal Brougham Way) would require installation of utility poles. Transmission lines installed overhead would not disturb the roadway but could require vehicle lane or sidewalk narrowings or closures to separate traffic from construction activities. Once poles are constructed, transmission wire must be strung between the poles. During the period in which wire is pulled, no traffic can occur on roadways, sidewalks or railways beneath the area of pulling activity. Pulling of overhead wires over roadways would require coordination with SDOT, and pulling of wires over train tracks would require coordination with BNSF Railway and Sound Transit. If connection of transmission wires to the Massachusetts Substation disrupts traffic on South Massachusetts Street between Colorado Avenue South and First Avenue South, coordination with BNSF Railway and the Port of Seattle would be required to ensure minimum disruption to trucks traveling between the Port of Seattle and the BNSF North SIG Yard (intermodal facility) located directly south of the substation.

If City Light chooses to construct the SODO portions of the transmission line underground, impacts to streets would be similar to those described for other portions of the transmission line. If the portion crossing the BNSF Railway and Sound Transit railroad tracks is placed underground, it would likely require microtunneling. The following transportation impacts would result from construction of the transmission line alternatives.

Impacts Common to All Alternatives

<u>Construction-generated Vehicle Trips</u>

Trips would be generated by trucks traveling to and from the site to support construction activities, and also by construction workers commuting to and from the site. The average daily vehicle trips expected to be generated by construction of each transmission line alternative is approximately the same, about 88 trips per day (Jonasson Consultants, LLC, 2013; Heffron Transportation, 2013). These estimates are averages, and actual trips would likely vary from day to day, depending on the type of construction activity occurring. Truck traffic would be generated at varying points along the segment of the project under construction, and trucks may be noticeable to residents and businesses adjacent to the construction site. However, with mitigation described in Section 7.5 in place, construction-generated vehicle trips are expected to have a minor impact on roadway operations.

Roadway Capacity Restrictions

Construction of the transmission line alternatives would require temporary lane closures in the roadway right-of-way where construction occurs. In addition to reducing the vehicle capacity of the street, some disrupted lanes could include marked bicycle lanes or sharrows, or eliminate on-street parking. With mitigation described in Section 7.5 in place, roadway capacity restrictions would have minor to moderate impacts, depending on the traffic volumes traveling through the construction zone, which would vary by location, time of day, and day of week.

Sidewalk Impacts

Construction of any of the transmission line alternatives overhead or underground would likely occur on only one side of the street and could require that the sidewalk adjacent to the segment under construction be narrowed or closed. If sidewalks are present on both sides of the affected street, pedestrians would likely be detoured to the sidewalk across the street. Otherwise, pedestrian ways adjacent to the construction zone would be created with barriers or cones. Special accommodations would be needed to retain pedestrian access to businesses along the construction route if the sidewalk were closed. With pedestrian detours in place, these impacts would be minor to moderate, depending on the number of pedestrian generators located adjacent to the construction zone and level of pedestrian activity, which would vary by location, time of day, and day of week.

Bicycle Impacts

Where roadway lanes with marked bicycle facilities (bicycle lanes or sharrows) would be narrowed or closed during construction, bicyclists would need to be detoured to a roadway lane or sidewalk where they could travel safely. Where marked bicycle facilities do not exist, traffic management plans to accommodate closed or narrowed roadway lanes would also need to be designed to safely accommodate bicyclists. With bicycle detours in place, these impacts would be minor to moderate, depending on the number of bicyclists traveling through the construction zone, which would vary by location, time of day, and day of week.

Disruption at Roadway Intersections

Duct bank construction through an intersection would disrupt intersection operations and require manual traffic control. In addition, some signalized intersections have in-pavement induction loops that control traffic operations. Excavation of the pavement at these locations would destroy the existing induction loops. With manual traffic control in place, the impact on intersection operations are expected to be minor to moderate, depending on the roadway capacity reduction that would also occur at the intersection as part of construction.

Disruption at Alleys and Driveways

Duct bank construction across a driveway or alley would disrupt property access at that location. Driveways located along the transmission line route must be passable during construction unless there is an alternative driveway serving a property that can accommodate vehicles if one driveway is closed. With mitigation described in Section 7.5 in place, disruption at alleys and driveways would be minor to moderate impacts, depending on level of activity at the driveway, the availability of alternate access points, time of day, and day of week.

Bus Stop Closure or Relocation

Duct bank construction on streets with bus routes would affect bus service on those streets, thus potentially requiring temporary closure or moving bus stops and detouring bus routes. Bus stop closure impacts would be minor to moderate, depending on the walking distance to the nearest alternative bus stop, which would typically be between one and three blocks.

Disruption of Bus Trolley Power Lines

To the extent possible, duct banks would be located so they could be constructed without affecting overhead bus trolley lines. However, if construction equipment clearances require, it could be necessary to either temporarily relocate or deactivate the trolley lines during construction. Since transit service could still be provided by non-trolley buses if trolley lines are temporarily disrupted, this impact would be minor.

On-street Parking Removal

Construction at the substation site or within the roadway right-of-way for transmission line construction would also likely result in temporary elimination of public on-street parking adjacent to construction activities, including 24 RPZ spaces on Pontius Avenue North, Minor Avenue North, and John Street, as well as the existing surface lots on Parcels 1 and 3. Additional parking demand could also be generated by construction employees who work at the site. Temporary removal of on-street parking would have minor to moderate impacts, depending on the distance to other available parking in the area, which would vary by location, time of day, and day of week.

Effect on BNSF Railway and Sound Transit Rail Yard Operation

Installation of an overhead transmission line across the Sound Transit rail yard and BNSF Railway tracks would require disruption of operation of Sounder commuter trains, Amtrak passenger trains, or freight trains during the period in which the wires are pulled (up to one hour per wire, for three wires). City Light would coordinate with BNSF Railway, Sound Transit, and Amtrak to define the appropriate construction periods, methods and measures needed to minimize the impact of this activity on train operations. With coordination and the short duration of disruption, this impact would be minor.

Connection of an overhead transmission line to the existing Massachusetts Substation could disrupt truck traffic between the Port of Seattle and the BNSF North SIG Yard located directly to the south of the substation. City Light would coordinate with BNSF Railway and the Port of Seattle to define the appropriate construction periods, methods and measures needed to minimize the impact of construction activities on truck operations. Since truck access to and from the BNSF North SIG Yard is provided via both Colorado Avenue South and First Avenue South, disruption at one cross street could likely be accommodated by routing all trucks to the other cross street. With coordination, this impact would be minor to moderate, depending on the duration, time of day, and day of week that the disruption would occur.

If the transmission line crossing the rail yards were placed underground, it would likely be done using microtunneling at a depth that would ensure that the rail track bed and supporting utilities would not be affected. Microtunneling would be done using a boring machine launched from a pit on one side of the tracks and retrieved from a pit on the other side. Details of tunneling design are not known at this time; therefore, the locations of the launch and retrieval pits and construction duration are not known. Microtunneling would not require suspension of train traffic. Transportation impacts from placing the SODO portions of the transmission line underground would include additional lane closures on city streets and a slightly increased number of truck trips to remove excavated material as compared to the overhead option. With mitigation similar to the measures identified for the other underground sections of the transmission line alternatives, impacts would be minor to moderate, depending on the traffic volumes traveling through construction zones, which would vary by location, time of day, and day of week.

Transmission Line Alternative 1 (TL1)

Roadway Capacity Restrictions

Table 5-4 in the Transportation Discipline Report provides a detailed summary of all transportation system elements that could be affected by temporary lane closures during construction of TL1. In addition to the affected roads described in the Discipline Report, TL1 would impact the following freeway ramps providing access to and from downtown Seattle:

- **6th Avenue at University Street/I-5 northbound on-ramp** – This ramp provides access to I-5 for approximately 8,900 vehicles per day.
- **6th Avenue at Seneca Street/I-5 northbound off-ramp** – This ramp provides egress from I-5 for approximately 12,300 vehicles per day.
- **6th Avenue at Spring Street/I-5 southbound on-ramp** – This ramp provides access to I-5 for approximately 14,800 vehicles per day.
- **6th Avenue from Marion Street to Yesler Way** – Southbound I-5 traffic exits onto 6th Avenue at Marion Street and enters the freeway just south of James Street. The segment of 6th Avenue between Marion and James Streets collects and distributes this traffic to the downtown grid. 7th Avenue on the east side of the freeway functions in a similar manner for northbound traffic, with the off-ramp at James Street and an on-ramp at Columbia Street. Each of the various ramps is used by 10,000 to more than 15,000 vehicles per day. Many of them converge through the 6th Avenue/James Street intersection.

These ramps provide for the majority of access between downtown Seattle and the regional highway system. Because a limited number of access and egress points are provided between I-5 and downtown Seattle, closure of any one ramp would require that a large amount of traffic be rerouted to or from an alternate ramp, thereby increasing traffic not only on the alternate ramp but on the surface streets required to make the detour. Closures during weekday peak periods would be expected to result in substantial increases in traffic congestion on downtown streets. As described in Section 7.5, Mitigation Measures, construction through these on- and off-ramp junctions would likely require nighttime or weekend closures of the ramps to minimize this potentially significant transportation impact. With mitigation, off-ramp closures would have a minor to moderate impact on transportation.

TL1 would also affect streets in the International District and the Denny Triangle area. Temporary lane and sidewalk closures and narrowings would extend through these neighborhoods up to three blocks at a time. Some of the affected blocks have had recent street construction projects, such as 5th Avenue South at Jackson Street, which has been affected by construction of the First Hill Streetcar line. The TL1 transmission line installation would occur several years in the future and therefore would not overlap with or extend the period of disturbance from these current projects. With mitigation described in Section 7.5 in place, impacts from roadway capacity restrictions would be minor to moderate, depending on the traffic volumes traveling through the construction zone, which would vary by location, time of day, and day of week.

Transmission Line Alternative 2 (TL2)

Roadway Capacity Restrictions

Approximately half of the TL2 route would be located within the DSTT. However, the segment of the proposed TL2 route located north of Pine Street (between the Denny Substation site and the existing DSTT) would require trenching in the roadway right-of-way, similar to that described for TL1. Table 5-5 in the Transportation Discipline Report summarizes the transportation system elements outside of the DSTT that would be affected by temporary lane closures during construction of TL2. With mitigation described in Section 7.5 in place, impacts from roadway capacity restrictions would be minor to moderate, depending on the traffic volumes traveling through the construction zone, which would vary by location, time of day, and day of week.

Transit Operating Restrictions

In addition to traffic lane and sidewalk narrowings and closures described earlier for all transmission line alternatives, TL2 would require construction in the DSTT, which would affect transit operations and require that transit operations move to surface streets for periods of time. Rerouting transit operations to surface streets would cause congestion for all surface traffic, especially if the rerouting extended through morning and evening peak commute hours or during large events such as sports events or parades. Therefore, a mitigation measure is identified in Section 7.5 to install the transmission line through the tunnel at off-peak hours, primarily at night and on weekends, and preferably when transit is not operating, to avoid this potentially significant transportation impact. This could disrupt regular maintenance activities or bus/light rail driver training that Sound Transit and Metro must conduct at night resulting in a moderate impact. Construction of vaults and splicing of transmission line sections at each station would require longer windows of time than a few hours at night, thus requiring that the tunnel be closed for 3 to 4 weekend days (Saturday and/or Sunday) for each location.

On any weekend days when the DSTT would be closed during normal transit operating times, tunnel buses would need to be detoured to downtown surface streets. On Saturdays, 625 buses per day (307 northbound and 318 southbound) use the tunnel; on Sundays, 456 buses (228 northbound and 228 southbound) use the tunnel. If the tunnel were closed, these buses would need to be rerouted. In comparison, almost 1,000 buses per day (501 northbound and 496 southbound) use the tunnel during weekdays (King County Metro, 2013).

Tunnel closure on weekends would also require cancellation of the light rail trains that use the tunnel. On Saturdays, approximately 216 trains per day (108 northbound and 108 southbound) use the tunnel; on Sundays, approximately 200 trains per day (100 northbound and 100 southbound) use the tunnel. During weekdays, about 248 trains per day (124 northbound and 124 southbound) use the tunnel (Sound Transit, 2013). As light rail trains could not be detoured, it is possible that Sound Transit would need to provide buses to accommodate downtown transit connections during tunnel closures. This would add more buses to the downtown surface streets, in addition to the detoured Metro buses. Rerouting of transit to surface streets would be expected to have a moderate impact on transit users, who would need to access and egress downtown buses at different stops; light rail riders from outside of the downtown area may also need to make additional transfers to downtown buses. Although an increase in the number of downtown buses on surface streets could be noticeable, they would be expected to have minor impacts on weekend roadway traffic operations.

Transmission Line Alternative 3 (TL3)

<u>Roadway Capacity Restrictions</u>

Table 5-6 in the Transportation Discipline Report summarizes the transportation system elements that would be affected by temporary lane closures during construction of TL3.

In addition to the affected roads described in the Discipline Report, TL3 would cross near and potentially affect operations at the following freeway entrance and off-ramps:

- **7th Avenue, between Marion Street and Madison Street, I-5 northbound off-ramp** – This ramp provides egress from I-5 for approximately 15,100 vehicles per day.
- **7th Avenue, between Columbia Street and Cherry Street, I-5 northbound on-ramp** – This ramp provides access to I-5 for approximately 17,600 vehicles per day.
- **7th Avenue, between Yesler Way and James Street, turns into the I-5 northbound off-ramp** – This ramp provides egress from I-5 for approximately 10,200 vehicles per day.
- **South Dearborn Street at 10th Avenue South** – Northbound I-5 entrance and off-ramps intersect with South Dearborn Street at this location. Although the ramp intersections are close to the proposed route, the route turns west on South Dearborn Street at this location and does not cross the I-5 ramps. No daily traffic counts are provided for these ramps in the SDOT traffic count database.

It is likely that construction could be performed along 7th Avenue and South Dearborn Street without needing to close any of these ramps. However, as described in Section 7.5, Mitigation Measures, depending on the location of the duct bank trench, nighttime or weekend construction may be preferable to avoid reducing the lane capacity at these ramp junctions. With mitigation described in Section 7.5 in place, impacts from roadway capacity restrictions would be minor to moderate, depending on the traffic volumes traveling through the construction zone, which would vary by location, time of day, and day of week.

7.2.3 Broad Street Substation Inductor Options

Because the proposed Broad Street Substation inductor and associated equipment would be installed in the Broad Street right-of-way scheduled to be closed as part of the new north portal for the AWV Project, no disruption to other roadways is expected from construction of either BI1 or BI2 at the Broad Street Substation or Annex, with the exception of staging trucks carrying excavated material or other construction-related material and potential temporary sidewalk closures. It is expected that installation of the new equipment would generate a total of about 128 round truck trips (256 one-way trips) for BI1 and a total of about 112 round truck trips (224 one-way trips) for BI2, as well as a small number of construction worker commute trips. These estimates are averages, and actual trips would likely vary from day to day, depending on the type of construction activity occurring. Truck traffic would be generated at varying points along the segment of the project under construction, and trucks may be noticeable to residents and businesses adjacent to the construction site. However, with mitigation described in Section 7.5 in place, construction-generated vehicle trips are expected to have a minor impact on roadway operations.

7.2.4 Distribution System

Installation of the proposed distribution lines would occur beneath existing roadways and require excavation, construction, backfill, and pavement restoration within the roadway right-of-way. At least one traffic lane and possibly more would need to be closed for construction of each segment.

The types of construction impacts expected to result during construction of the Phase I Build-out and Future Build-out areas would be similar to the impacts expected from construction of the transmission line described above in Section 7.2.2, except that no BNSF Railway lines would be affected and no distribution lines would be located overhead. Mitigation measures to eliminate or reduce construction-related impacts are presented in Section 7.5, Mitigation Measures. The following transportation impacts would result from construction of the distribution system.

Phase 1 Build-out Area

Construction-generated Vehicle Trips

Approximately 76 average daily vehicle trips (one-way trips) are expected to be generated by construction of the Phase I Build-out of the distribution system in South Lake Union neighborhood, which would include trucks traveling to and from the site to support construction activities, and also construction workers commuting to and from the site (Jonasson Consultants, LLC, 2013; Heffron Transportation, 2013). These estimates are averages, and actual trips would likely vary from day to day, depending on the type of construction activity occurring. Truck traffic would be generated at varying points along the segment of the project under construction, and trucks may be noticeable to residents and businesses adjacent to the construction site. However, with mitigation described in Section 7.5 in place, construction-generated vehicle trips are expected to have a minor impact on roadway operations.

Roadway, Sidewalk, Bicycle, and Parking Capacity Restrictions

The specific elements that would be affected within each roadway block located in the Phase I Build-out area (e.g., affected intersections, affected transit routes and stops, bicycle facilities, numbers of driveways, and on-street parking) are summarized in Table 5-8 in the Transportation Discipline Report. Lane closures would be required at the locations where construction occurs. In addition to reducing the vehicle capacity of the street, some disrupted lanes could include marked bicycle lanes or sharrows, or eliminate on-street parking. In-road construction could also affect access to and from intersecting driveways or alleys, thus potentially requiring that special measures be implemented to ensure that adequate access to adjacent properties be maintained. Sidewalk closures or narrowings could potentially be required adjacent to construction activities. Roadway lane or sidewalk closures could also affect transit service provided along a roadway and potentially require that bus stops be closed or moved, or that buses be detoured. With mitigation described in Section 7.5 in place, impacts from roadway capacity restrictions would be minor to moderate, depending on the traffic volumes traveling through the construction zone, the number of pedestrian generators located adjacent to the construction zone, and level of non-motorized activity, which would vary by location, time of day, and day of week.

Disruption at Streetcar Crossings

In addition to the impacts described for both areas of the distribution system, construction of the Phase I Build-out area in the South Lake Union neighborhood would require crossing of the South Lake Union Streetcar route along Terry Avenue North at Thomas Street and Harrison Street, as well as the route along Westlake Avenue North at Harrison and Republican Streets. Construction at these crossings would need to occur when the streetcar is not operating. A duct bank already exists at the crossing of Terry Avenue North at Republican Street, so no construction would need to occur under the tracks at that location.

In addition, trenching would occur along the north side of Harrison Street adjacent to the streetcar tracks, between Terry Avenue North and the streetcar storage facility just east of Fairview Avenue North. Although the trench would be located near the streetcar tracks, it is expected that it could be sufficiently shored to allow the streetcar to operate while construction is underway. With mitigation described in Section 7.5 in place, impacts to streetcar operation would be minor to moderate, depending on whether all construction could occur during nighttime when the streetcar is not operating, or whether some weekend closures would be needed.

Future Build-out Area

Potential transportation impacts in the Future Build-out area would be similar to those identified within the Phase 1 Build-out area, although they could be spread out both geographically and over a longer time period.

7.2.5 Cumulative Impacts

Construction of the Denny Substation Project components would occur in the context of multiple private development and public infrastructure projects that are expected to be under construction or completed by the time the Denny Substation Project components are constructed. The distribution system construction could occur at the same time as building construction for other projects in the same area of South Lake Union, and the combined effect on transportation could result in moderate impacts such as traffic detours and delays on multiple streets. With coordination by SDOT, and given the short duration of the distribution system construction in any one place, no significant impacts are expected. Similarly, the substation could be under construction at the same time as adjacent development to the south (1200 Stewart Street). Because of their positions on opposite sides of Denny Way, the primary cumulative impacts would be on local traffic and pedestrian movement, which would be managed by SDOT and would not result in any significant impacts. Transmission line construction would occur after the other project components, and could occur in conjunction with adjacent development. Because of the short duration of construction in any given location, and because measures would be employed to minimize transportation disruptions through coordination with SDOT, these impacts are expected to be minor to moderate.

7.3 Operational Impacts

This section presents the transportation impacts that are expected to result after construction is completed and the proposed project is operational. Impacts described below would be minor unless otherwise noted.

7.3.1 Substation Alternatives

Impacts Common to All Alternatives

Operational Trips Generated by Project Site

Maintenance and operation of the Denny Substation would require no more than one vehicle round trip per day, and often no trips would be needed. The substation could have ancillary uses such as storage for a small number of trucks and staff facilities.

Nonmotorized Circulation

Street frontage improvements proposed for each of the three substation alternatives would enhance conditions for pedestrians and bicyclists along all streets adjacent to the substation site. Enhancements would include upgrading and widening sidewalks where needed to meet the minimum design standards (6-foot-wide sidewalk plus 6-foot-wide planting strip inclusive of curb) and installing landscaping, lighting, and curb ramps at pedestrian crossings compliant with the Americans with Disabilities Act (ADA).

Transit

As described above, each of the three substation alternatives would improve the street frontage along the Denny Way bus route, thereby enhancing conditions at the bus stop adjacent to the site.

Equipment Delivery to Substation Site over Time

Each of the three substation alternatives would require infrequent (i.e., less than once a year) replacement of very large equipment such as transformers, resulting in oversized loads being carried on surface streets from either regional freeways or a waterside dock to the substation site. The same route and time of day restrictions could be imposed by the City and/or WSDOT for such loads, as described above in Section 7.2, Construction Impacts. With WSDOT and City time and route restrictions in place for oversized loads, infrequent transport of large equipment is not expected to significantly impact traffic along the haul route.

Substation Alternative 1 (SA1)

Vehicle Circulation

With SA1, no changes would be made to the adjacent streets. The sidewalk and other frontage improvements would improve nonmotorized circulation and would not affect vehicle traffic. Therefore, SA1 would have no effect on vehicle circulation in the site vicinity.

Parking

With SA1, on-street parking eliminated during construction would be restored. Parking adjacent in the surface lots on Parcels 1 and 3 could be restored or City Light could surplus the lots. No public parking would be displaced except at the site driveways on John Street, which would be a minor impact on parking.

Nonmotorized Circulation

With SA1, frontage improvements that meet SDOT standards would be provided for the rights-of-way directly adjacent to Parcel 2, along John Street, Pontius Avenue North, and Denny Way. Enhancements would include provision of new sidewalks (6-foot-wide); planting strips (6-foot-wide inclusive of curb) with street trees; and other landscaping, lighting, and ADA-compliant curb ramps at pedestrian crossings. Curb bulbs would be installed along John Street, thus shortening the pedestrian crossings along the north side of the site. No adverse impacts are expected as a result of these street improvements. Adjacent to the sidewalk along John Street, the project would include a large access panel so that equipment such as transformers could be lifted to and from the lower floors of the substation. The access panel is estimated to be approximately 30 feet by 40 feet in size.

Substation Alternatives 2 and 3 (SA2 and SA3)

Operational Trips Generated by Project Site

The substation could have exterior shell spaces that could accommodate a learning center and/or community space in addition to other ancillary uses described above under Impacts Common to All Alternatives. These options are being considered as part of the ongoing design process, including City of Seattle Design Commission review.

For traffic and parking, the worst-case conditions for any programmed space at the site would be for a meeting facility. Similar meeting spaces in Seattle, such as those that exist at the City's community centers and libraries, generate few, if any, peak-hour trips because meetings are generally scheduled for either midday or in the evenings. No public parking would be provided on-site, and it is expected that the majority of visitors to the site and meeting attendees would come from within the local neighborhood and walk to the site.

Although the additional site uses have not yet been defined, it has been assumed that the peak-hour traffic generation from all operations on the substation site would be 30 or fewer trips. This is a very small percentage of the total trips on the surrounding street system, which would be spread out because no parking would be accommodated on site. Therefore, the occasional trips that could be generated by the substation during site operations would have a negligible impact on traffic operations on the surrounding street network.

Vehicle Access

With SA2 or SA3, large trucks would access the project site via a driveway on John Street. For access flexibility, this driveway would be aligned with the north leg of Pontius Avenue North at John Street to allow very large trucks that deliver parts and equipment to the site to use Pontius Avenue North to directly enter and exit the site without turning; it would also allow consideration of the entire street grid to the north in determining the optimal route that large trucks should use to enter and exit the site vicinity. If the driveway were not aligned with Pontius Avenue North, all trucks would be required to turn into and out of the site at the driveway, which could be highly constrained for very large trucks. The City typically requires that a driveway be offset from an intersection so that drivers are not confused and assume it is part of the street grid. However, because the substation driveway would be gated, this could not occur with the proposed project even if the driveway is aligned.

Vehicle Circulation

SA2 or SA3 would vacate Pontius Avenue North between John Street and Denny Way. This is not expected to adversely impact vehicle circulation or traffic patterns in the area because this segment of Pontius Avenue North does not provide continuity in the street grid; specifically, it does not align with the street grid to the north or to the south. To the north, it is offset about 135 feet west of Pontius Avenue North, north of John Street and about 30 feet east of an alley. To the south, Pontius Avenue North terminates at Denny Way, which serves as the border between two streets grids of different orientations—the South Lake Union street grid and the downtown Seattle street grid.

Due to the high traffic volumes on Denny Way (with ADT of 22,800 near the site) and the non-perpendicular orientation of its intersection approach legs, traffic does not cross Denny Way except at signalized intersections. Signals on Denny Way are located at Fairview Avenue (about 500 feet west of Pontius Avenue North) and Stewart Street (about 400 feet east of Pontius Avenue North). Major north-south vehicle movements between Mercer Street and Denny Way are served by Fairview Avenue North and Eastlake Avenue North (both principal arterials). Additional north-south movements between these major streets are served by Minor Avenue North and Yale Avenue North; these streets accommodate north-south vehicle movement through the area with or without the south segment of Pontius Avenue North.

Street Vacation Analysis

Regulations for vacating public street right-of-way require that the City Council evaluate the proposal and determine whether the public interest would be served by the vacation. Seattle has adopted policies for street vacations to guide City Council review (Resolution 31142, City of Seattle, 2009).

The effect of the proposed street vacation of Pontius Avenue North on transportation under SA2 or SA3 would be evaluated according to Street Vacation Policies established and adopted by the City) after the Final EIS has been published. While a final determination on consistency with those policies must be made by the Council, a summary of the policies, including transportation circulation and access, is provided under the heading Street vacation Policies below.

Parking

With SA2 or SA3, vacation of the segment of Pontius Avenue North adjacent to the substation site would permanently remove approximately 37 on-street parking spaces. Currently, parking along this street is regulated by pay stations with a 2-hour time limit from 8 a.m. to 6 p.m., which indicates it is intended for short-term parking use during the day. However, the 22 spaces located on the west side of Pontius are part of RPZ 24, and permit holders are not limited to the 2-hour restriction in the blocks designated for RPZ users. The vacation of this segment would eliminate 22 of the 212 parking spaces currently included in RPZ 24.

As described above, the City has a target occupancy of 70 to 85 percent for on-street paid parking. The City may adjust on-street parking price or time limits to achieve this target occupancy.

Elimination of the on-street parking spaces along Pontius Avenue North would reduce supply in the South Lake Union neighborhood, which could increase average on-street parking occupancy elsewhere in the area. The City's parking occupancy data indicate the overall average peak parking occupancy in the east South Lake Union and northeast Denny Triangle area is 88 percent during the weekday. However, none of the streets between John Street and Denny Way, including the segment of Pontius Avenue North, were included in the City's parking occupancy data. If the 27 vehicles counted on Pontius Avenue North during the weekday instead parked elsewhere in the area, this would result in weekday average peak occupancy of about 92 percent. In the evening, the overall average occupancy in the east South Lake Union and north Denny Triangle area is about 67 percent. Since no evening parking count data were available for Pontius Avenue North, it was assumed that vehicles in all 37 spaces would park elsewhere in the area; this would result in an evening average occupancy of about 72 percent. Based on the existing weekday average occupancies, the City could determine whether it is appropriate to increase hourly parking rates and/or reduce time limits for on-street parking in this area, with or without the elimination of the spaces along Pontius Avenue North that would result from SA2 or SA3. Removal of on-street parking spaces would have minor to moderate impacts, depending on the distance to other available parking in the area, which would vary by time of day and day of week.

SA2 or SA3 would also permanently eliminate the existing surface parking lot with 113 spaces on Parcel 1. The off-street public parking lots located in the site vicinity would likely accommodate some of the parking demand that was using Parcel 1 prior to the remediation project. Twelve public parking lots located within approximately 800 feet of the substation site have a total of about 750 spaces. In addition, the Alley 24 parking garage directly north of the substation site on John Street accommodates public parking.

It is also possible that some or all of the surface parking lots in the area could be redeveloped in the future, which could further reduce parking supply and/or increase parking demand in the neighborhood, which would make the loss of on-street parking from vacation of Pontius Avenue North more noticeable. However, the loss of parking due to the street vacation would still be considered a moderate impact, given the availability of parking and transit option that would be available in the area

The following City policies set forth in its Comprehensive Plan (City of Seattle, 2005) encourage management of parking supply:

- Policy T37 – Consider establishing parking districts that allow for neighborhood-based on- and off-street parking management regulations to help meet urban center mode split goals.
- Policy T42 – During construction or implementation of new transportation projects, consider replacing short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss.

In addition, Comprehensive Plan policies T-20 through T-36 all encourage increases in alternative transportation modes such as transit, walking, and bicycling.

The proposed substation site is located in the South Lake Union Urban Center; the Downtown Urban Center is directly to the south, with Denny Way serving as the border between the two centers (City of Seattle, 2005). SMC Chapter 23.54.015 indicates that for all uses located within an Urban Center (except hospitals) there are no minimum parking requirements. Additionally, SMC Chapter 25.05.675 (Policy M) indicates that "No SEPA [State Environmental Policy Act] authority is provided to mitigate the impact of development on parking availability in the Downtown and South Lake Union Urban Centers."

A reduction in on-street parking, combined with the availability of public transit in the area (with numerous bus routes and the Seattle Streetcar located within a few blocks of the project site), support City policies encouraging increased use of alternative transportation modes, particularly in higher density areas such as the Downtown and South Lake Union Urban Centers.

Parking Analysis

The potential effect of eliminating parking was analyzed based on policies in the City's Comprehensive Plan (City of Seattle, 2005) and also relevant sections of the Seattle Municipal Code that pertain to parking supply in the Downtown and South Lake Union Urban Centers.

Therefore, neither removal of the existing parking lot nor vacation of the Pontius Avenue North segment adjacent to the site would require parking mitigation.

Nonmotorized Circulation

The proposed vacation of Pontius Avenue North with either SA2 or SA3 would not adversely affect pedestrian conditions in the area. The existing Pontius Avenue North street segment in question has sidewalks on both sides and provides a connection between Denny Way and the residential and commercial development near Pontius Avenue North/John Street to the north of the substation site. However, due to its offset with the north-south streets to the north and its termination at Denny Way at an intersection that has no pedestrian signal or stoplight, this street segment does not provide continuity in the pedestrian grid. At both the south and north ends of this segment of Pontius Avenue North, pedestrians must travel east or west to find a safe crossing to another north-south street. As part of the street vacation for SA2 or SA3, the proposed project would include a public open space and walkway on the west side of the site within about 100 feet of the existing Pontius Avenue North right-of-way. This would connect to the pedestrian grid, and north-south pedestrian movement between Denny Way and John Street would be directly accommodated through this area. The park-like site design would enhance the pedestrian experience. The pedestrian connection between Denny Way and John Street would also remain along Minor Avenue North (sidewalks on both sides of the street), approximately 175 feet west of the Pontius Avenue North segment that would be vacated.

Under SA3, an elevated walkway is proposed around a portion of the perimeter of the substation structure. This walkway would be built according to design standards with necessary safety features to ensure that pedestrians could not fall off of the walkway, so there would be no adverse safety impacts. This feature would be integrated into the public features of the site itself; the walkway is not intended to serve the primary pedestrian circulation system but rather as an additional amenity for pedestrians, separate from the sidewalk system.

With SA2 or SA3, frontage improvements that meet SDOT standards would be provided along Minor Avenue (6-foot-wide sidewalk plus 6-foot-wide planting strip inclusive of curb). Along John Street, the curb line would be pushed north to allow for a wider planting strip (12 feet inclusive of curb) than provided for SA1. Along Denny Way, the standard 6-foot-wide sidewalk and 6-foot-wide planting strip would be provided for SA2; however, for SA3, the building would be set back from the street to provide a wider sidewalk and planting areas. With SA3, the sidewalk on Denny Way would vary from 10 feet wide just east of Minor Avenue to almost 20 feet wide at the alley on the east end of the site, and the planting strips would vary from 5 feet to 8 feet wide (inclusive of 6-inch-wide curb) along Denny Way. Both SA2 and SA3 would provide landscaping, lighting, and ADA-compliant curb ramps at pedestrian crossings. Curb bulbs would be installed along John Street and Minor Avenue North, which would shorten the pedestrian crossings along the north and west sides of the site. The project would also install bicycle racks and trash/recycling receptacles on site (Power Engineers, 2013). No adverse impacts are expected as a result of these improvements.

Transit

The proposed vacation of Pontius Avenue North with SA2 or SA3 would not adversely impact transit. As a local access street, this segment of Pontius Avenue North does not serve transit; therefore, its vacation would not impact the integrity or continuity of the public transit system. The street vacation would lengthen the curb on Denny Way if Metro Transit desired to move or lengthen the existing bus stop. SA3 also proposes a wider setback of the substation building adjacent to the Denny Way bus stop than the other substation alternatives, which would provide additional space for waiting bus passengers.

City of Seattle Street Vacation Policies

The City has adopted policies for street vacations (Resolution 31142) that must be addressed by the applicant, in this case City Light. A draft application for vacation of Pontius Avenue North was prepared by the design team (NBBJ, 2013; Appendix B Pontius Avenue North Street Vacation Petition) in support of the design for SA3 because it is the preferred alternative, and contains a detailed discussion of conformance with street vacation policies. If SA2 were selected, the application would be modified. With SA1, no vacation would be required and the application would be cancelled. The following summarizes the findings relating to the five substantive street vacation policy areas required to be addressed the application. (There are several procedural policies that are not addressed here, but are either addressed in the application or would be through the street vacation process.) The following repeats some of the findings stated earlier in this chapter, particularly regarding circulation, access, and parking.

Policy 1 – Circulation and Access

The segment of Pontius Avenue North between John Street and Denny Way is classified by the City as a local access street, and its vacation is not expected to adversely affect overall vehicle circulation or traffic patterns in the area. As a local access street, this segment of Pontius Avenue North does not serve transit or truck routes; therefore, its vacation would not affect the integrity or continuity of the public transit system or truck route system. Pontius Avenue North does not include existing bicycle facilities, and no future bicycle facilities are planned by the City along this roadway; therefore, street vacation would not interfere with any existing or planned bicycle routes. The existing street has sidewalks on both sides and primarily provides access between Denny Way and the residential and commercial development located near Pontius Avenue North/John Street, one block to the north. With the proposed street vacation, pedestrian connection between Denny Way and John Street would still be accommodated by Minor Avenue North, approximately 175 feet to the west of the Pontius Avenue North segment, as well as by a public walkway in the proposed open space.

Vacation of this segment of Pontius Avenue North would remove approximately 37 on-street parking spaces that provide short term (2-hour) parking during the daytime and free parking at night. Other paid parking options are available in the area both on- and off-street, and all on-street parking is free at night. The area is also well-served by transit, reducing the need for reliance on automobiles for transportation, consistent with City of Seattle policies encouraging increased use of alternative transportation modes, particularly in higher density areas such as the Downtown and South Lake Union neighborhoods.

Policy 2 – Utilities

All utility services to existing structures within this segment of Pontius Avenue North would be disconnected, demolished, and services would be re-routed. Utility providers have been consulted and each has provided conceptual approval to re-route lines and ducts around the project site. See Chapter 11, Utilities, for additional information.

Policy 3 – Light, Air, Open Space, and View

The vacation of this segment of Pontius Avenue North would eliminate approximately 22,090 square feet of paved and developed street right-of-way while establishing public open space not otherwise required by the Land Use Code, including approximately 46,000 square feet of public open space on the project site. Of these 46,000 square feet, approximately 15,000 square feet would also serve as emergency access to the exterior perimeter of the facility, and 15,000 square feet would be on the elevated walkway extending along three sides of the screen wall structure. The triangular open space to the west of the facility would be approximately 16,000 square feet in area and could be programmed for any number of open space functions as described in Chapter 2, Description of Alternatives. The height and bulk of the project would be much smaller than the zoning would allow on the site, and the project would not block any protected public views. Vacation of Pontius Avenue North would allow the substation and its associated screen wall to be slightly closer to the adjacent building (The Brewster apartments) at Pontius Avenue North and John Street than would be possible without the street vacation, but the screen wall would remain approximately 60 feet from The Brewster apartments at its closest point.

There are no environmentally critical areas that would be affected by the street vacation.

The Land Use Policy analysis in the street vacation application also provides discussion of open space. See Chapter 3, Aesthetics, for additional information on light, air, open space, and views affected by the project.

Policy 4 – Land Use

The proposed Denny Substation is located within one of City of Seattle's six designated Urban Centers: the South Lake Union Urban Center. The Denny Substation would support increased residential, commercial, and industrial development density as planned for in the Seattle Comprehensive Plan and the South Lake Union Neighborhood Plan. The street vacation is not sought as a means of increasing the development potential of the site but rather to meet the space needs of a substation serving the South Lake Union and surrounding area for the foreseeable future, to avoid cost and operational inefficiencies that would be present on a smaller site, where a two level substation would be required to accommodate the same equipment. The street vacation would consolidate two large blocks of land into one of approximately 3.4 acres, creating the largest single parcel in the immediate vicinity. The existing development pattern in the area ranges from parcels of approximately 0.2 acre to parcels of approximately 2.1 acres.

The project eliminates a street in a commercial zone but would not jeopardize the function of the commercial zone. It would not eliminate any existing businesses or disrupt the continuity of an existing commercial street front. The purpose for the project is to provide needed electrical capacity to serve the broader area of South Lake Union and beyond, a goal of both the comprehensive plan and the neighborhood plan. See Chapter 8, Land Use and Housing, regarding comprehensive plan and neighborhood plan policies.

Policy 5 - Public Benefit

The proposed public benefits associated with the street vacation for the Denny Substation (SA3) include:

- Public access to open space plaza
- Elevated pedestrian walkways
- Enhanced alley pavement treatments

7.3.2 Transmission Line Alternatives

As noted in Chapter 2, it is possible that each transmission line alternative route, although anticipated to be underground, could have an overhead component at the south end, approaching the Massachusetts Substation. Underground lines do not generally affect the transportation system over time because ongoing access to them is not usually required and they have no aboveground components. If utility poles were constructed in sidewalks along the sections with overhead lines, they would be located (or sidewalks improved) in a way that would not hinder pedestrian traffic.

With TL2, Sound Transit raised the possibility that operating the 230-kilovolt (kV) line would create magnetic interference with tunnel equipment, leading to a need for emergency closures of the tunnel during operating hours to address problems (see Appendix B – Sound Transit Memorandum on Use of DSTT for Transmission Line Alternative 2). Chapter 5, Environmental Health – Electric and Magnetic Fields, describes the issue of electromagnetic interference (EMI) in more detail. City Light has indicated that while verification would be needed during final design, it appears unlikely that there would be EMI impacts from the project.

Sound Transit also raised the issue of potential cable or splice failures, which would require a need for emergency access for repairs and tunnel closures to transit; this was judged by City Light to be highly unlikely, so no probable transportation impacts associated with this type of tunnel closure are expected (Risch, 2014). Also, any maintenance or inspections of the transmission line that would be required over time would be conducted to avoid impacts to Sound Transit operations and in accordance with a pre-agreed protocol to be established between Sound Transit and City Light.

Transportation infrastructure disrupted during construction would be restored prior to project operation, and the transmission line would not generate vehicle trips except during repair or replacement of lines or equipment, which would be infrequent. Therefore, no operational impacts on transportation are expected to result from any of the transmission line alternatives.

7.3.3 Broad Street Substation Inductor Options

Because the proposed Broad Street Substation inductor and associated equipment would be installed in the Broad Street right-of-way scheduled to be closed as part of the new north portal for the AWV Project, no disruption to other roadways is expected from construction of either BI1 at the Broad Street Substation Annex or BI2 at the Broad Street Substation. As described in Chapter 2, Description of Project and Alternatives, City Light would need to go through the City's street vacation process for the portion of the Broad Street right-of-way that would be used for the project. However, since this street segment will already be closed and not be part of the city street and sidewalk grid, use of the former street right-of-way would not affect transportation, therefore no significant transportation impacts are expected from installing the inductor.

When constructed, BI1 or BI2 would be physically separated from transportation infrastructure and services and would not typically generate vehicle trips. Therefore, no operational impacts on transportation are expected to result from this element of the proposed project.

7.3.4 Distribution System

When constructed, the distribution system in the Phase I Build-out and Future Build-out areas would be located underground and physically separated from transportation infrastructure and services. Transportation infrastructure disrupted during construction would be restored prior to project operation, and the distribution system would not typically generate vehicle trips. Therefore, no operational impacts on transportation are expected to result from the distribution element of the proposed project.

7.4 Impacts of No Action Alternative

Installing an inductor at the Denny Substation site would likely require short-term work in the right-of-way to split the existing underground transmission line into two lines, resulting in a temporary lane narrowing or closure. Truck trips and commute trips related to installing inductors would otherwise result in transportation impacts similar to those described above in Section 7.2.3, Broad Street Substation Inductor Options. Temporary street narrowings and closures, and construction trip generation from installation of underground distribution lines south of Denny Way would result in transportation impacts similar to those described above in Section 7.2.4, Distribution System.

Since the proposed Denny Substation would not be built, no operational trips would be generated. City Light could resume leasing Parcels 1 or 3 for public parking as they were used prior to the start of the remediation project.

7.5 Mitigation Measures

Since no operational impacts are identified for the Denny Substation project, no mitigation measures are warranted. This section presents general and specific mitigation measures identified to avoid or reduce the potential transportation impacts expected to occur during project construction.

7.5.1 General Avoidance and Minimization Measures

Measures Common to All Alternatives – The following mitigation measures would avoid and/or minimize impacts for all project components and would be used unless SDOT determines that they are not needed.

- **Maintenance of Traffic Plans** – The contractor would be required to prepare maintenance of traffic plans for any work within the public right-of-way that affects vehicular, transit, bicycle, or pedestrian traffic. These plans must show the location of traffic cones, traffic control personnel, and signs; note if bus stops are to be closed or relocated; and indicate special treatments for pedestrian and bicycle access.
- **Haul Routes** – The contractor would also need to coordinate with the City to determine appropriate times of travel and haul routes for construction-generated truck traffic. In general, construction-generated truck traffic should be prohibited during weekday peak periods (6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m.). Haul routes generally would be on arterial streets through commercial areas and consist of the most direct path to and from the state highway system.
- **Construction Employee Parking Restriction** – The project is expected to prohibit construction employees from parking on public streets within 12 blocks of the project site (Vosk Group, 2013). In the contractor specifications, any parking for construction employees that could not be directly accommodated on the substation site would need to be in paid lots and garages at market rates. This restriction, combined with the cost of parking in surface lots and garages in the South Lake Union and downtown Seattle areas, would be expected to encourage a higher use of alternative transportation modes by construction employees.
- **Construction through an Intersection** – Manual traffic control would be needed when construction occurs through an intersection. Work in a signalized intersection (or within 50 feet of a signalized intersection) would require police officer control; work in an unsignalized intersection can be performed with certified flaggers.
- **Construction across Driveways** – When trenching across a driveway, the work can usually be done in two parts: trench across one-half of the driveway and then plate it for driving before trenching the other half of the driveway. At major driveways, flagger control may be needed to facilitate alternating enter and exit traffic. Special treatment would be needed for

developments that have split driveways (with one driveway serving entering traffic and one serving exiting traffic) if traffic cannot easily be shifted to the other driveway for two-way operation. Driveways locations are noted in the Transportation Discipline Report. The contractor would be required to coordinate with property owners when driveways or alleys are affected by construction.

- **Signal Detection Disruption** – Some intersections in Seattle have in-pavement induction loops that control traffic signal operations. Prior to trenching through these intersections, alternate detection equipment (e.g., camera detectors) might need to be installed to maintain proper signal function. Loops or permanent cameras would need to be installed as part of restoration.
- **Bus Stop Closure or Relocation** – The duct bank routes use many streets served by transit, and some stops might need to be closed or relocated during construction. The contractor would be required to coordinate with Metro Transit (and Sound Transit and Community Transit for some locations) to close or relocate a bus stop.
- **Construction Below Bus Trolley Power Lines** – To the extent possible, the duct bank would be located so it could be constructed without affecting overhead bus trolley lines. However, if construction equipment clearances require, the contractor would need to work with King County Metro Power Distribution to either temporarily relocate or deactivate the trolley lines during construction.
- **On-street Parking Removal** – The contractor must obtain a street use permit and pay for lost parking revenue to take any on-street parking out of service during construction. Permits are issued by SDOT.
- **Holiday Moratorium –** SDOT does not allow construction work during winter holidays in streets or sidewalks located in the downtown retail core. The ban on construction supports Seattle businesses during the peak shopping season and reduces traffic congestion during this busy time of year. The moratorium period is from Thanksgiving Day through January 1. The moratorium area is bounded on the south by Seneca Street, on the northeast by Denny Way, on the east by I-5, on the north by Virginia Street, and on the west by 1st Avenue. City Light could impose a similar restriction on its contractors in other areas where holiday retail traffic is substantial, such as in portions of the Chinatown/International District.
- **Coordination with Other Construction Projects** – Through its Street Use Permit process and consistent with SMC 15.32.050, the Capital Projects and Roadway Structures Division of SDOT would coordinate the construction needs and impacts of this project with the other infrastructure and development projects in the study area (current major planned projects are listed in Tables F-1 and F-2 and shown in Figure F-1 in Appendix F, Planned Infrastructure and Development Projects). City Light would participate in any construction coordination processes that SDOT establishes for major projects.
- **Education and Outreach** – The public involvement program that would be implemented prior to project construction would not only provide information about the purpose and importance of the Denny Substation Project, but also provide detailed information about the types and locations of expected construction impacts and the measures that would be implemented to minimize those impacts. City Light would work with SDOT to establish a construction outreach team, which would work closely with affected residents and business owners to minimize construction-related impacts throughout the duration of project construction. A contact person

would be identified whom community members can contact to address specific concerns both prior to and during project construction.

Substation Alternatives – To avoid significant transportation system impacts, City Light would implement the following mitigation measure as part of the substation alternative project component:

- **Connection to East Pine/Broad Street Transmission Line** – As described in Section 7.2, Construction Impacts*,* connection of the substation to the existing transmission line located under Denny Way would require major in-street excavation that would likely close more than one lane, and the process could take up to 4 to 6 weeks. The methods required to connect the transmission line into the new Denny Substation site would require that some portions of the work be continuous, so it would not be possible to restrict this work only to weekend and nighttime hours. During this construction element, a full-time closure of at least one direction of Denny Way would likely be required, and traffic would be detoured, most likely via Bellevue Avenue East, East Pine Street, and Boren Avenue, including detour of Metro Route 8. Traffic would also likely need to be detoured off of John Street east of Fairview Avenue North during the same period. The contractor and City Light would coordinate with SDOT to determine the appropriate timing and method for constructing this element to minimize the impacts to traffic on Denny Way, and to continue close coordination throughout the duration of construction.

Transmission Line Alternative 2 – To avoid significant transportation system impacts, City Light would implement the following mitigation measure for TL2:

- **DSTT Closure on a Weekend** – City Light would coordinate with Sound Transit and Metro in order to plan portions of construction at night when the DSTT is closed and to minimize disruption to other activities that need to occur at night. Construction within the stations requiring tunnel closures over weekends would lead to buses being rerouted onto surface streets. Light rail service through the DSTT would also be cancelled and alternate on-street bus service may need to be provided to bridge that light rail gap. Any weekend tunnel closure would occur on days with no major events downtown (sporting events, shows, or festivals), and all work in stations would occur simultaneously where possible to minimize the disruption to transit service. City Light would coordinate closely with Sound Transit and Metro to determine other appropriate mitigation for temporary tunnel closures.

7.5.2 Specific Mitigation Measures

Some segments of project construction would require special treatment to avoid significant transportation system impacts. The potential treatments and targeted locations are described below.

Substation Alternatives

Accommodation of Oversized Loads for Large Equipment Delivery – With any of the substation alternatives, City Light would obtain and comply with permits or approvals needed for hauling overweight and/or oversized loads (e.g., transformers) to the substation site, both for initial mobilization and long-term maintenance. If the equipment were to be transported via I-5 and any other interstate highways, both a WSDOT and a City permit would be required. It is likely that permits would also be required from any other states through which the equipment would travel. It is expected that a minimum of 3 weeks lead time would be needed to obtain each required permit. If the equipment were to be transported by sea and offloaded in Seattle, only a City permit may be required.

Trucks from I-5 would likely be directed to use the southbound Mercer Street off-ramp. This ramp has no vertical clearance limitation (as the northbound off-ramp does in its tunnel) and no weight limitation because it is not on a structure. Trucks are usually directed to travel north of Seattle on Interstate-405 (I-405) (east of Lake Washington) to Lynnwood and then travel south on I-5 to Mercer Street. This route allows heavy trucks to avoid use of any bridge overpasses where weight or turning radii might be an issue.

SDOT will likely regulate when, where, and how the trucks could move on city streets. Typically, they can only be transported between 12:00 a.m. and 5:00 a.m. under police escort.

Transmission Line Alternatives

Mitigation Common to All Alternatives

Construction over Roadways – Installation of an overhead transmission line across roadways would require temporary closure of roadways and sidewalks during the period that the overhead wires are pulled (up to one hour per wire, for three wires). City Light would conduct close coordination with SDOT to define the appropriate construction periods, methods and measures needed to minimize the impact of this activity on roadway and nonmotorized operations.

Construction across Rail Yard – Installation of an overhead transmission line across the Sound Transit rail yard and BNSF Railway tracks would require disruption of operation of Sounder commuter trains, Amtrak passenger trains, or freight trains during the period in which the wires are pulled (up to one hour per wire, for three wires). City Light would conduct close coordination with BNSF Railway, Sound Transit, and Amtrak to define the appropriate construction periods, methods and measures needed to minimize the impact of this activity on train operations.

Construction at Massachusetts Substation – Connection of an overhead transmission line to the existing Massachusetts Substation could disrupt truck traffic between the Port of Seattle and the BNSF North SIG Yard located directly to the south of the substation. City Light would conduct close coordination with BNSF Railway and the Port of Seattle to define the appropriate construction periods, methods and measures needed to minimize the impact of construction activities on truck operations. Since truck access to and from the BNSF North SIG Yard is provided via both Colorado Avenue South and First Avenue South, disruption at one cross street could likely be accommodated by routing all trucks to the other cross street.

Transmission Line Alternative 1 (TL1)

Full or Partial Street Closure at Night and/or on Weekends – Construction of the underground transmission line under TL1 would require trenching across and along principal arterials and freeway ramps, which would create substantial traffic and transit impacts if performed on weekdays when traffic volumes and transit ridership are highest. Segments where nighttime and weekend lane closures may be required are listed below:

- 6th Avenue at University Street/I-5 northbound on-ramp
- 6th Avenue at Seneca Street/I-5 northbound off-ramp
- 6th Avenue at Spring Street/I-5 southbound on-ramp
- 6th Avenue between the Marion Street and Yesler Way

Transmission Line Alternative 3 (TL3)

Full or Partial Street Closure at Night and/or on Weekends – Construction of underground transmission line for TL3 would require trenching across and along principal arterials where freeway ramps that serve downtown Seattle connect. The capacity of the ramp junctions could be affected if the duct bank trench requires traffic lane closures. Depending on the location of the duct bank trench, SDOT may require nighttime and weekend construction on:

- 7th Avenue between Marion Street and Madison Street
- 7th Avenue from James Street to Cherry Street
- South Dearborn Street between the I-5 northbound on-ramp to the I-5 southbound off-ramp

Broad Street Substation Inductor Options

No additional special mitigation measures would be needed for either BI1 or BI2.

Distribution System

Phase 1 Build-out Area

No Construction on Principal or Minor Arterials during Peak Commute Hours – It is anticipated that SDOT would not allow City Light to engage in construction on the following principal and minor arterials during these weekday time periods:

- Fairview Avenue North – No construction from 6:00 a.m. to 9:00 a.m. and from 3:00 p.m. to 6:00 p.m.
- Republican Street – No construction from 6:00 a.m. to 9:00 a.m. and from 3:00 p.m. to 6:00 p.m.

Crossing Fairview Avenue North – When trenching along or across Fairview Avenue North, it is anticipated that SDOT would require that two lanes of traffic in each direction be maintained during the commuter peak periods from 6:00 a.m. to 9:00 a.m. and from 3:00 p.m. to 6:00 p.m. Traffic could be routed through parking lanes to achieve this capacity. During off-peak hours, the travelway could be narrowed to one lane in each direction.

Along or under the Streetcar Tracks – There are two possible methods that can be applied to construct the duct bank across the streetcar tracks without requiring removal of the tracks themselves:

- Trenching up to each side of the streetcar tracks, tunneling under the set of tracks, and then setting a precast duct bank
- Excavating a jacking (starting) pit on one side and a receiving pit on the other side, using a small boring machine to dig a tunnel between the two pits, and then sliding in a precast duct bank

Although the second method could possibly allow the streetcar to continue to run, it is likely that either method would require that streetcar operations cease during construction. Therefore, it is anticipated that SDOT would require construction to occur at night (if noise restrictions can be met) or on weekends. It is estimated that each crossing would require one to two weekend closures to construct.

For installation of duct bank adjacent to the auxiliary trolley barn tracks on Harrison Street, if a 10-foot clearance between the construction activities and the track cannot be attained, it is anticipated that SDOT would require one of the following measures to be applied:

- Install a temporary hard barrier at the edge of the track during streetcar operating hours to separate the track from construction activities.
- Place a flagger/spotter at the edge of the track and have equipment and construction activities stand down when a streetcar is passing.
- Conduct construction activities during nighttime hours when the streetcar is not operating.

City Light would coordinate with Metro to define the appropriate timing and methods needed to minimize the impact of construction activity on streetcar operations.

7.6 Unavoidable Significant Adverse Impacts

No unavoidable significant adverse impacts to transportation are anticipated from either construction or operation of the Denny Substation Project.

Chapter 8: LAND USE AND HOUSING

8.1 Affected Environment

To define the affected environment for land use and housing, the land uses in the vicinity of the project components were inventoried and tabulated. The types and nature of housing in the Denny Substation site study area were identified and described, with emphasis on understanding the extent of low-income housing that could be affected by the project. The project's consistency with land use policies was also evaluated.

Land Use and Housing Key Findings

The substation use would contrast with adjacent residential and commercial uses in that it would require minimal operational attendance and would not, of itself, attract visitors. It is not expected to adversely affect the viability of adjacent land uses.

The substation would not displace any existing housing, nor disproportionately affect low-income households off-site.

The transmission line alternatives, the distribution system, and the Broad Street Substation inductor options would not affect adjacent land use.

The Denny Substation alternatives are consistent with City plans and policies. The transmission line, Broad Street Substation inductor, and distribution system were not separately evaluated for such consistency since no changes in land use are anticipated from them.

The No Action Alternative would prevent extension of network service to South Lake Union, which would be inconsistent with City policies supporting high density, technology development. Indirect impacts could arise from the lack of network service for the South Lake Union neighborhood. If surplused, the substation parcels could support mixed-use towers of up to 400 feet in height.

No unavoidable significant impacts to land use or housing are anticipated from any of the action alternatives.

8.1.1 Substation Alternatives

Existing Plans, Policies, and Regulations

<u>City of Seattle Comprehensive Plan</u>

The City of Seattle (City) Comprehensive Plan (City of Seattle, 2005) is a 20-year policy plan containing goals and policies that articulate a vision for how the city will grow in ways that sustain its citizens' values. The plan is organized around 12 elements, including urban village, land use, transportation, utilities, and economic development. The land use element identifies five land use designations (single-family, multifamily, commercial, industrial, and downtown) that serve as the basis for more detailed zoning designations in Seattle's Land Use Code. The Denny Substation site is designated Commercial/Mixed Use Areas. Policies specific to the Denny Substation Project include provision of public open space in conjunction with major public projects; coordination of City investment in utilities with business, employment, and economic development opportunities; and provision of reliable utility service. The policies identified in the South Lake Union Urban Center Neighborhood Plan (described below) are adopted into the Neighborhood Planning Element of the City's Comprehensive Plan.

South Lake Union Urban Center Neighborhood Plan

The South Lake Union Urban Center Neighborhood Plan (DPD, 2007) establishes goals, policies, and strategies for the following topics: housing, sustainable development, neighborhood character, transportation, and parks and open space. The plan is meant to guide future actions by the City and community. Policies specific to the Denny Substation Project include supporting the growth of innovative industries by creating reliable power, incorporating the arts into the design of public projects, promoting safe pedestrian and bicycle connections, and providing for new parks and open spaces.

Identifying the Affected Environment

Existing land uses in the vicinity of all project alternatives were identified using King County parcel data, King County Assessor's data, City of Seattle geographic information system data, photographs provided by City Light, publicly available aerial photographs, and, in some cases, site inspection. For transmission line alternatives, the length of the frontage of the land uses that are wholly or partially within one-half block of the routes on both sides of the right-of-way were included in the analysis. The right-of way within which the transmission line route is located is not included in the calculations.

Housing within the Denny Substation site vicinity was evaluated by identifying the quantity, type, age, and condition of structures. The presence of low-income housing adjacent to and in the general vicinity of the proposed substation site was noted. Proposed new developments ("pipeline projects") were identified using land use permit application submittals, and potential development was assessed based on an analysis of zoning, the presence of development, and the age of structures.

Substation Area Zoning

Zoning districts establish allowed and prohibited uses as well as maximum building heights and other development standards. The Denny Substation site is currently zoned Seattle Mixed (SM) 240/125-400. The allowed uses and heights are described in detail below in this section under Proposed and Potential New Uses and Development.

City of Seattle Land Use Code

The City's Land Use Code establishes standards specific to each zoning designation. The Denny Substation site must meet regulations established in Seattle Municipal Code (SMC) Chapter 23.48, Seattle Mixed.

City of Seattle SEPA Policies on Land Use and Housing

The City's State Environmental Policy Act (SEPA) policy on land use SMC 25.05.675.J.2.a states: "It is the City's policy to ensure that proposed uses in development projects are reasonably compatible with surrounding uses and are consistent with any applicable, adopted City land use regulations, the goals and policies set forth in Section B of the land use element of the Seattle Comprehensive Plan regarding Land Use Categories…" The analysis of applicable policies and regulations in this chapter provides the basis for assessing whether the project is consistent with any applicable land use regulations, goals and policies, and a determination as to whether the project is reasonably compatible with surrounding uses.

Seattle's SEPA policy on housing (SMC 25.05.675.I.2) focuses on housing preservation, especially housing for low-income residents. The policy directs that project proponents must disclose on-site and off-site impacts of the proposed projects upon housing, with particular attention to low-income housing. It also indicates that compliance with City ordinance provisions relating to housing relocation, demolition, and conversion constitutes compliance with the SEPA housing policy. Finally, the policy directs that the City shall give high priority to limiting demolition of low-income housing in the development of its own facilities.

Green Streets

The purpose of a Green Street is to enhance and expand public open space, and to reinforce desired land use and transportation patterns on appropriate City street rights-of-way. The City's Comprehensive Plan and Transportation Strategic Plan collectively contain the policy guidance for designation and development of Green Streets. The design and construction of Green Street improvements is voluntary and can be funded by developers in exchange for increased floor-area-ratio or other land use code departures, as specified in Seattle's Land Use Code (SMC 23.49.013). John Street is a designated Green Street.

What is a Green Street?

A Green Street is a street right-of-way that, through a variety of design and operational treatments, gives priority to pedestrian circulation and open space over other transportation uses.

Seattle City Light Integrated Resource Plan

The Seattle City Light Integrated Resource Plan (City Light, 2012a) is a long-term plan that describes how City Light will meet anticipated customer needs over the next 20 years. The plan presents a preferred portfolio as the best option to meet customer demand and energy-policy objectives. City Light can meet its energy needs out to 2020 through a combination of new conservation approaches, seasonal market purchases, and power contract flexibility.

Seattle City Light 2013–2018 Strategic Plan

The Seattle City Light 2013–2018 Strategic Plan (City Light, 2012b) establishes a course for how City Light will best meet its customers' current and future needs for the next six years. Strategic investments are identified consistent with one or more of the plan's four key objectives: Objective 1, improve customer experience and rate predictability; Objective 2, increase workforce performance and safety practices; Objective 3, enhance organizational performance; and Objective 4, continue conservation and environmental leadership. The Denny Substation (identified in the plan as north downtown substation) is listed as a strategic investment consistent with Objective 1.

Land Use and Housing

Land uses and housing units within the blocks immediately adjacent to the proposed Denny Substation site were identified and evaluated. This area is referred to as the land use and housing study area. These are the properties that would potentially be affected by operation of the project. Properties that are more than a block away from the site are generally blocked from the site by other buildings. The Denny Substation site land use and housing study area is shown along with parcel numbers in Figure 8-1.

Figure 8-1. Denny Substation Site Land Use and Housing Study Area

Land Use

Land use in the study area includes a mix of multifamily residential, mixed-use residential, retail, office, institutional uses, religious facilities, and parking lots. Within the blocks analyzed, there are 50 properties shown in Figures 8-1 and 8-2. Figure 8-2 shows land uses by parcel number within the study area.

Figure 8-2. Land Uses in Denny Substation Site Study Area

Figure 8-3 shows the percentage of each use by lot area in the Denny Substation study area. The numbers in parentheses indicate the number of parcels in that particular use. As shown in Figure 8-3, retail (e.g., restaurants, equipment retailers, shopping centers), office, parking lots, and residential (e.g., apartments, retirement homes, transitional housing) uses are the predominant uses in the area (72 percent). Mixed-use residential (residential buildings with retail on the ground floor) constitutes 13 percent of properties. The remaining uses include institution (the Seattle Cancer Care Alliance [SCCA] House and YouthCare - see description in Table 8-1 below; and the Minor Avenue Children's House, a Montessori preschool) and religious facility (the Immanuel Lutheran Church).

Figure 8-3. Land Uses in the Denny Substation Site Study Area (by lot area)

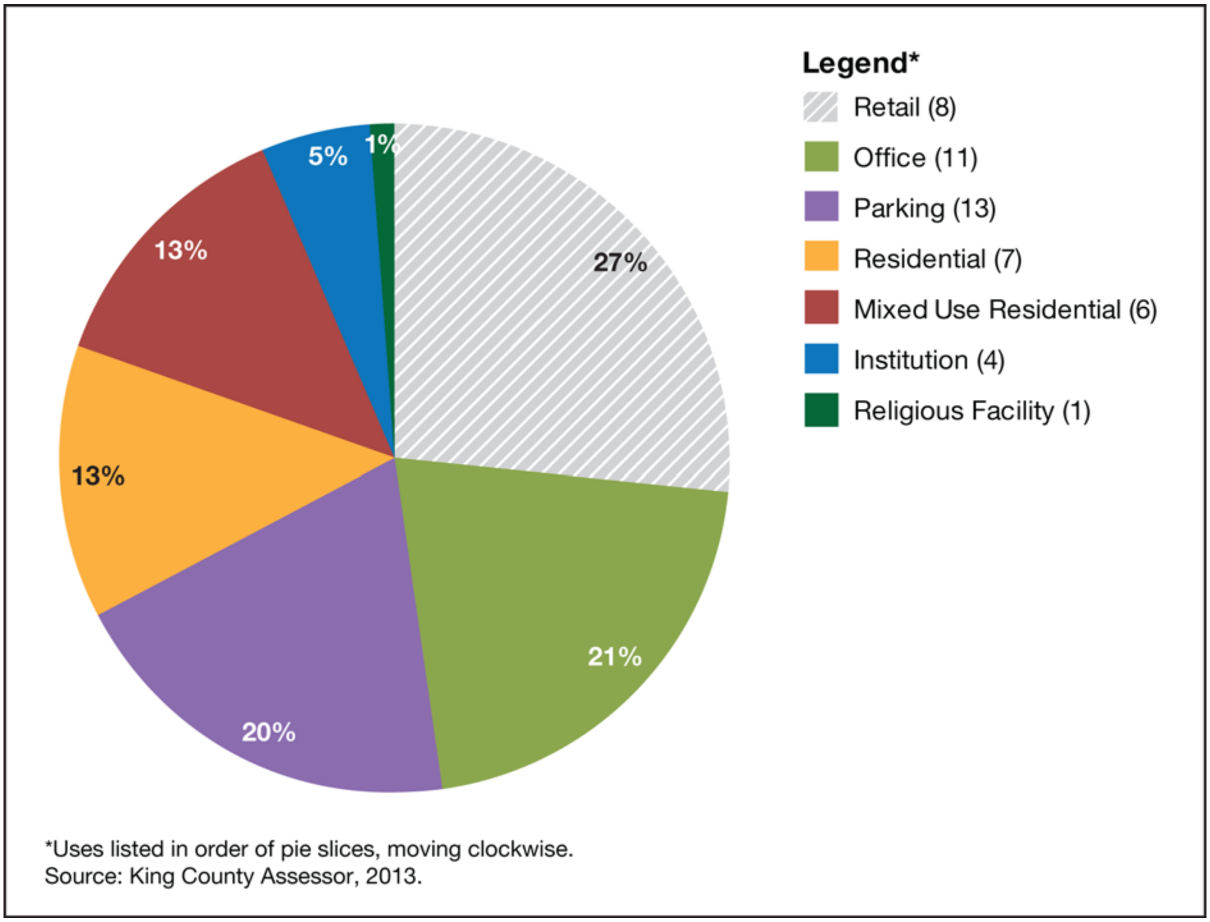


Table 8-1 below describes the land uses on the properties adjacent to the substation site, including the name of the use or building and the age of structures.

Nine buildings are directly adjacent to the proposed substation site. They include retail, residential, and commercial uses. There are no public parks, schools, religious organizations, or other community uses directly adjacent. Denny Way is a highly traveled, 50-foot-wide roadway that limits interaction between land uses on either side of the street, so land uses south of Denny Way are not considered in this analysis.

Table 8-1. Uses Immediately Adjacent to the Proposed Denny Substation Site

Parcel Number	Name	Description
2468400060, 2468400035, 2468400025, 2468400005	Mirabella Seattle Retirement Community	12-story, 724,148-square-foot residential retirement community. Main entrance is on Fairview Avenue. Constructed in 2007. Building has underground parking and retail on the ground floor.
2468400070	The Brewster apartments	Three-story, 24,000-square-foot brick apartment building. Constructed in 1916. Owned by Capitol Hill Housing.
2467400430	Seattle Cancer Care Alliance (SCCA) House	Six-story, 83,000-square-foot building. Constructed in 2008. Provides short-term (nightly) and medium-term (monthly) housing for SCCA patients and their families and/or caregivers while receiving treatment at SCCA. Building has underground parking.
6849700130	Alley 24 Apartments (South Tower)	Six-story, 81,542-square-foot residential building. Constructed in 2006. Market rate apartments. Building has underground parking.
6849700145, 6849700155, 6849700165, 6849700175	Alley 24 Office (223 Yale Bldg)	Six-story, 336,700-square-foot office building with ground-floor retail. Retail uses do not face John Street. The building extends all the way through the block from John Street to Thomas Street. Constructed in 2005. Building has underground parking.
6849700205	Recreational Equipment, Incorporated (REI)	Outdoor equipment retailer. Four-story, 270,723-square-foot building, constructed in 1996. Parking and main entrance are on Yale Avenue. Building has underground parking.
6849700280	1370 Stewart Street	Two-story 5,700-square-foot office building. Constructed in 1971.
6849700075	Feathered Friends	Outdoor equipment retailer and office. Two-story, 11,975-square-foot building, constructed in 1927.
6849700055	David Colwell building	Mixed-use (residential/retail), six-story building. Owned by Plymouth Housing. Ground floor retail use (5,066 square feet) is second-hand sports equipment. Top five floors are income-qualified rental units (64,603 square feet). Building has underground parking and was constructed in 2000.

Three buildings listed in Table 8-1 have main entrances facing the proposed substation site. The SCCA House has its main entrance at the corner of John Street and Pontius Avenue North. The Brewster apartment building has its main entrance on Pontius Avenue North. Five units in the Alley 24 Apartments (South Tower) have entrances on John Street. Both the Mirabella Seattle Retirement Community and Alley 24 office building have parking and service entrances facing the proposed substation site. The only active use, such as retail, eating and drinking establishment, entertainment use, or park facility, that faces the substation site is on the ground floor of the SCCA House, which has a retail shop at the corner of John Street and Pontius Avenue North. The Feathered Friends retail store is also adjacent to Parcels 2 and 3, but its main entrance is on Yale Avenue North.

Housing

There are approximately 886 residential units within the study area. Figure 8-4 shows residential properties within the study area, with their names and the number of units in each. Of the units shown, 198 (22 percent) are market rate apartments or townhouses. A total of 242 units (27 percent) are reserved for cost-burdened households (with incomes that are considered insufficient to afford market rate rental housing), and the others are special-purpose housing (e.g., retirement community). For comparison, Seattle Planning Commission found that 35 percent of all households in Seattle were cost-burdened. 44 percent of all households in Seattle are defined as low-income households (with incomes less than 80 percent of the median household income for King County) (Seattle Planning Commission, 2011).

Figure 8-4. Housing in the Denny Substation Site Study Area

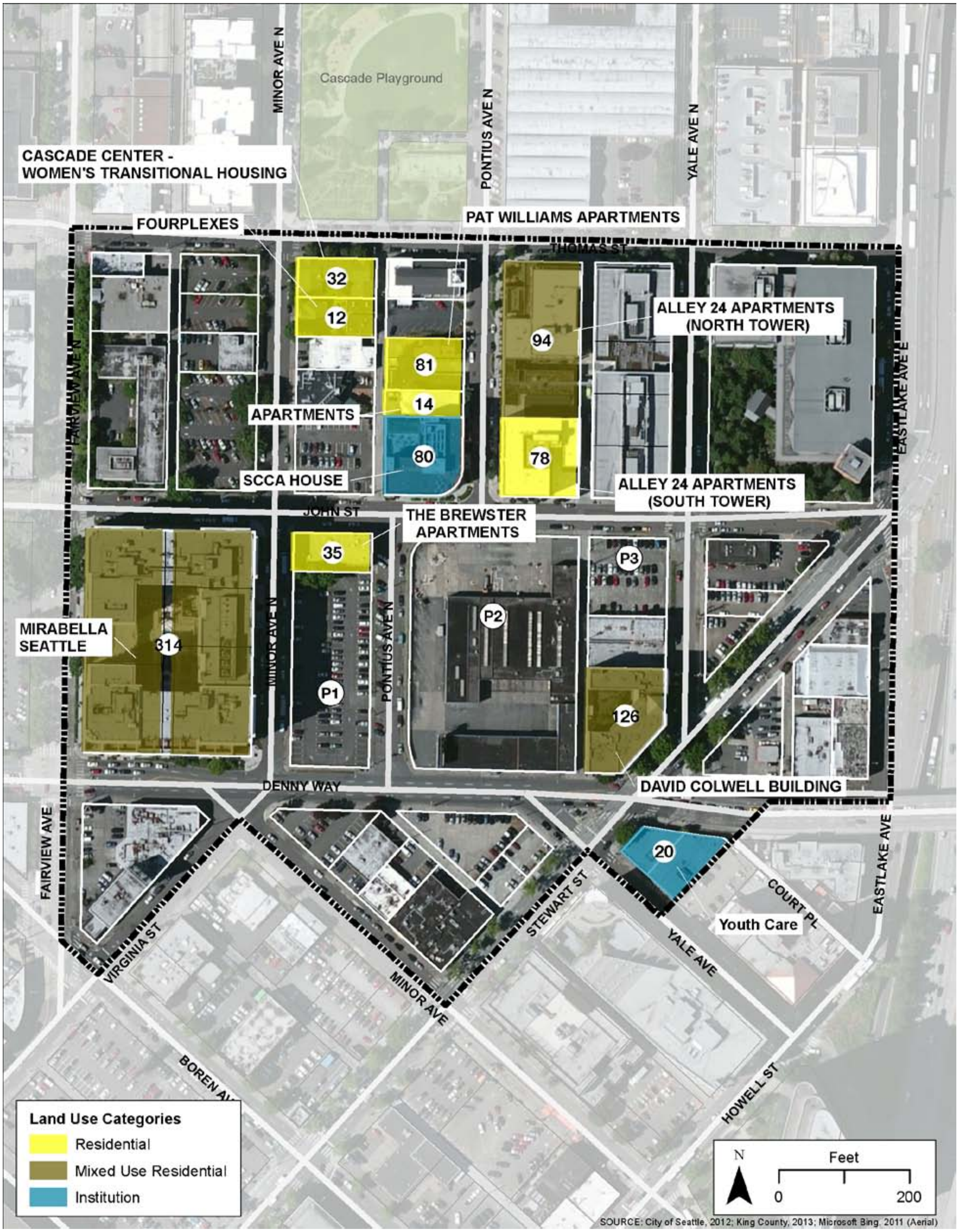


Table 8-2 provides information for non-market rental housing in the Denny Substation Site Study Area, including the name of the building, number of units, and a description of the housing.

Table 8-2. Income-Qualified or Other Special-Purpose Housing in the Denny Substation Site Study Area

Building Name	Number of Units	Description
Income-qualified Housing		
The Brewster Apartments	35	The Brewster apartments are owned and operated by Capitol Hill Housing, a public corporation organized by the City of Seattle. The building serves households earning 40 to 50 percent of area median income.
Pat Williams Apartments	81	The Pat Williams Apartments were built in 2012 by the Plymouth Housing Group. The apartment serves previously homeless individuals who are recovering from substance abuse and addiction. Tenants pay one-third of their incomes.
David Colwell Building	126	The David Colwell building is owned by the Plymouth Housing Group. It provides income-qualified rental units. The Plymouth Housing Group serves a homeless population with disabilities such as mental illness, chronic medical conditions, chemical dependency, HIV/AIDS, post-traumatic stress disorder, and the effects of aging and poverty.
Other Special-purpose Housing		
Mirabella Seattle Retirement Community	314	Mirabella Seattle Retirement Community is a continuing care retirement community developed by Pacific Retirement Services, Inc. It includes multiple floor plans for independent living, assisted living, and skilled nursing care.
Cascade Center - Women's Transitional Housing	32	This building was developed by the Compass Housing Alliance. It provides services, shelter, and transitional housing for homeless women. Participants may stay up to 1 year and pay 30 percent of their income.
Seattle Cancer Care Alliance (SCCA) House	80	The SCCA House provides short-term (nightly) and medium-term (monthly) housing for SCCA patients and their families and/or caregivers while receiving treatment at SCCA.
YouthCare	20	YouthCare provides overnight emergency shelter for 18-24 year olds at the James W. Ray Orion Center. YouthCare serves Seattle's homeless youth by providing outreach, basic services, housing, counseling, education and employment training.

Proposed and Potential New Uses and Developments

Planned Future Development

Within the study area, one master use permit has been issued by the Seattle Department of Planning and Development (DPD), indicating a strong likelihood of future development. A permit has been issued for the Lexas Towers, located a block south of the proposed substation site, between Minor Avenue, Stewart Street, and Denny Way, for two 35-story towers above a 5-story podium. This complex would contain 340 residential units, approximately 30,000 square feet of retail and restaurant, and underground parking for 940 vehicles. The permit was originally issued in February 2012 but has been extended until September 2016. Northwest of the Denny Substation site, permits have been issued for two new seven-story buildings at 222 Fairview Avenue North and 221 Minor Avenue North. These would have 213 and 264 residential units respectively, and would include a small amount of live/work units and retail space.

Potential New Uses

Potential types of new uses and developments at the proposed site and within the study area are limited by the City's zoning code. Whether a property will be developed or redeveloped is determined by market factors such as the existing use, age of the existing building, and potential return on investment from new development. Determining the likelihood of development based on market factors is beyond the scope of this analysis. However, it is assumed that older, smaller buildings and underdeveloped lots are most likely to be redeveloped.

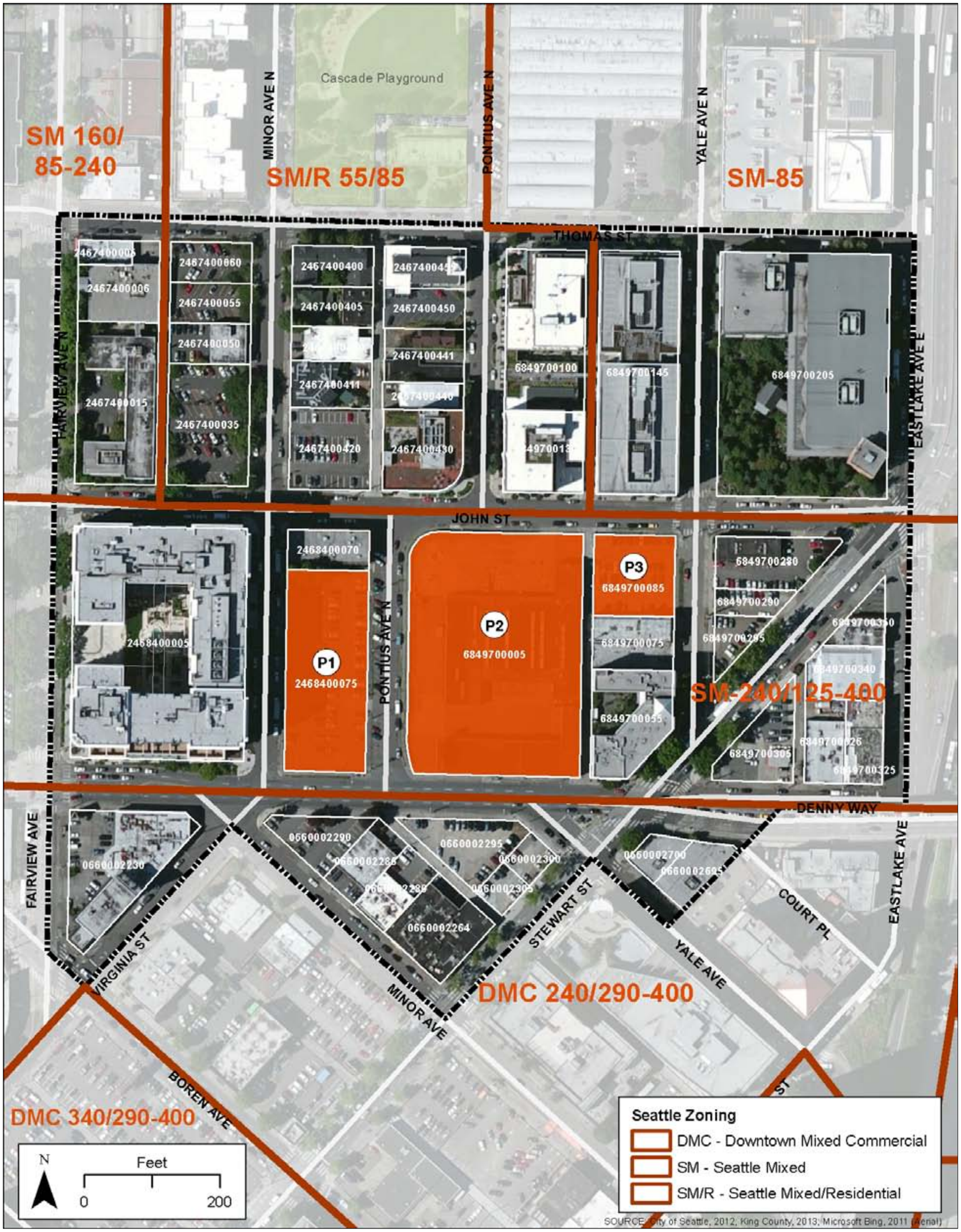
Of the nine buildings immediately adjacent to the proposed Denny Substation site, five have been constructed since 2000 (see Table 8-1) and are, therefore, unlikely to redevelop in the near future. The Feathered Friends building on Yale Avenue and The Brewster apartments on John Street were built in 1927 and 1916, respectively. The owners of The Brewster apartment building sold 36,000 square feet of their transferable development rights (TDR) in 2009. The receiving site for those TDRs was on Terry Avenue. Therefore, The Brewster apartments are unlikely to redevelop. A small office building at 1370 Stewart built in 1971, is just two stories, while zoning allows far more. Based on this information, the Feathered Friends building and the 1370 Stewart Building are the only buildings immediately adjacent to the Denny Substation site that appear likely to be redeveloped.

There are several parking lots immediately adjacent to or on the proposed Denny Substation site. One of them is Parcel 1, which would be used as part of the substation facility under Substation Alternative 2 (SA2) and Substation Alternative 3 (SA3) but would be potentially surplused for private development under Substation Alternative 1 (SA1). A second is Parcel 3, which would potentially be surplused for private development under all three substation alternatives. A third parking lot is a privately owned 14,400-square-foot parking lot on the northwest corner of Minor Avenue North and John Street. Two other small parking lots stand on separate parcels on the east side of Yale Avenue North, across from Parcel 3. These parking lots are considered likely to redevelop given the demand for land in the South Lake Union area.

Zoning and Allowed Land Uses

Potential new development and redevelopment would presumably be consistent with and guided by the City's zoning code. The Seattle City Council (City Council) adopted zone changes for South Lake Union in May 2013. These changes allow for increased density and greater building heights through incentives (see explanation following). The Denny Substation site is zoned SM 240/125-400. Properties on the north side of John Street are zoned Seattle Mixed/Residential (SM/R) 55/85. Properties from the midblock line between Yale Avenue North and Pontius Ave North, north of John Street are zoned SM 85. The properties south of Denny Way are zoned Downtown Mixed Commercial (DMC) 240/290-400. Figure 8-5 shows the zoning districts in the study area.

Figure 8-5. Zoning Districts in the Denny Substation Site Study Area



The SM zone is applied to areas within urban centers that provide for "a wide range of uses to encourage development of the area into a mixed-use neighborhood with a pedestrian orientation" (SMC 23.34.128). Both SM and SM/R allow mixed residential and non-residential uses, although the SM/R zone includes special provisions to encourage residential development. The code allows nearly any use in both zones, with some limited exceptions and conditional uses. The code prohibits all high-impact uses, heavy manufacturing, certain adult uses, jails and corrections-related uses, animal-related uses, certain types of parking lots, waste-handling related uses, outdoor storage, and other uses (SMC 23.48.004(B)).

The DMC zone, located across Denny Way from the substation, also allows most land uses, with similar prohibitions as SM, except that park-and-ride lots, park and pool lots, animal husbandry and shelters, mobile home parks, jails, and work release programs are not prohibited, while all general manufacturing is prohibited. Substations are permitted uses in all zones in Seattle including the zones listed in Table 8-3 below.

Maximum height and floor area limits for typical development anticipated in the SM zone vary, and can be achieved through incentives. Developers are allowed to build to a "base" height and floor area ratio (FAR) without using the incentive program. Additional floor area and height require contribution of public amenities in the form of affordable housing, childcare amenities, provision of public open space, or purchase of development rights through a transfer of development rights program. Table 8-3 summarizes the maximum height allowance for applicable zones in the study area.

Table 8-3. Potential Building Heights for Properties Planned or Likely to Redevelop or Develop at or Adjacent to Proposed Denny Substation Site

Zone	Applicable Properties	Base Height (feet)	Maximum Height with Incentives
SM/R 55/85	210 Minor Avenue North	55 feet for structures occupied only by residential use.	85 feet for mixed-use structures with at least 60% gross floor area in residential use.
SM 240/125-400	Parcels 1–3 and Feathered Friends building	240 feet for nonresidential uses or 125 feet of residential use.	An additional 275 feet of residential use up to a total maximum height of 400 feet with incentives. Buildings greater than 85 feet have a maximum podium height of 65 feet along Denny Way and 45 feet along John Street.
DMC 240/290-400	All properties south of Denny Way	240 feet for non-residential uses OR 290 feet of residential use.	An additional 110 feet of residential use up to a total maximum height of 400 feet.

DMC = Downtown Mixed Commercial; SM = Seattle Mixed; SM/R = Seattle Mixed/Residential

Pedestrian Environment

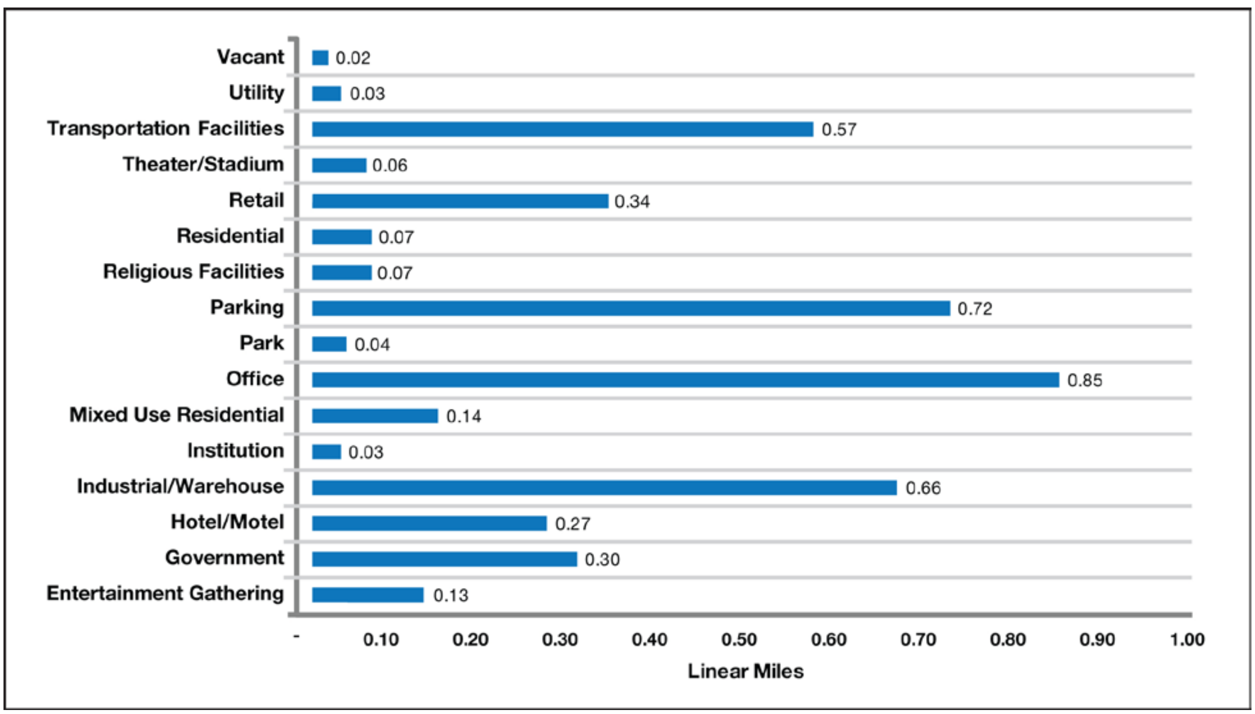
For typical development anticipated in the SM zone, a minimum of 60 percent of the street-facing building façade must be transparent (windows or other openings) along "Class 2 Pedestrian Streets" and "Neighborhood Green Streets" (SMC 23.48.014(D)(1)(a)). These include Denny Way, Stewart Street, and Fairview Avenue. Ground floor active uses are not required along the streets adjacent to the proposed substation. However, ground floor active uses (general sales and service uses, eating and drinking establishments, entertainment uses, public libraries, public parks, or arts facilities) are encouraged by exempting their floor area from FAR limits. Any portion of a façade that is not transparent is considered to be a blank façade. Blank façades are generally limited to 15 feet wide, except for garage doors, along Denny Way, John Street, and Fairview Avenue North.

8.1.2 Transmission Line Alternatives

Transmission Line Alternative 1 (TL1)

The Transmission Line Alternative (TL1) stretches 2.93 miles, passing through several Seattle neighborhoods (see Appendix A, Neighborhood Map). Twenty-six percent of the length of the route is located adjacent to right-of-way (e.g., street intersections); this percentage does not include the rights-of-way in which the line would be installed. The frontages of land uses located to either side of the route are shown in Figure 8-6 as linear miles (both sides of the route are counted which results in a doubling of total linear miles of the route). The most prominent land uses along either side of the transmission line are office, off-street parking, industrial warehousing and transportation facilities, including King County Metro's Ryerson Base (bus maintenance) and BNSF Railroad property (rail yard) in the South of Downtown (SODO) neighborhood. Uses that are particularly sensitive to construction noise (such as residential, religious facilities, and parks) comprise a relatively small proportion of the total land uses along the route.

Figure 8-6. Land Uses on Either Side of TL1 in Linear Miles



Source: King County Assessor, 2013

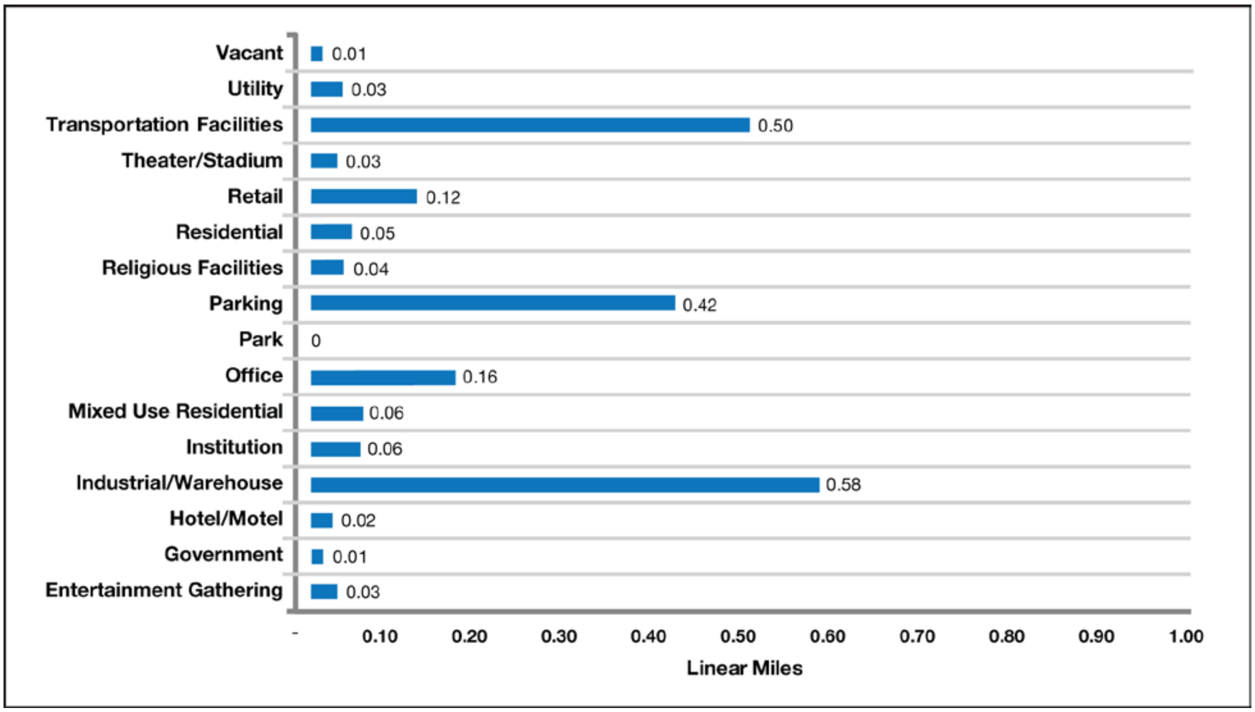
Transmission Line Alternative 2 (TL2)

Transmission Line Alternative 2 (TL2) route would be virtually the same length as TL1, at 2.95 miles. People at the aboveground land uses in the vicinity of the TL2 route as it passes through the Downtown

Seattle Transit Tunnel (DSTT) would neither see the transmission line after installation nor be aware of construction activities underground, so land uses along the DSTT portion of the TL2 route were not considered in this evaluation. Twenty-four percent of the length of the route is located adjacent to right-of-way (e.g., street intersections); this percentage does not include the rights-of-way in which the line would be installed or the DSTT portion of the route. The frontages of land uses located to either side of the route outside of the DSTT are shown in Figure 8-7 as linear miles (since both sides of the route are counted, the total linear miles of land uses is doubled). The most prominent land uses along either side of the transmission line are industrial/warehouse, transportation facilities (King County Metro Ryerson Base and BNSF rail yard) and off-street parking.

Uses that may be particularly sensitive to construction noise and activities (such as residential and religious facilities) comprise a relatively small proportion of the total.

Figure 8-7. Land Uses on Either Side of TL2 in Linear Miles

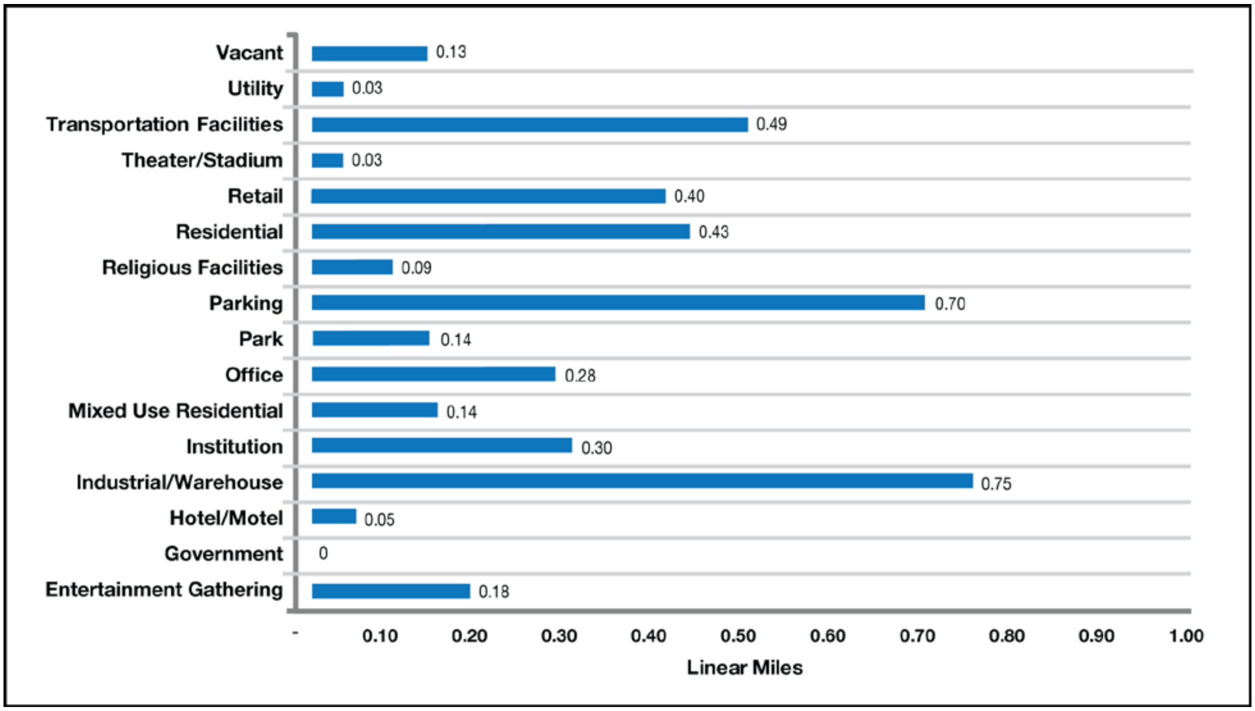


Note: Uses adjacent to the portion of the TL2 route within the DSTT are not included
Source: King County Assessor, 2013

Transmission Line Alternative 3 (TL3)

The Transmission Line Alternative 3 (TL3) would be the longest of the route alternatives, at 3.29 miles. Thirty-seven percent of the length of the route is located adjacent to right-of-way (e.g., street intersections); this percentage does not include the rights-of-way in which the line would be installed. The frontages of land uses located to either side of the route are shown in Figure 8-8 as linear miles (since both sides of the route are counted, the total linear miles of land uses is doubled). The most prominent land uses along either side of the transmission line are industrial/warehouse, off-street parking, and transportation facilities. Uses that may be particularly sensitive to construction noise (residential, religious facilities, healthcare institutions and parks) comprise a larger proportion of the total land uses along the route than the other transmission line alternatives.

Figure 8-8. Land Uses on Either Side of TL1 in Linear Miles

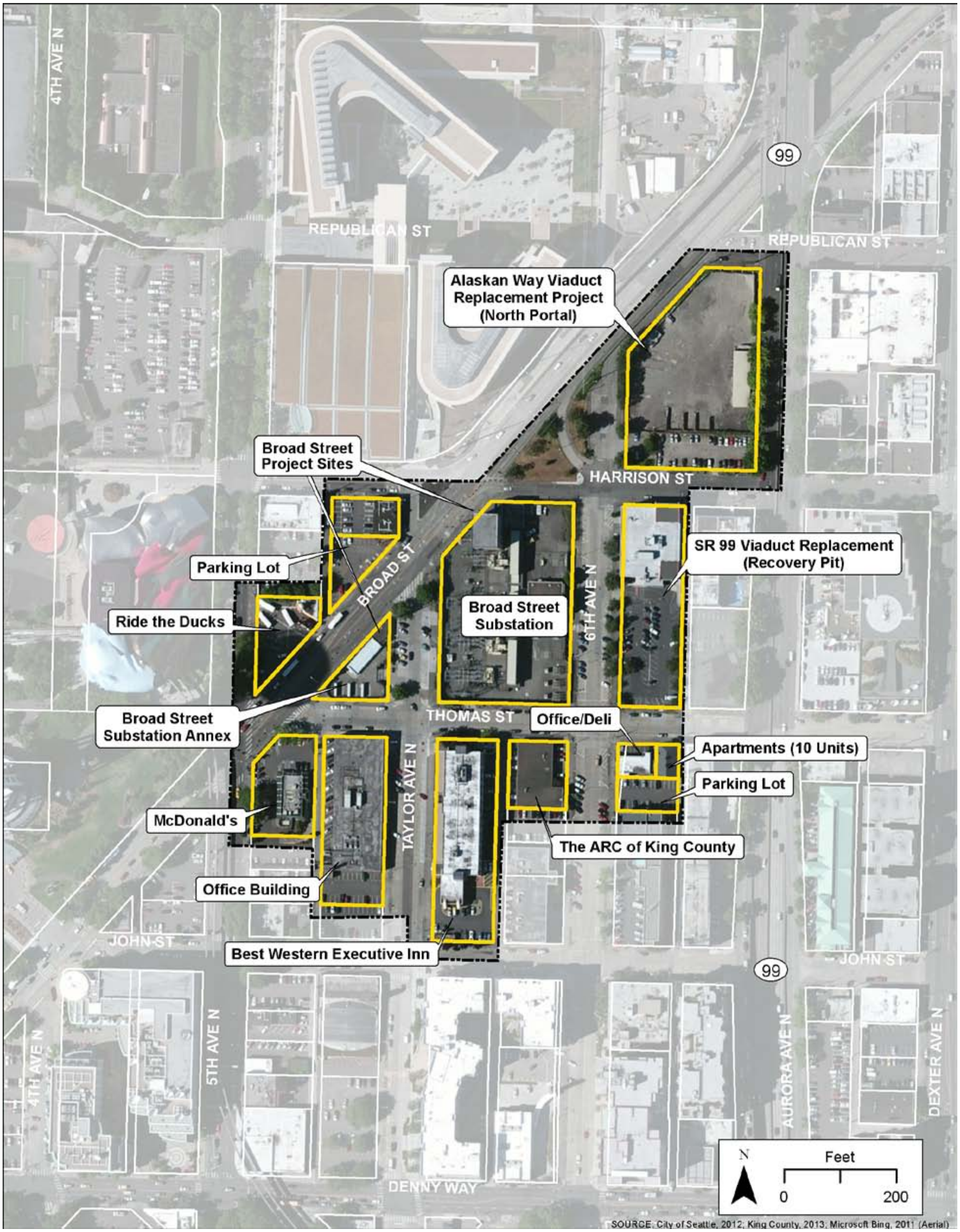


Source: King County Assessor, 2013

8.1.3 Broad Street Substation Inductor Options

As shown in Figure 8-9, land uses in this area include office, retail, a hotel, a fast food restaurant, a non-profit organization (The Arc of King County), and off-street parking. Currently, the major land uses in the area are the Washington State Department of Transportation (WSDOT) construction sites for the Alaskan Way Viaduct Replacement Project. These construction sites are likely to be used for construction and staging for several years and ultimately will be used as permanent transportation facilities (State Route 99).

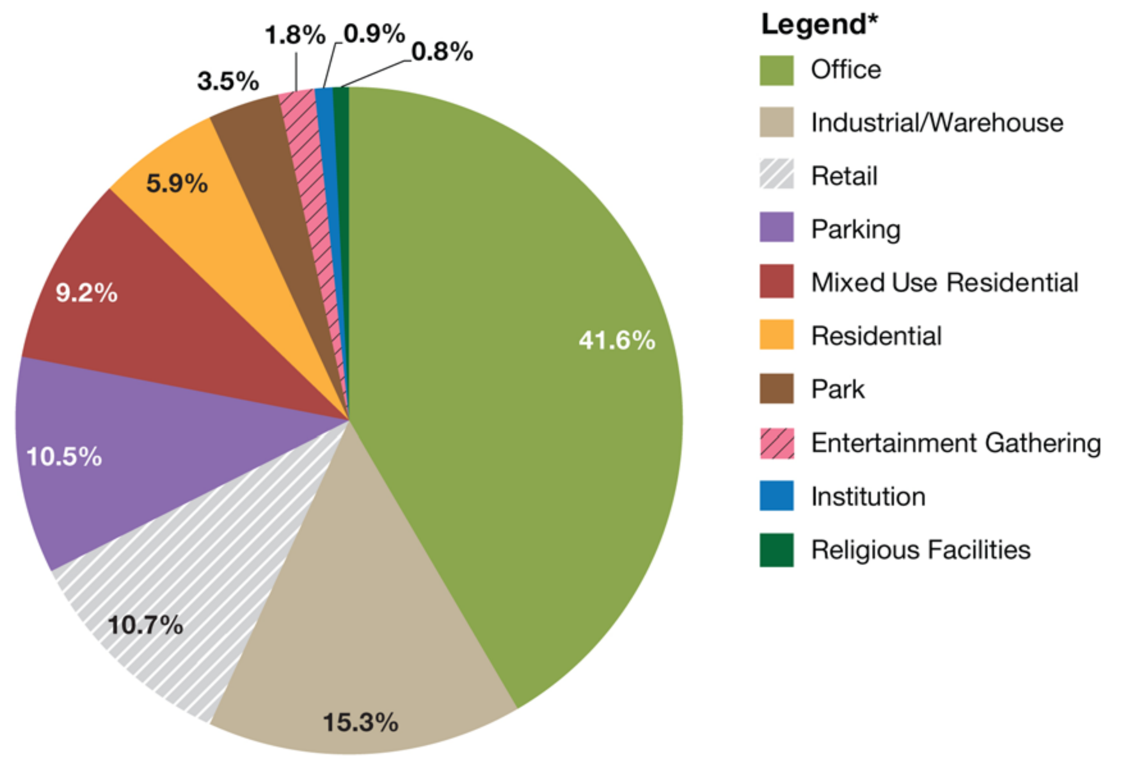
Figure 8-9. Land Use Adjacent to Broad Street Substation and Annex



8.1.4 Distribution System

Land uses within the Phase 1 Build-out area of the distribution system were also determined. These land uses are summarized in Figure 8-10 by percentage within the 59-acre Phase 1 Build-out area.

Figure 8-10. Current Land Uses by Percentage in Phase 1 Build-out Area

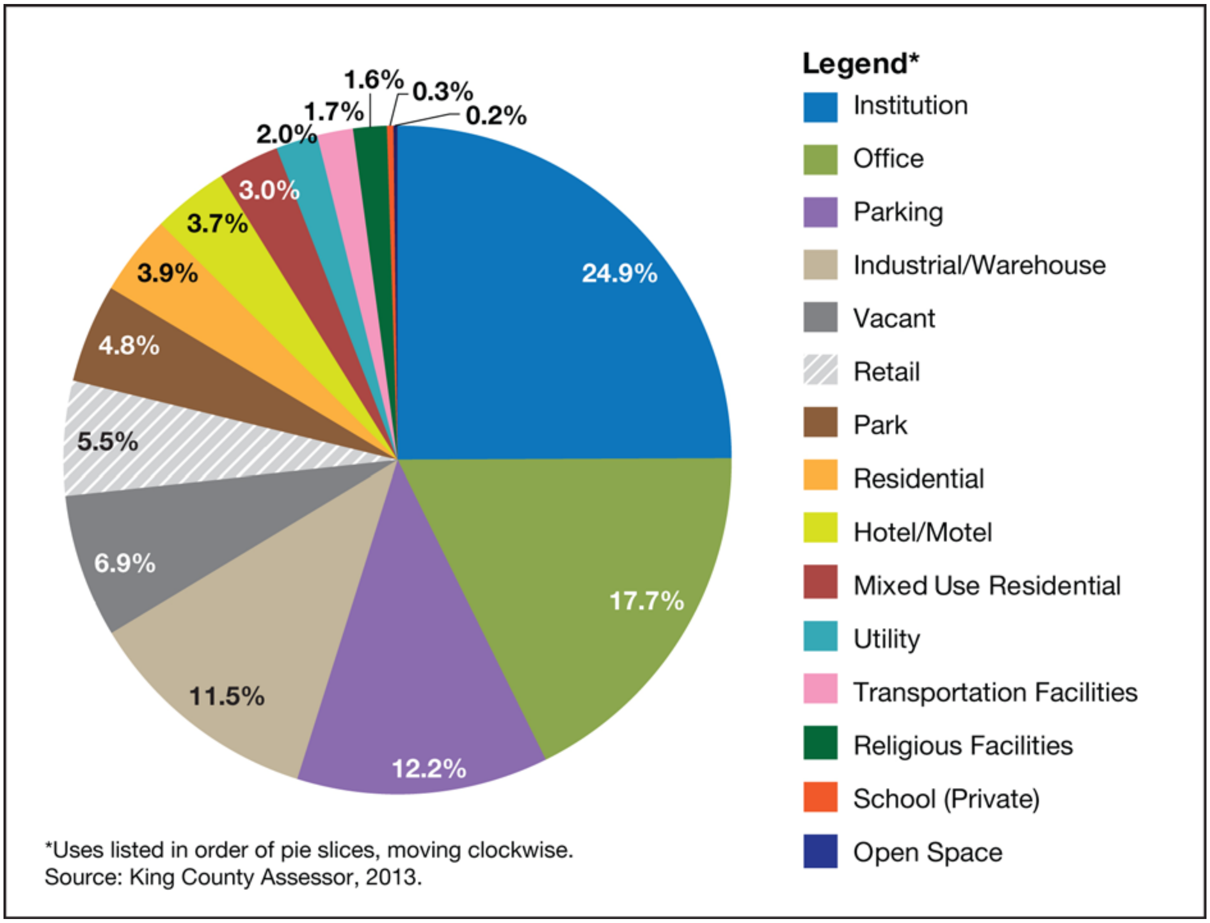


*Uses listed in order of pie slices, moving clockwise.
Source: King County Assessor, 2013.

As shown in Figure 8-10, the most common uses in the Phase 1 Build-out area are office (41.6 percent) and industrial/warehouse (15.3 percent). Single-use retail (10.7 percent) and parking (10.5 percent) each comprise slightly more than 10 percent of the area. All other uses represent less than 10 percent of the area, which includes the central portion of the rapidly re-developing South Lake Union neighborhood.

Land uses within the 97-acre Future Build-out area are summarized in Figure 8-11 by percentage.

Figure 8-11. Current Land Uses by Percentage in Future Build-out Area



As shown in Figure 8-11, the most common uses in the Future Build-out area are institution (24.9 percent) office (17.7 percent), parking (12.2 percent) and industrial/warehouse (11.5 percent),. All other uses represent less than 10 percent of the area.

Between 2002 and 2004, real estate projections and estimates of the economic potential through 2020 for the north downtown area were developed for the north downtown area (as described in the Initial Business Case for Serving Load in North Downtown Seattle prepared by City Light; City Light, 2012c). These projections included square footage of real estate development segregated by biotech, office, and retail/residential categories; job creation projections; and revenue generation. At the end of 2010, these projections were reevaluated. The analysis concluded that growth through 2010 exceeded its forecasted estimates for construction, job creation, and revenue generation while the national, state, and local economies declined (City Light, 2012c).

8.2 Construction Impacts

8.2.1 Substation Alternatives

Construction of the substation is not anticipated to cause land use or housing impacts, due to the short duration of 18 to 24 months (depending on the alternative). Although there may be noise, transportation, and other impacts that would affect users of adjacent properties on an intermittent basis, such inconveniences are common in urban areas and typically do not cause changes in land use. Analysis of and mitigation for specific construction impacts such as noise and transportation can be found under those chapters of this EIS.

8.2.2 Transmission Line Alternatives

No changes to land uses along the transmission line alternative routes are anticipated from construction of the proposed project because of the short duration of construction in any one location.

8.2.3 Broad Street Substation Inductor Options

Since the installation of the inductor under the Broad Street Substation Inductor Option 1 (BI1) or Broad Street Substation Inductor Option 2 (BI2) would be within the closed Broad Street right-of-way and is expected to take up to one year, impacts to land use are not anticipated, given the nature of commercial uses that would be adjacent to either inductor location, and the relatively short duration of construction.

8.2.4 Distribution System

No changes to land uses in the Phase 1 Build-out and Future Build-out areas are anticipated from construction of the distribution system because of the short duration of construction in any one location.

8.3 Operational Impacts

8.3.1 Substation Alternatives

Consistency with Plans, Policies, and Regulations

City plans envision South Lake Union as an urban center featuring dense housing and employment that will attract innovative industries, including biotechnology, information technology, environmental sciences, and technology firms (City of Seattle, 2005; City of Seattle Department of Planning and Development, 2007). The Denny Substation Project would help provide the essential infrastructure needed to see the visions for South Lake Union realized. Development of a substation would facilitate and encourage the type of growth envisioned by the City's Comprehensive Plan and Neighborhood Plan for South Lake Union.

All of the substation alternatives have been designed to be consistent with City of Seattle and City Light planning documents (see Appendix J, Summary of Substation Alternatives Consistency with Long-range Planning Documents). Policies addressing the reliability of utility service, providing stable and reliable supply of electrical power to South Lake Union, supporting the growth of innovative industries, coordinating City investment in utilities with economic development, focusing new infrastructure in areas expecting to see additional growth or subject to subarea rezones, and improving Denny Way to increase pedestrian and bicycle safety and access are found to be consistent with all substation alternatives.

In terms of public amenities, SA2 and SA3 would be consistent with policies that encourage open space, parks, and recreation. Since SA1 would not result in a street vacation, open space is not required or proposed.

John Street, north of the proposed Denny Substation site, is designated as a Green Street. Green Streets are intended to give priority to pedestrian circulation and open space over other transportation uses. Although open space adjacent to John Street and a narrowing of John Street along the section adjacent to the Denny Substation area are proposed under all three substation alternatives, none propose to improve John Street under the voluntary Green Streets program, which would involve developing a concept plan consistent with streetscape design guidelines.

The substation design for SA3 requires City Council waivers from the City's Land Use Code to address regulations regarding primary pedestrian entrance, minimum façade height, permitted street-level setbacks, façade transparency, blank façade requirements, and screening and landscaping standards. The City Council waivers are requested in response to a unique utility use not specifically addressed in SM zoning district development standards. This is not considered to be a significant impact because City Council waivers for public projects are not unusual and zoning standards are typically written to apply to buildings and other private development structures, not, for example, utility uses. See Appendix F, Summary of Substation Alternatives Zoning Analysis Matrix for more details on the project's consistency with the zoning code.

Potential Impacts to Land Use and Housing

This section describes potential effects on land uses and housing in the vicinity of the substation site for each of the three substation alternatives.

Impacts Common to All Alternatives

When constructed, a utility use would differ from the residential and commercial uses surrounding the site and what is expected with future development. However, the Denny Substation would require minimal operational attendance. It would not generate significant vehicular traffic, odors, or air pollution. Noise impacts would be minor.

Based on these factors, the presence and operation of the substation would not preclude or impair continued operation of existing adjacent uses (residential, hotel, office, and retail). Likewise, it would not preclude the development or redevelopment of currently underdeveloped properties, including the proposed development across Denny Way, which would likely generate more pedestrian and vehicular traffic and would likely have a greater influence on the character of the South Lake Union and Denny Triangle neighborhoods than the Denny Substation.

The substation would not displace existing housing units. Although the development of a substation would preclude the possibility of developing housing on Parcels 1 and/or 2 (depending on the alternative), the zoning code also allows for non-residential uses on the site, so this "opportunity cost" would be somewhat speculative. Parcel 3 could be surplused, thus allowing private development consistent with current zoning as noted under Proposed and Potential New Uses and Development in Section 8.1.1. The types of uses developed on Parcel 3 would be determined based on market factors, and could include residential units.

As described above, operational impacts from the Denny Substation would be minimal and would not necessarily reduce the livability of the neighborhood. Furthermore, the area adjacent to the substation site does not include a disproportionately high number of low-income households.

Substation Alternative 1 (SA1)

Compared to the other action alternatives, the major difference of SA1 from a land use perspective is that this alternative would not include a public open space large enough to generate an active streetscape, as encouraged in adopted policies. Pedestrian activity is currently not intense in the area, with most activity limited to residents and visitors leaving and entering the adjacent buildings. Denny Way is not characterized by an active pedestrian streetscape in the vicinity of the substation site, with the exception of a bus stop. There is only one ground-level active use facing the substation site. There are no park or public open spaces adjacent to the site. Denny Way and Stewart Street serve as physical edges to the neighborhood, limiting the movement of pedestrians in and around the substation site. Therefore, the land use change resulting from the substation would mean that the sides of the substation along Pontius Avenue North, Denny Way, and John Street would not contribute substantially toward developing the future generally envisioned for streets in the South Lake Union area.

Under SA1, Parcels 1 and 3 could be surplused, thus allowing private development consistent with current zoning as noted under Proposed and Potential New Uses and Development in Section 8.1.1. Underground duct banks could be located in the center of Parcel 1, influencing the design of future development (e.g., limiting the construction of underground parking). City Light easements, or a similar mechanism, would be placed on Parcel 1 to allow City Light access to the duct banks. The types of uses developed on Parcels 1 and 3 would be determined based on market factors and could include residential units. Until the properties are surplused, Parcels 1 and 3 would continue to be used as off-street parking lots.

Substation Alternative 2 (SA2)

In general, potential impacts from SA2 would be similar to SA1, with two exceptions: (1) Parcel 1 would not be available for development, and (2) Pontius Avenue North would be vacated.

Under SA2, Parcel 1 would be used for the substation and therefore would not be surplused. No development beyond the substation would occur at that site.

Pontius Avenue North would be vacated to allow the larger footprint of the substation under SA2 than SA1. The street in front of The Brewster apartments would be closed, except that a sidewalk would remain allowing continued access to the entrance.

Street Vacation Policies

The City Council must determine whether the project is consistent with City Street Vacation policies. A summary of City Light's application for street vacation is included in Chapter 7, Transportation.

As documented above under Consistency with Plans, Policies and Regulations, construction of the substation is considered to serve the public interest by developing public infrastructure that is consistent with the City's plans and policies and facilitates the type and intensity of development envisioned in the City's South Lake Union neighborhood plan. SA2 would also include a suite of design features that serve the public's interest. At the stage of design when this EIS was prepared, any of the following features could be incorporated in to the design or operation of SA2:

- Public open space
- Playground area
- Skate park
- Dog park
- P-Patch
- Shell spaces
- Sculpture garden
- Wi-Fi connectivity
- Bicycle amenities
- Electric vehicle charging
- Alley lighting and pedestrian improvements

The substation under SA2 could be designed with exterior shell spaces that could accommodate a learning center or community space. These public benefit features could serve to create a more active pedestrian environment than under SA1. This list may be updated based on the Final Vacation Petition once an alternative is selected.

Under SA2, the substation structure would be set back from John Street and Minor Avenue North, thereby allowing accessible open space along these roads for public benefit features. The structure would also be set back from Denny Way to provide landscape buffers. Open space would be included to the north, west and east of the substation. These spaces could provide for informal recreation or gathering and could be lawns, planting, or plaza areas. The open space along John Street could consist of seating, bicycle racks, shade trees, accent planting, or special paving. Landscaping would also include buffer planting around the substation to help screen the substation from pedestrians and adjacent residences. Table 2-1 in Chapter 2, Description of Project and Alternatives, shows a comparison of substation features including open space for all three action alternatives. Table 3-4 in Chapter 3, Aesthetics, shows a comparison of setbacks from all property lines for all alternatives.

Substation Alternative 3 (SA3)

Impacts from SA3 would be the same as described for SA2 except that the SA3 design would afford access to more open space, including paved walkways connecting the corner of Denny Way and Minor Avenue to the intersection of John Street and Pontius Avenue North. The walkway would serve as a through-block connection, thus retaining much of the pedestrian function currently offered by the existing Pontius Avenue North. The walkway would provide pedestrian seating and street trees to provide shelter. Additionally, an elevated walkway along the south and east side of the substation would be an accessible route that provides an alternate pathway between Denny Way and John Street (see Chapter 2, Description of Project and Alternatives, Figure 2-11).

The western, southern, and eastern edges of the proposed project site currently have sidewalks or paving that facilitates movement along streets and through the alley. By elevating the walkway, the design would create a new urban experience that would afford unique views to the interior of the substation yard and could be activated by an art installation. The intent would be to create a unique pedestrian promenade and experience that is inviting to the public. In addition, the elevated walkway would contain a series of outdoor seating venues that facilitate a pedestrian-friendly experience.

8.3.2 Transmission Line Alternatives

No operational impacts on land use are expected for any of the transmission line alternatives. When the transmission line is in place, very little associated activity would be required. The majority of the transmission line would be underground. Periodic maintenance using maintenance hatches would be performed. If overhead lines are installed in the SODO neighborhood, the poles would be taller than existing poles but would not affect adjacent uses. Maintenance activity would also be infrequent on overhead lines.

8.3.3 Broad Street Substation Inductor Options

No operational impacts to land uses would be anticipated under either BI1 or BI2 because expansion of the existing facility is limited in scope and would represent only a minor change from existing conditions.

8.3.4 Distribution System

Land uses and housing within the Phase 1 Build-out and Future Build-out areas are not expected to be adversely affected by the installation of the distribution system infrastructure. As redevelopment occurs within the Phase 1 Build-out and Future Build-out areas, new and existing uses are expected to request network distribution service. The availability of network service to these areas is expected to support the types of commercial and research and development that are envisioned in the long-term plans for the South Lake Union area.

8.4 Impacts of No Action Alternative

The No Action Alternative would be inconsistent with policies in the Seattle Comprehensive Plan on operating utilities consistent with regional growth plans as well as plans for a new substation in the South Lake Union neighborhood. The No Action Alternative would be inconsistent with policies in the South Lake Union Urban Center Neighborhood Plan that call for a stable and reliable supply of electrical power to the South Lake Union Urban Village. The City Light 6-year Strategic Plan's objective of improving the customer experience and rate predictability by building a new north downtown substation could not be achieved under this alternative.

The Denny Substation properties could be used by City Light or another City department or they could be sold for private use or development. There is currently no plan or request in place for an alternate City use of the three proposed substation parcels. Parcels 1 and 3 are currently in use as off-street parking lots. Parcel 2 is currently fenced and not in active use and would need to comply with zoning requirements that do not allow parking as a principal use. If surplus to City Light and City needs, development of the proposed substation parcels would likely proceed under current zoning. Under the City's rules for surplus property, low income housing providers would have an opportunity to acquire the property before it would be offered to the general public for purchase. As noted above, current zoning allows for nonresidential (commercial), residential, and mixed-use buildings, consistent with the land uses within the study area. Mixed-use buildings that comply with the City's incentive zoning are able to achieve the greatest floor area. Under a maximum build-out scenario, each property could support mixed-use towers of up to 400 feet in height. Parcel 3 might need to be consolidated with the neighboring property to support a tower. This type of development would enhance the streetscape with additional pedestrian activity. It is not possible to know the types of uses, ratio of commercial to residential, or number of residential units that might occur. All of these possible uses are heavily dependent on market factors that are beyond the scope of this EIS.

As with the action alternatives, under the No Action Alternative there would be no housing demolished or adversely affected.

Indirect impacts could arise from the lack of network distribution service for the South Lake Union neighborhood. As noted in Chapter 2, Description of Project and Alternatives, reliable electrical power service in the South Lake Union neighborhood would be compromised, particularly considering the land use intensity envisioned by the City's planning efforts. Less reliable service could result in power disturbances that would likely be experienced by customers as power outages during the heat of summer. In the long term, under the No Action Alternative land uses in the South Lake Union neighborhood might be indirectly affected by the lack of network distribution. However, several uses currently provide their own backup power, so it would be speculative to state what effect a continued lack of network distribution would have on land use.

8.5 Mitigation Measures

8.5.1 General Avoidance and Minimization Measures Common to All Alternatives

Construction would not generate impacts to land use or housing due to the temporary nature of the activities. Construction is expected to be completed within 18 to 24 months depending on the substation alternative. Design features, including construction of an attractive screen wall, incorporation of art work, and provision of landscaping, will help to reduce the utilitarian character (including blank façades created by the screen wall) of the substation that could make it appear as a less attractive neighboring land use.

Provision of open space in SA2 and SA3 would generate an active streetscape and offset some of the reduced transparency necessary with the screen wall. The open space could be an amenity for residential uses in the area, which has limited public open space at present, thus supporting policies encouraging housing development in South Lake Union.

8.5.2 Specific Mitigation Measures

No adverse impacts are anticipated to land use or housing; therefore, no specific mitigation measures are proposed beyond those to be incorporated in the design through the review process with the City of Seattle Design Commission.

8.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to land use or housing are anticipated.

Chapter 9: HISTORIC AND CULTURAL RESOURCES

9.1 Affected Environment

9.1.1 Aboveground Historic and Cultural Resources

The overall historic and cultural resources study area, including study areas around the proposed Denny Substation site, transmission line alternatives routes, existing Broad Street Substation inductor options, and proposed distribution system, is shown in Figures 9-1 through 9-6. For aboveground historic and cultural resources, an initial distance of two blocks was reviewed for the Denny Substation site, which was further refined and reduced after a field visit. A distance of one-half block was used for the transmission line alternatives. For the Broad Street Substation inductor options, the study area was the parcels adjacent to and across the street from the proposed inductor locations. For the distribution system Phase 1 Build-out and Future Build-out areas, the study area was the footprint of the build-out areas.

A detailed evaluation of the affected environment was completed for all project components except the Future Build-out area. The analysis of this area was conducted on a programmatic basis because specific locations for installing the distribution lines and construction completion dates are not yet known. For the Future Build-out area, this chapter includes a summary of properties currently listed on a historic register, rather than the more in-depth analysis completed for the other project components. In evaluating the rest of the Denny Substation Project's affected environment, specific historic resources were independently identified and considered.[1]

Historic and Cultural Resources Key Findings

There are properties listed on historic registers adjacent to all project components.

No potential impacts to archaeological resources are anticipated from the Denny Substation alternatives.

Each of the transmission line alternatives would pass underground through City-designated special review historic districts and could require Certificates of Approval that incorporate mitigation measures. Two of the transmission line alternatives would pass through the boundaries of a recorded archaeological site—a former refuse deposit. The significance of this site has not yet been evaluated by the Washington State Department of Archaeology and Historic Preservation.

Excavation for the transmission line, distribution system, and Broad Street Substation inductor have the potential to intersect with buried cultural resources; in order to avoid this potential significant impact an Inadvertent Discovery Plan, at a minimum, will be developed for use during construction.

No unavoidable significant impacts to historic and cultural resources are anticipated.

[1] This chapter summarizes the affected environment and construction and operational impacts for historic and cultural resources for the Denny Substation Project, as described in more detail in the Denny Substation Project Historic and Cultural Resources Discipline Report (ESA, 2014a).

The analysis of aboveground resources focused on two main datasets: (1) those buildings currently listed on a historic register, and (2) those buildings that would meet minimum age thresholds to be considered for listing but have not yet been evaluated for inclusion on a historic register. These datasets provide context for the possible maximum number of aboveground resources in the cultural resources study.

To be listed on a historic register, a property (building, structure, or site) generally must meet the minimum age requirements described below. In conjunction with looking at the age of properties, the property is evaluated consistent with criteria established by a historic register. The criteria relates to the property's historic or cultural importance to determine their "significance." Significant historic and cultural resources represent important themes, cultures, or patterns in our past. A property may be significant at the national, state, or local level (or all three).

Different historic registers use different age thresholds for starting the consideration of whether a property has historical significance. The National Register of Historic Places (NRHP) and Washington Heritage Register (WHR) generally require a property to be at least 50 years old to be considered for listing as a Historic Property. To be eligible for listing as a Seattle Landmark, a property would need to be at least 25 years old. Since the project includes different components that will start construction at different times, City Light chose to evaluate existing buildings based on what their age will be at the overall construction end date (2020). Thus, properties in the study area qualifying for consideration to the NRHP and WHR would include those constructed during or before 1970 (making them 50 years old or older in 2020), and properties in the study area qualifying for consideration as a Seattle Landmark would include those buildings constructed during or before 1995 (making them 25 years or older in 2020). This analysis did not include an evaluation of properties that meet the minimum age threshold to determine their consistency with criteria established by each historic register because it is not necessary for assessing the significance of potential project impacts under the State Environmental Policy Act (SEPA).

Identifying the Affected Environment and Assessing Historic and Cultural Resource Impacts

Analysis of the potential impact of the Denny Substation Project first required a review of known historic and cultural resources in the study area.

The substation site was visited and the views from the substation parcels were photographed to demonstrate where buildings on adjacent properties obstructed the view to the substation parcels. The study area was defined for both aboveground and underground resources, and age thresholds were determined. Research was conducted to gather information on known historic and cultural resources. Sources included records on file at the Washington State Department of Archaeology and Historic Preservation, Seattle City Landmarks, and the Seattle Municipal Archives.

In determining impacts to aboveground properties, the analysis relied in part on findings for other elements of the environment analyzed in this EIS, including aesthetics and noise (including vibration). Potential impacts to archaeological resources were assessed by considering ground disturbance.

The project was also assessed for consistency with relevant City plans, policies, and regulations, as well as the policies of other agencies with jurisdiction over historic and cultural resources.

In addition to individual properties, historic registers also include districts that have historical significance. The proposed transmission line alternatives routes traverse two City of Seattle (City) historic districts: the International Special Review District and the Pioneer Square Historical District. Transmission Line Alternatives 1 (TL1) and 3 (TL3) would be installed underground through the International Special Review District. Transmission Line Alternative 2 (TL2) would be constructed within the existing Downtown Seattle Transit Tunnel (DSTT), which intersects both of the historic districts at their boundaries. No other project components are located within City historic districts.

The International Special Review District and Pioneer Square Historical District are managed as individual resources (as codified in SMC 23.66); buildings within the districts are not typically nominated individually as Landmarks. This differs from the management approach for NRHP historic districts, wherein buildings must first be nominated individually to the NRHP and then the district is defined to include eligible and contributing buildings. TL1 and TL3 would pass through two NRHP historic districts: the Seattle Chinatown Historic District and Pioneer Square-Skid Road National Historic District. Although the City and NRHP historic districts are similarly named, the boundaries of all four historic districts are unique.

Table 9-1 summarizes the historic register status of properties within the study areas for each project component and alternative under consideration for the Denny Substation Project. Listed and designated properties are also depicted on Figures 9-1 through 9-5. Table 9-1 also depicts the number of aboveground resources that meet minimum age thresholds to be considered for listing but have not yet been evaluated for inclusion on a historic register.

Table 9-1. Historic Register Status of Aboveground Resources for all Denny Substation Project Study Areas

Study Area	Resources Listed or Designated		Resources Meeting Typical Age Thresholds, But Not Evaluated	
	Listed on NRHP or WHR	Designated as a Seattle Landmark or Within a Seattle Special Review District[1]	NRHP or WHR (≥50 years old)	Seattle Landmarks Designation (≥25 years old)[2]
Substation Alternatives	1 NRHP and WHR	2 individually designated	19	20
Transmission Line Alternative 1 (TL1)	7 NRHP and WHR	3 individually designated; 12 within boundaries of the International Special Review District; 1 within boundaries of the Pioneer Square Historical District	40	53
Transmission Line Alternative 2 (TL2)	11 NRHP and WHR 2 WHR[3]	13 individually designated (although 10 of these below the DSTT); 15 within boundaries of the International Special Review District; 14 within boundaries of the Pioneer Square Historical District	60	77
Transmission Line Alternative 3 (TL3)	3 NRHP and WHR 1 WHR	2 individually designated; 27 within boundaries of the International Special Review District	53	56
Broad Street Substation Inductor Options	None	None	2	2
Phase 1 Build-out area	2 NRHP and WHR	7 individually designated	69	72
Future Build-out area	1 WHR	6 individually designated	N/A	N/A

[1] Includes individual properties designated as a Seattle Landmark and those buildings within the boundaries of a City historic district.
[2] Does not include properties ≥25 years old that are located within the International Special Review District or the Pioneer Square Historical District.
[3] Site of First Public School (now Safeco Plaza at 1001 Fourth Avenue) and Site of Battle of Seattle (now King County Courthouse at 516 Third Avenue). The King County Courthouse is also a King County Landmark.
DSTT = Downtown Seattle Transit Tunnel; N/A = not applicable; NRHP = National Register of Historic Places; WHR = Washington Heritage Register

Figure 9-1. Aboveground Historic and Cultural Resources in Substation Alternatives, Broad Street Substation Inductor Options, and Distribution System Phase 1 Build-Out Study Areas

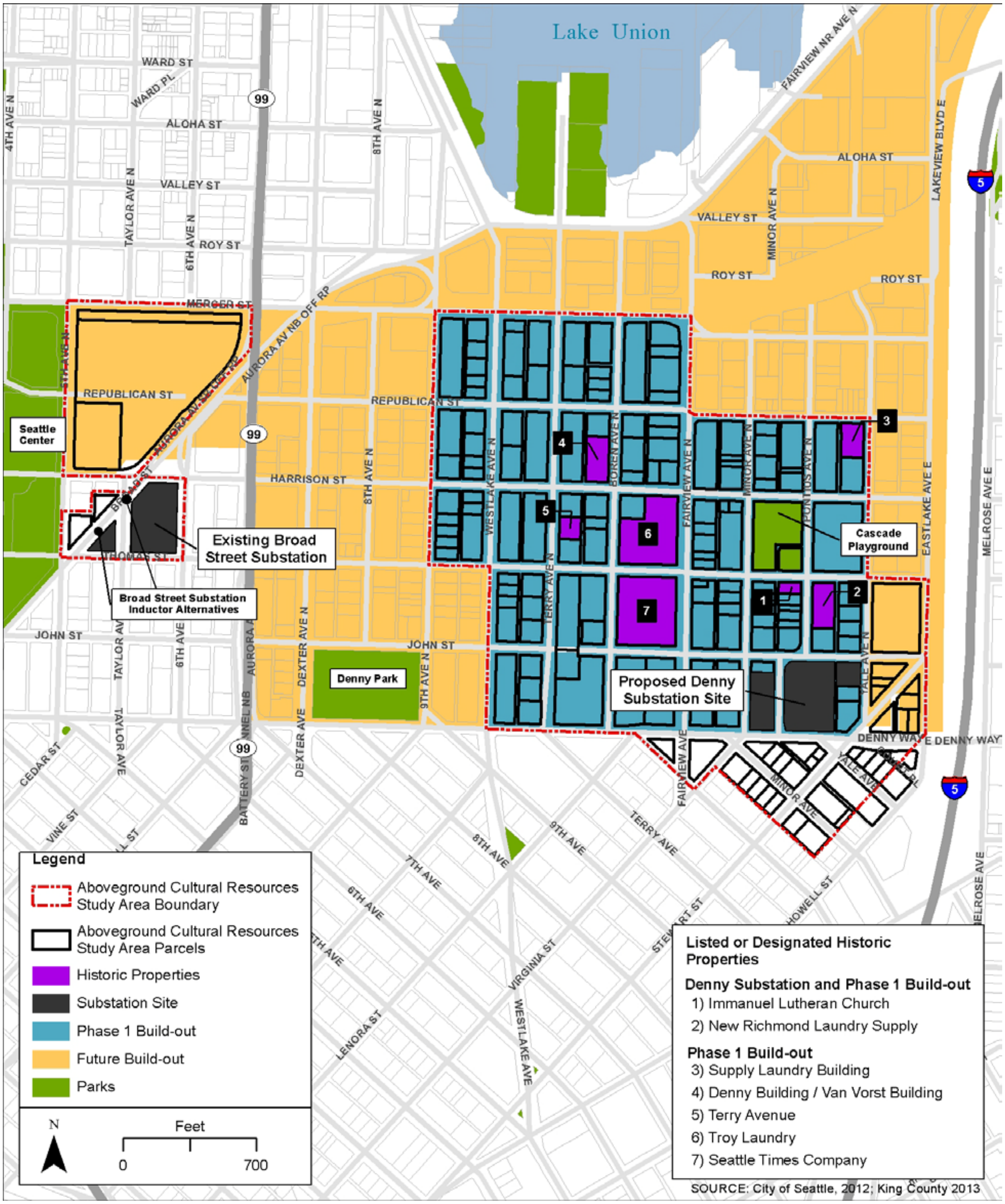


Figure 9-2. Aboveground Historic and Cultural Resources in Distribution System Future Build-Out Study Area

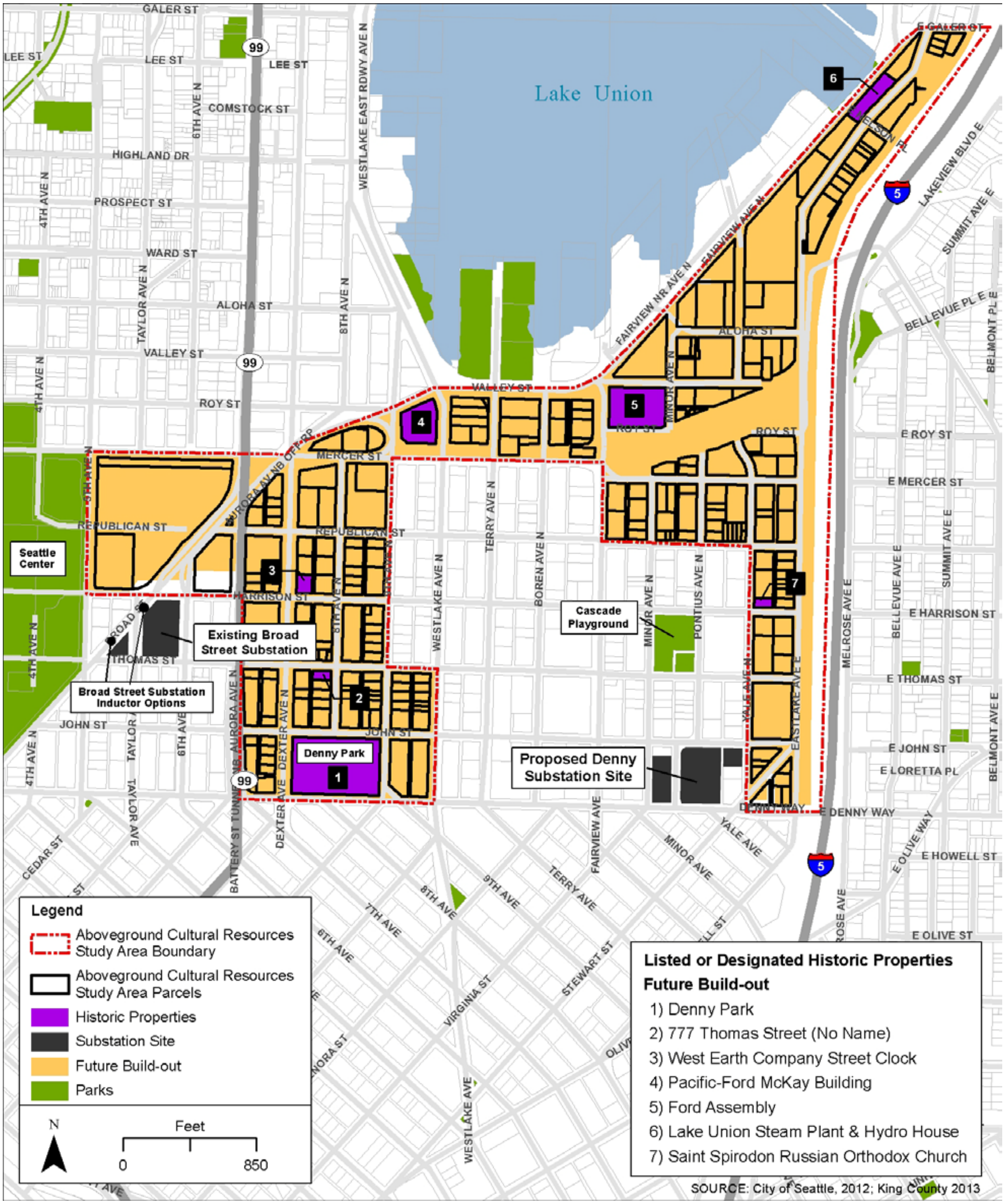


Figure 9-3. Aboveground Historic and Cultural Resources Transmission Line Alternative 1 (TL1) Study Area

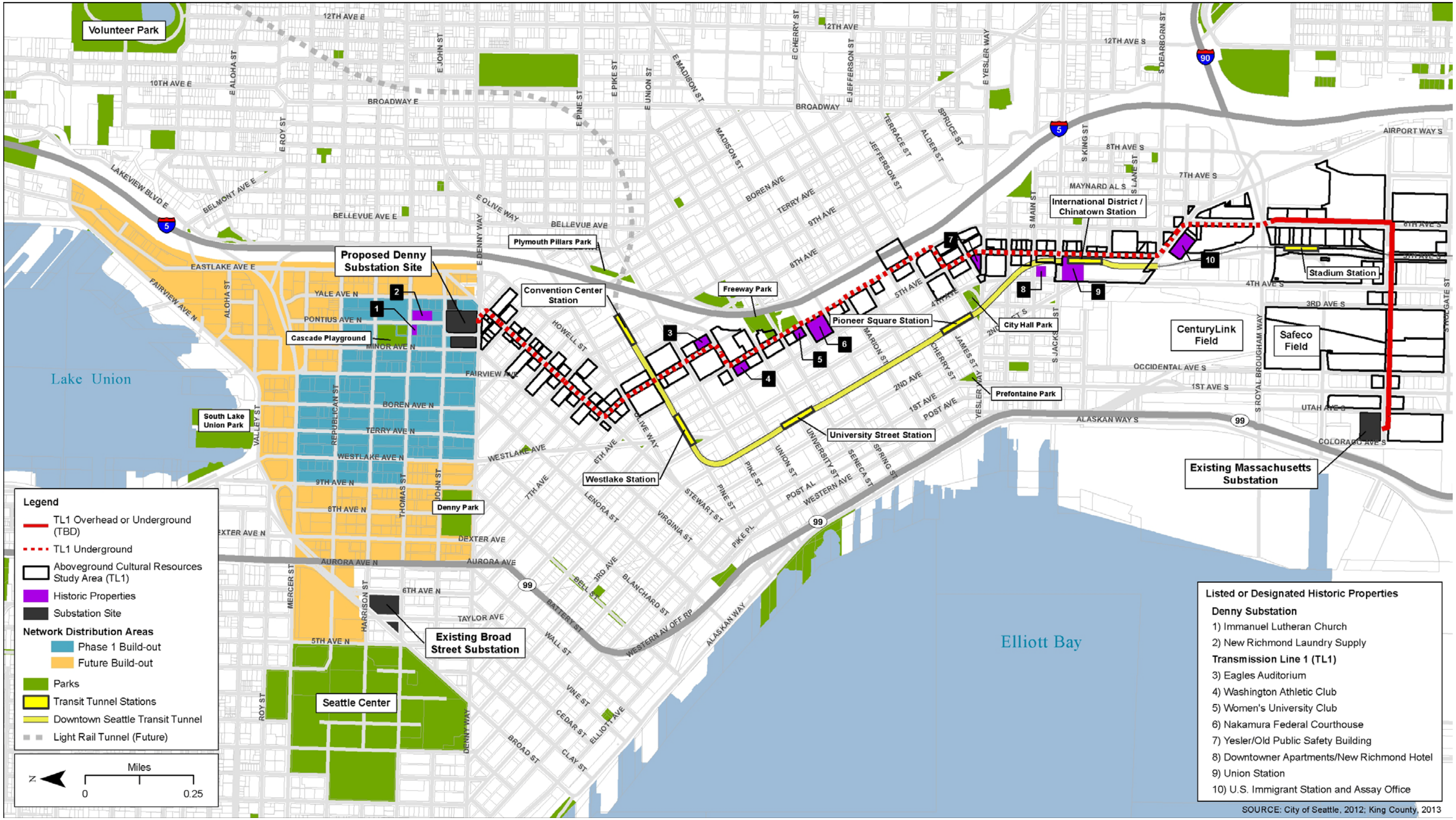


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Figure 9-4. Aboveground Historic and Cultural Resources Transmission Line Alternative 2 (TL2) Study Area

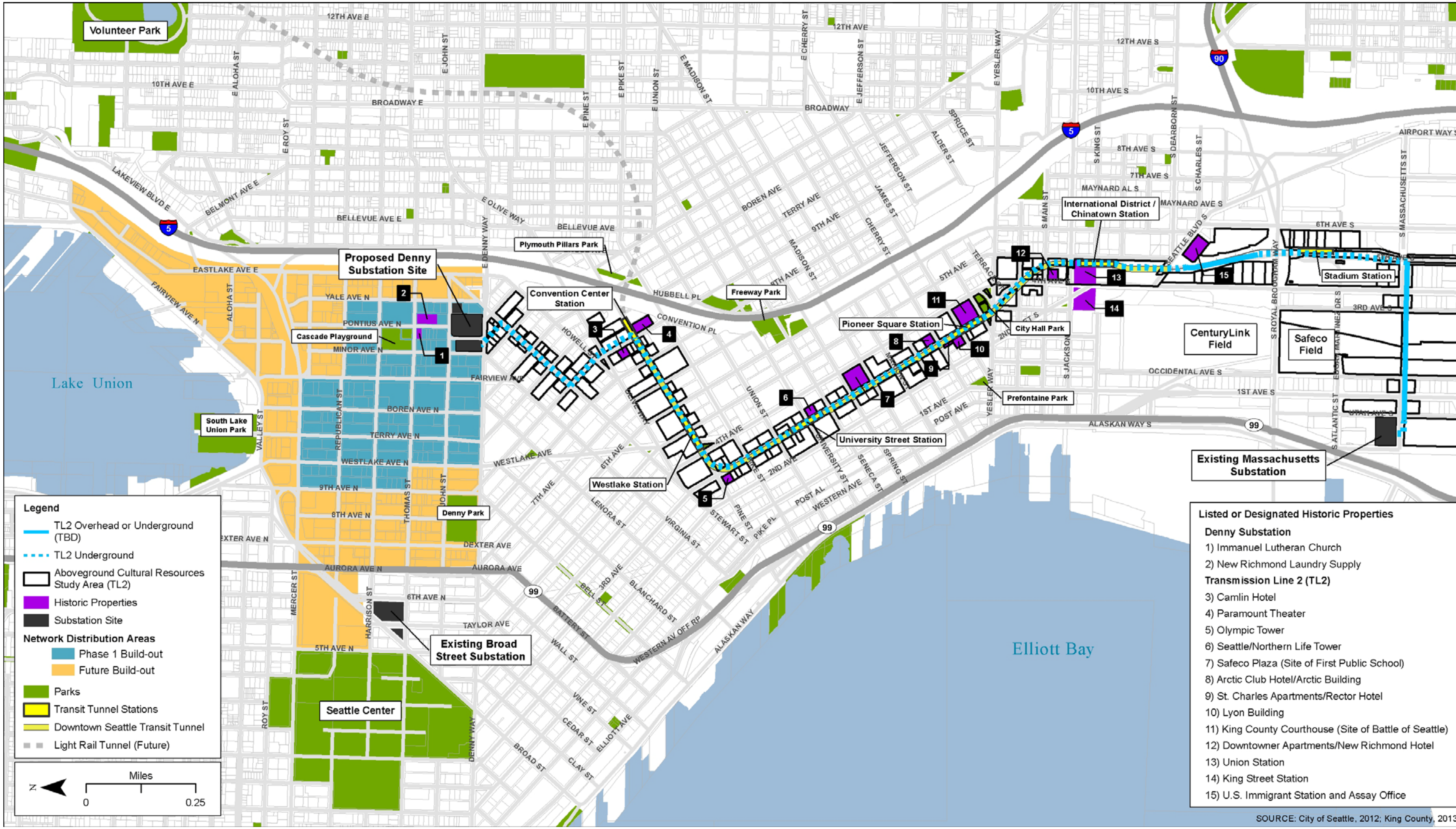

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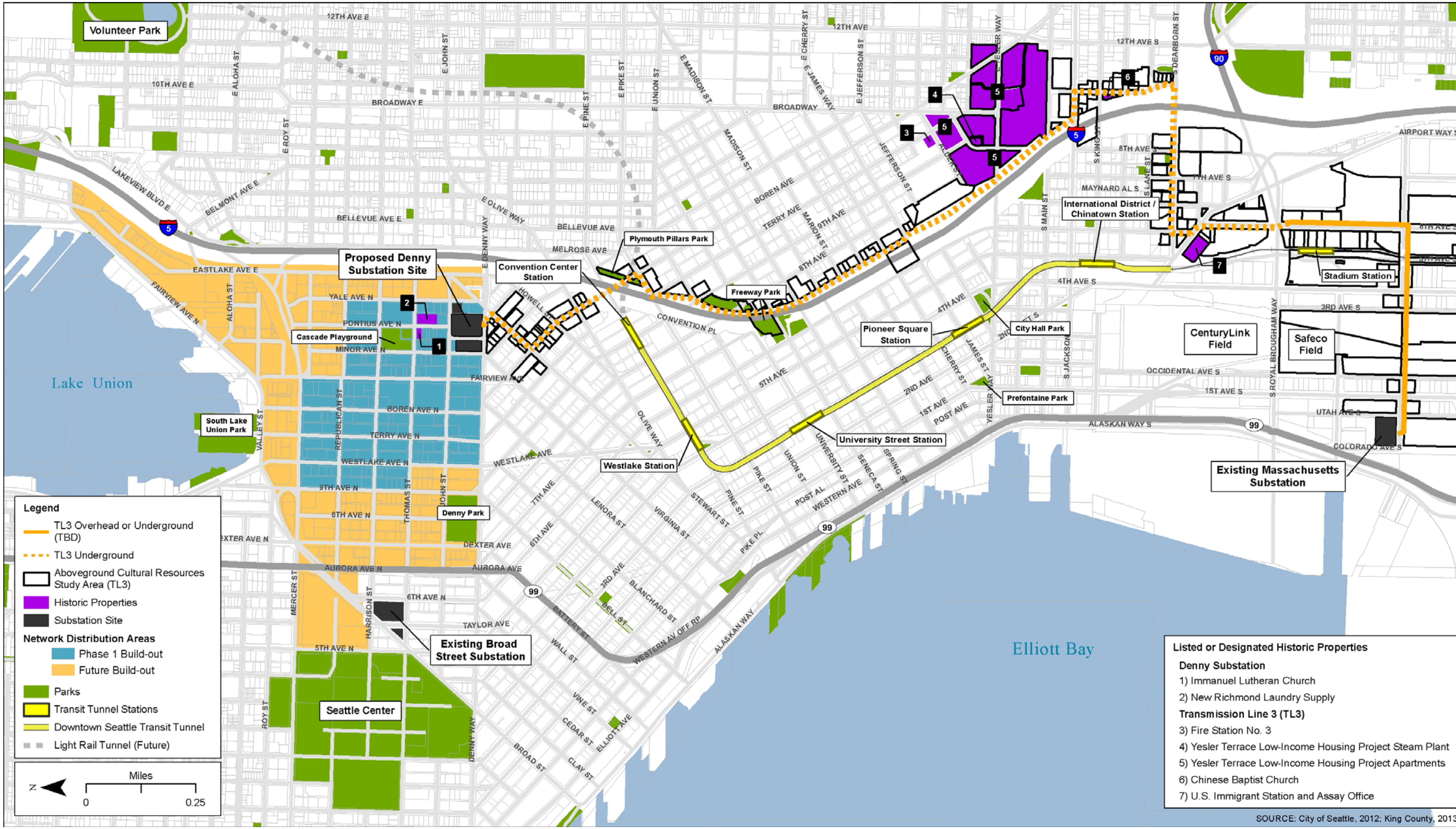
Figure 9-5. Aboveground Historic and Cultural Resources Transmission Line Alternative 3 (TL3) Study Area



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9.1.2 Archaeological Resources

For archaeological resources, a standard distance of 1 mile in all directions from the project footprint was reviewed (see Figure 9-6); the analysis excluded sunken ships and airplanes as well as any docked historic ships recorded as historic resources. More than 100 archaeological reports have been prepared for project locations within 1 mile of the study area for the entire project (DAHP, 2013). Virtually all archaeological study within Seattle has been conducted as part of project permitting (as resources have been found in conjunction with site development) subject to specific state and federal laws. Where field investigations have been conducted, inquiry has usually been limited to the footprint of the project.

Precontact Archaeological Sites

Native Americans have lived within the Puget Sound region for more than 10,000 years and along the shorelines of Seattle for at least 4,000 years. All action alternatives would be constructed within areas classified by the Washington State Department of Archaeology and Historic Preservation's (DAHP) Statewide Predictive Model to have a high to very high probability for precontact archaeological sites, with the exception of the portion of the proposed TL3 route between Olive Way and University Street, which is classified to have a moderate to moderately low probability. However, as of December 2013, there were only four archaeological sites containing components recorded as precontact within approximately 1 mile of the study area and none within the study area itself (DAHP, 2013).

What does "Precontact" mean?

Precontact archaeological sites date prior to the point of contact between European-American peoples (including explorers, fur traders, and military personnel) with Native American peoples. In Seattle, the precontact period is considered to have ended with arrival of the Denny Party in 1851.

Historic Period Archaeological Sites

As of December 2013, there were 27 recorded archaeological sites with historic-period components within 1 mile of the study area (DAHP, 2013). Generally, these sites date to the late 1800s and early 1900s, a time of profound social, economic, and, in many cases, physical landscape change as Seattle developed into a metropolitan area. Site types range from railroad properties, to waterfront and tideland refuse deposits, to remains of early businesses.

Only one recorded site—the 6th Avenue South Refuse Deposit (45-KI-765)—is within the study area (near the TL1 and TL3 routes) and, therefore, potentially subject to impacts from the proposed project. The site, on 6th Avenue South between South Royal Brougham Way and South Massachusetts Street, is a historical debris concentration or informal garbage dump in former tideland, dating from 1890 to 1923 (Fallon, 2006; Fallon et al., 2007). The site was recommended *not* eligible for NRHP-listing (Fallon et al., 2007), but the site has not been formally evaluated by the State Historic Preservation Office (SHPO), and its listing status is given as "potentially eligible" (DAHP, 2013).

9.2 Construction Impacts

This section and Section 9.3 summarize historic and cultural resource construction and operational impacts, respectively, expected from the Denny Substation Project.

For aboveground historic resources, construction impacts are anticipated to be the same under all substation and inductor alternatives, including the No Action Alternative, which includes construction activities required for installation of the inductors at the Denny Substation site and Broad Street

Substation. There are slight differences in anticipated construction impacts for the transmission alternatives.

Any potential impacts to archaeological resources would occur during construction and are assumed to be permanent because it is assumed that the resources would be displaced from their context during construction.

At the time this Draft EIS was prepared, there were no unavoidable impacts anticipated on historic and cultural resources within the overall study area; no aspect of the proposed project would require significant changes to any of the identified eligible, listed, or designated historic properties.

9.2.1 Substation Alternatives

Construction impacts are expected to be the same for all substation alternatives. Under all substation alternatives, potential construction impacts on aboveground historic properties, including increased dust, vibrations, and noise, are anticipated from construction-related activities; however, these are not expected to be significant impacts. No potential impacts related to any other element of the environment would be expected to affect archeological or historic resources in the substation study area.

There are no recorded archaeological sites within the substation alternatives study area, which has been subjected to previous construction and disturbance episodes, including recent remediation and filling of soils on Parcel 2 of the proposed substation site. Excavation at Parcels 1 and 3 of the site is expected to be within glacial deposits. Therefore, no potential impacts to archaeological resources are anticipated.

9.2.2 Transmission Line Alternatives

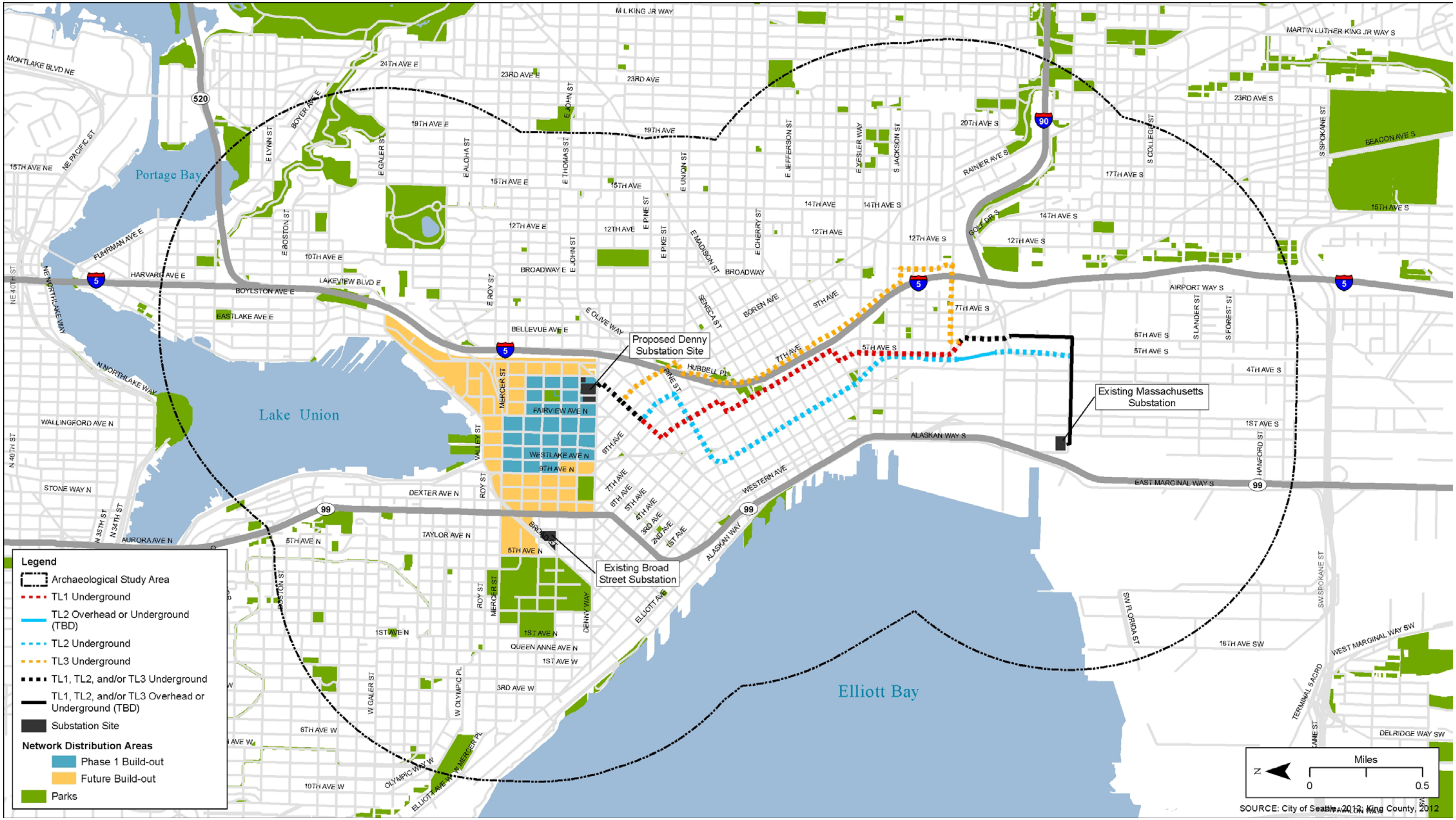
Impacts Common to All Alternatives

All three transmission line alternatives propose segments of primarily underground transmission line within the right-of-way in duct banks and vaults, with possible overhead transmission lines on utility poles in the southern portions of the routes. All three transmission line alternatives are adjacent to listed and designated historic buildings, although the majority of listed or designated buildings along the TL2 route are located above the DSTT (see Table 9-1 and Figures 9-3 through 9-5).

Construction of any of the three transmission alternatives would involve construction impacts from noise and vibration; however, these impacts would not be considered significant. Therefore, no adverse effects from noise or vibration are expected on historic structures, where present. As with the substation, no potential impacts related to any other element of the environment would be expected to affect archeological or historic resources in the transmission line alternatives study area.

All three transmission line alternatives would pass through historic districts (including work within the public right-of-way), although work on TL2 within the historic districts would be entirely within the existing DSTT, as discussed above in Section 9.1.1. This construction would require review by the applicable district-specific review board.

Figure 9-6. Archaeological Resources Study Area



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Among the three transmission line alternatives, TL2 has the least potential to cause an impact on historic and cultural properties because it would run through the existing manmade DSTT. TL1 would potentially have an impact on twice as many listed or designated historic properties as TL3; TL3 would have a greater potential impact within the International Special Review District boundaries.

Transmission Line Alternatives 1 (TL1) and 3 (TL3)

Ground disturbances that reach intact sediments younger than approximately 14,000 years old (i.e., Latest Pleistocene and Holocene) have the potential to cause an impact on precontact archaeological resources. There are incomplete data available for the proposed TL1 route to determine if these deposits would be reached during excavations for line installation. Depending on its origin and context, overlying historical fill may have the potential to contain historic archaeological resources.

Under TL1 and TL3, the underground transmission line would be installed partly within the boundaries of a recorded historic archaeological site, 45-KI-765 (6th Avenue South Refuse Deposit). As noted above, the site has been recommended not eligible for NRHP listing (Fallon et al., 2007), but the site has not been formally evaluated by SHPO (DAHP, 2013). If the site is formally determined not eligible, then no further action would be required by City Light. However, if the site were determined eligible, then impacts would likely be considered significant unless mitigation measures identified in Section 9.5 were implemented.

Landscape Context

Since the late 1800s, the landscape of downtown Seattle has been substantially altered by urbanization and, in many places, massive regrading. This work has resulted in placement of layers of fill. Depending on its *origin* or source, a layer of fill may include archaeological remains that were carted, trucked, or sluiced in from elsewhere, but these remains would not retain their original *context* or relationship to their surroundings.

On the other hand, there is chance that intact historic archaeological remains accumulated and were preserved whenever people had time to build structures or otherwise use a particular location during lulls in placement of different fill layers.

Transmission Line Alternative 2 (TL2)

Because City Light would use an existing facility (the DSTT) for the majority of the TL2 route, no impacts to archaeological resources in this segment of the route are anticipated. Along the portion of the route outside of the DSTT, ground disturbances that reach buried native terminal Pleistocene or Holocene deposits have the potential to disturb, destroy, or remove precontact archaeological resources. Depending on its origin and context, overlying historical fill could potentially contain historic archaeological resources.

9.2.3 Broad Street Substation Inductor Options

Both Broad Street Substation Inductor Options 1 (BI1) and 2 (BI2) have the potential to cause a significant impact on archaeological resources due to the depth of basement construction in an area known for historic regrading in the early twentieth century, unless mitigation measures identified in Section 9.5 are implemented.

Construction for the inductor installation under BI2 also has the potential to cause an impact on a recorded adjacent historic archaeological site—the Harrison Street Regrade (45-KI-1146)—documented beneath Harrison Street less than 200 feet east of the Broad Street Substation. The site is a retaining wall and may have associated features related to the 1905 Harrison Street Regrade located approximately 11 feet below the current street surface (Elliott and Johnson, 2013). The site was interpreted to extend beneath the Broad Street Substation based on a review of historic maps and observations in the field. Ground disturbances that reach buried native terminal Pleistocene or Holocene deposits have the potential to cause a significant impact on precontact archaeological resources if such resources are present, unless mitigation measures identified in Section 9.5 are implemented.

9.2.4 Distribution System

Phase 1 Build-out Area

The proposed distribution system would involve trenching within the right-of-way to install the distribution lines, and Chapter 4, Noise, finds that this construction would not involve significant noise or vibration. Therefore, no impacts would be expected on historic structures from construction of the distribution system Phase 1 Build-out area. There are no potential construction impacts related to any other element of the environment that would be expected to cause an impact on archeological or historic resources in the area.

Ground disturbances that reach buried native terminal Pleistocene or Holocene deposits have the potential to cause a significant impact on precontact archaeological resources, if present, unless mitigation measures identified in Section 9.5 are implemented. Depending on its origin and context, overlying historical fill might have the potential to contain historic archaeological resources.

Future Build-out Area

The impacts to the identified historic resources for the Future Build-out area would be similar to those for the Phase 1 Build-out area and would be further addressed if needed on a case-by-case basis when that construction is proposed.

9.3 Operational Impacts

This section discusses possible operational impacts on potentially eligible and listed or designated historic properties within the study area of each proposed alternative. Any possible impacts that might occur to buried historic or cultural resources would have occurred during construction and would be considered a permanent impact because it is assumed that the resources would be displaced from their context during construction. That aspect of the project was discussed above in Section 9.2, Construction Impacts. No unavoidable operational impacts are anticipated on historic and cultural resources within the overall study area; no aspect of the proposed project would require significant changes to any of the identified eligible, listed, or designated historic properties.

9.3.1 Substation Alternatives

Operational impacts would be similar under any of the substation alternatives. The scale and character of the proposed substation could present visual impacts on the integrity of the surrounding potentially eligible historic properties. Although Seattle's SEPA policies do not provide any authority to require mitigation for impacts to these properties, the potential for impacts is described below.

The Brewster apartment building (1916), Feathered Friends building (1927), and Youthcare building (1920), which are adjacent to or across the right-of-way from the proposed substation site, may be eligible for Seattle Landmarks designation or listing on the NRHP or WHR based on their age. The ultimate impact to historic buildings depends on whether the buildings are considered eligible for a historic register and which elements contribute to their historical significance. Chapter 3, Aesthetics, finds that none of the proposed substation alternatives would introduce significant height differences between surrounding buildings, and that the scale of the structure would be similar to or smaller than the largest buildings adjacent to the substation site, particularly the Mirabella Seattle Retirement Community to the west, as well as proposed development that is expected to be constructed by the time the substation is complete, such as the Lexas Towers south of Denny Way.

Of the three potentially eligible buildings, only The Brewster faces the proposed substation. Of the four sides of The Brewster apartment building, three face one street each (Minor Avenue North, John Street, and Pontius Avenue North, respectively), and its fourth side façade is adjacent to Parcel 1 of the substation site. None of the buildings facing The Brewster are of similar age or character to The Brewster. The substation would not block views of The Brewster from any adjacent properties or streets except from the substation site itself (under all alternatives), and under Substation Alternative 2 (SA2) or Substation Alternative 3 (SA3) from the site of the proposed Lexas towers. Substation Alternative 1 (SA1) has the least potential to have an impact on The Brewster apartment building because the substation screen wall would not be as close to the building as with the other two alternatives, and Pontius Avenue North would be left in its current condition, with only modest changes to the streetscape. Under SA2 or SA3, the street would be eliminated, which would change the setting on the east side of The Brewster. The street would become a park-like open space; therefore, it would not necessarily be considered to adversely affect The Brewster's potential for Landmark status. Because The Brewster is not designated as a Landmark now, and because the changes to the setting would not necessarily adversely affect the eligibility of the building for Landmark, NRHP, or WHR designation, this is not considered to be a significant impact.

9.3.2 Transmission Line Alternatives

Each of the three transmission line alternatives would pass through historic districts in underground duct banks and vaults, as discussed above in Section 9.1.1. For the segments of the line that would be underground, there would be no operational impacts.

Each of the three transmission line alternatives includes a segment of possible overhead transmission. There are no listed or designated historic properties in these portions of the three transmission line alternatives, however each passes between 12 and 19 properties that meet the minimum age qualifications for consideration to be listed on federal, state, and local historic registers. If the properties were determined eligible for inclusion on a historic register, the new transmission poles could cause visual impacts on the integrity of potentially eligible historic properties in the study area. However, because there are existing power poles in these parts of the alignment; adding or replacing the poles with the new transmission line poles is not anticipated to be a significant impact.

All three transmission line alternatives could trigger the requirement for Americans with Disabilities Act upgrades; this would result in only minor visual changes.

9.3.3 Broad Street Substation Inductor Options

Both BI1 and BI2 would install the proposed inductor and associated equipment in the Broad Street right-of-way. New security wall and fencing similar to the existing substation would be extended around the new inductor and associated equipment. According to Chapter 3, Aesthetics, the proposed inductor equipment is similar to equipment already in use in other portions of the substation and annex; therefore, no operational impacts are anticipated on aboveground historic resources in the Broad Street Substation inductor options study area.

9.3.4 Distribution System

No significant operational impacts on aboveground historic and cultural resources are anticipated for the proposed distribution system within the Phase 1 Build-out area because underground distribution would be within the right-of-way, thus avoiding any operational visual impacts on eligible historic buildings. Similarly, at a programmatic level, no significant operational impacts are anticipated in the Future Build-out area.

9.4 Impacts of No Action Alternative

None of the impacts described above for the substation alternatives, transmission line alternatives, or distribution system would occur under the No Action Alternative. As with the action alternatives, the No Action Alternative has the potential for construction and operational impacts on aboveground and underground historic and cultural resources through the installation of an inductor at the Broad Street Substation or its annex and possibly at Parcels 1, 2, or 3 at the Denny Substation site. Construction and operational impacts at the Broad Street Substation would be the same as those described above and, if the inductor installation intersected buried cultural resources, it could be a significant impact. Because the location of an inductor at the Denny Substation site is not defined, there is a potential for construction and operational impacts on the integrity of the context of The Brewster apartment building, which is not currently designated a landmark but, as described above, is potentially eligible.

Any additional excavation required to improve network service reliability in the north downtown area could cause an impact on archaeological resources due to the history of the area.

9.5 Mitigation Measures

The construction and operational historic and cultural impacts that the Denny Substation Project might pose would be avoided or reduced by implementing both general and specific mitigation measures.

9.5.1 General Avoidance and Minimization Measures Common to All Alternatives

No unavoidable significant adverse impacts are anticipated on historic and cultural resources within the overall study area; no aspect of the proposed project would require significant changes to any of the identified eligible or listed historic properties.

Under Revised Code of Washington 27.44, archaeological resources identified during construction would need to be evaluated. If considered significant, any impacts on archaeological resources would require mitigation, which would likely entail archaeological investigation such as excavation and analysis. At a minimum, an Inadvertent Discovery Plan would be prepared for use during construction of the Preferred Alternative. The Inadvertent Discovery Plan outlines the procedures to be followed in the event that archaeological resources are identified during construction activities. It is possible that archaeological monitoring would be recommended for portions of the project; this work would be conducted under an Archaeological Resources Monitoring Plan.

Best management practices would be implemented during construction to minimize impacts from dust, noise, and vibration. Vibration monitoring may be conducted at historic buildings in the study areas to document that vibration does not exceed acceptable levels.

9.5.2 Specific Mitigation Measures

Work within City historic districts would require approval from the appropriate Special Review District Board. City of Seattle Historic Preservation Program staff members have indicated that if a Certificate of Approval is required, photographs and drawings showing existing conditions and planned changes would need to be submitted as part of the application (City Light, 2012). If Landmarks Preservation Board approval is required for an individually designated Landmark, City Light would present the project and application to the Board. Following the presentation, the Board would vote to approve, approve with conditions, or deny the application. Generally, a Certificate of Approval is issued for 18 months, and work would need to be completed during this period.

If The Brewster was found to be eligible for Seattle Landmarks designation, and the streetscape was determined by Landmarks Preservation Board to be a contributing element of the property's significance, then alterations to that streetscape would be re-evaluated and potentially redesigned to minimize any impacts on the integrity of the structure's setting. This would occur during predesign and permitting of the Denny Substation Project.

If TL1 or TL3 is selected as part of the Preferred Alternative, vault installation would intersect recorded archaeological deposits at 45-KI-765 (6th Avenue South Refuse Deposit), and City Light would request that SHPO evaluate the site for its eligibility to the NRHP. If SHPO determines 45-KI-765 is not NRHP-eligible, mitigation would not be required. If SHPO determines 45-KI-765 is eligible for listing on the NRHP, then City Light would need to apply for a State Archaeological Excavation Permit to conduct any ground-disturbing work within the site boundaries.

9.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to historic and cultural resources are anticipated as a result of the Denny Substation Project.

Chapter 10: AIR QUALITY AND GREENHOUSE GAS

10.1 Affected Environment

Air pollutant emissions and greenhouse gas (GHG) emissions are assessed separately in this analysis because they are regulated separately and because, unlike air pollutant emissions, GHG emissions contribute to cumulative carbon dioxide concentrations on a global rather than local or regional scale. Air quality standards and impact thresholds derived from them are health-based, while GHG emissions are inventoried to maintain an accounting of GHG reduction efforts to minimize climate change as well as other indirect impacts associated with their global increase.

The analysis did not consider GHG emissions associated with power generation since the project would not affect power generation in any way. The scope of this chapter addresses this specific Denny Substation project. Refer to City Light's 2012 Integrated Resource Plan (IRP) and City Light's IRP Environmental Impact Statement (EIS) for information on the impacts of meeting load growth.

Air quality is affected by atmospheric and topographical conditions, prevailing wind directions, the location of sources relative to receptors, and the regulatory environment with regard to air pollution sources. This section describes the regulatory environment with respect to air quality and GHGs and identifies pollutants of concern. It also presents the most recent air pollution monitoring data, describes the meteorological conditions in the Seattle area, and defines and identifies sensitive receptors in the vicinity of proposed project components.[1]

Air Quality and Greenhouse Gas Key Findings

Construction of any of the project components would result in minor pollutant emissions that would fall below thresholds considered by the U.S. Environmental Protection Agency to represent a threat to attainment or maintenance of national ambient air quality standards. Operational emissions of the substation alternatives would also result in criteria pollutant emissions below these thresholds.

Greenhouse gas (GHG) emissions from construction of the project would vary through the years of construction, peaking in 2016 with the simultaneous construction of the substation and distribution system.

Once operational, GHG emissions from the project alternatives would be below the State reporting threshold of 10,000 metric tons per year, and would be offset by Seattle City Light pursuant to City of Seattle Resolution 30144.

There would be no unavoidable significant adverse impacts related to air quality or GHG emissions as a result of the Denny Substation Project.

10.1.1 Regulatory Agencies and Requirements

Air quality in the Puget Sound region is regulated and enforced by federal, state, and local agencies—the U.S. Environmental Protection Agency (U.S. EPA), Washington State Department of Ecology (Ecology), and the Puget Sound Clean Air Agency (PSCAA); each have their own role in regulating air quality.

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[1] This chapter summarizes the affected environment and construction and operational impacts for air quality and greenhouse gas (GHG) for the Denny Substation Project, as described in more detail in the Denny Substation Project Air Quality and GHG Discipline Report (ESA, 2014).

U.S. Environmental Protection Agency

The 1970 Clean Air Act (last amended in 1990) requires that regional planning and air pollution control agencies prepare a regional air quality plan to outline the measures by which both stationary and mobile sources of pollutants will be controlled to achieve all standards by the deadlines specified in the Act. As required by the 1970 Clean Air Act, the U.S. EPA initially identified six criteria air pollutants that are pervasive in urban environments and for which state and federal health-based ambient air quality standards have been established. The U.S. EPA calls these pollutants *criteria air pollutants* because the agency has regulated them by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. Ozone, carbon monoxide (CO), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead are the six criteria air pollutants originally identified by U.S. EPA. Since then, subsets of PM have been identified for which permissible levels have been established. These include PM_{10} (matter that is less than or equal to 10 microns in diameter) and $PM_{2.5}$ (matter that is less than or equal to 2.5 microns in diameter).

The Clean Air Act established National Ambient Air Quality Standards (NAAQS) to protect the public health and welfare from air pollution. Areas of the U.S. that do not meet the NAAQS for any pollutant are designated by the EPA as *nonattainment areas*. Areas that were once designated nonattainment but are now achieving the NAAQS are termed *maintenance areas*. Areas that have air pollution levels below the NAAQS are termed *attainment areas*. In nonattainment areas, states must develop plans to reduce emissions and bring the area back into attainment of the NAAQS. The General Conformity Rule, established by the Clean Air Act Amendments of 1990, ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality.

Pollutants of Concern

The main criteria pollutants of interest for project construction are carbon monoxide (CO), particulate matter (PM), ozone precursors, volatile organic compounds (VOCs), and nitrogen oxides (NOx). Both federal and state standards regulate these pollutants.

CO is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The single largest source of CO is motor vehicles. The federal CO standards have not been exceeded in the Puget Sound area for the past 20 years (PSCAA, 2012). However, the Puget Sound region continues to be designated as a maintenance area for CO until U.S. EPA changes this designation.

PM is measured in two size ranges: PM_{10} and $PM_{2.5}$. Fine particles are emitted directly from a variety of sources, including wood burning, vehicles, and industry. The federal annual $PM_{2.5}$ standard has not been exceeded in the Puget Sound area since monitoring began. All four counties in Puget Sound have been below the daily and annual PM_{10} federal standards from the early 1990s until monitoring was ceased in 2006 (PSCAA, 2008). However, the Puget Sound region continues to be designated as a maintenance area for PM_{10} until U.S. EPA changes this designation.

Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOCs and NOx. The main sources of VOC and NOx, often referred to as ozone precursors, are combustion processes (including motor vehicle engines) and the evaporation of solvents, paints, and fuels. The Puget Sound region is designated as an attainment area for the federal ozone standard.

Washington State Department of Ecology

Ecology maintains an air quality program with a goal of safeguarding public health and the environment by preventing and reducing air pollution. Washington's main sources of air pollution are motor vehicles, outdoor burning, and wood smoke. Ecology strives to improve air quality throughout the state by overseeing the development of and conformity with the

State Implementation Plan, which is the state's plan for meeting and maintaining NAAQS. Ecology has maintained its own air quality standard for 1-hour ozone concentrations and established its own more stringent air quality standards for annual NO_2, SO_2, and PM concentrations.

Puget Sound Clean Air Agency

The PSCAA has local authority for setting regulations and permitting of stationary air pollutant sources and construction emissions. PSCAA also maintains and operates a network of ambient air quality monitoring stations throughout its jurisdiction.

10.1.2 Climate and Air Quality

The proposed Denny Substation Project is in the Puget Sound lowland, a narrow strip of land along Puget Sound extending generally from the Strait of Juan de Fuca in the north to the cities of Centralia and Chehalis in the south. Although the Puget Sound lowland area is the most densely populated and industrialized area in Washington, there is sufficient wind most of the year to disperse air pollutants released into the atmosphere.

10.1.3 Greenhouse Gases and Climate Change

Gases that trap heat in the atmosphere are referred to as GHGs because, like a greenhouse, they capture heat radiated from the earth. The accumulation of GHGs has been identified as a driving force in global climate change. Definitions of climate change vary between and across regulatory authorities and the scientific community. In general, however, climate change can be described as the changing of the earth's climate caused by natural fluctuations and anthropogenic activities (i.e., activities relating to, or resulting from the influence of, human beings) that alter the composition of the global atmosphere.

The principal GHGs of concern are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs). Electric utilities, including City Light, use SF_6 in electric distribution equipment. Each of the principal GHGs has a long atmospheric lifetime (one year to several thousand years). In addition, the potential heat-trapping ability of each of these gases varies significantly. CH_4 is 23 times as potent as CO_2 at trapping heat, while SF_6 is 23,900 times more potent than CO_2. Conventionally, GHGs have been reported as CO_2 equivalents (CO_2e). CO_2e takes into account the relative potency of non-CO_2 GHGs and converts their quantities to an equivalent amount of CO_2 so that all emissions can be reported as a single quantity.

SF_6

Sulfur hexafluoride (SF_6) is a potent GHG associated with operation of switching equipment and potentially, inductors, which has a relatively high global warming potential. SF_6 is used as an electrical insulator in high-voltage equipment that transmits and distributes electricity and is 23,900 times more potent than carbon dioxide (CO_2) as a GHG. Because of its long life span and high global warming potential potency, even a relatively small amount of SF_6 can have an impact.

The primary human-made processes that release GHGs include combustion of fossil fuels for transportation, heating, and electricity generation; agricultural practices that release CH_4, such as livestock production and crop residue decomposition; and industrial processes that release smaller amounts of high global warming potential gases such as SF_6, PFCs, and HFCs. Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the earth's capacity to remove CO_2 from the air and altering the earth's albedo (surface reflectance), thus allowing more solar radiation to be absorbed.

Ecology estimated that in 2010, Washington produced about 96 million gross metric tons ($MMTCO_2e$[2]; about 106 million U.S. tons) of CO_2e (Ecology, 2012). Ecology found that transportation is the largest source, at 44 percent of the state's GHG emissions, followed by electricity generation (both in-state and out-of-state) at 22 percent and residential, commercial, and industrial energy use at 20 percent. The sources of the remaining 14 percent of emissions are agriculture, waste management, and industrial processes.

In December 2010, Ecology adopted Chapter 173-441 Washington Administrative Code – Reporting of Emissions of Greenhouse Gases. This rule institutes mandatory GHG reporting for the following:

- Facilities that emit at least 10,000 metric tons of GHGs per year in Washington; or
- Suppliers of liquid motor vehicle fuel, special fuel, or aircraft fuel that supply products equivalent to at least 10,000 metric tons of CO_2 per year in Washington.

Locally, City Resolution 30144 established City Light's long-term goal of meeting all of Seattle's electrical needs with zero net GHG emissions. Resolution 30359 was then adopted to define specific actions, strategies, and timelines for Seattle City Light (City Light) to meet its zero net emission goal through energy conservation, new renewable energy, and CO_2 mitigation. City Light achieved GHG neutrality in 2005 through eliminating and reducing emissions, inventorying remaining emissions, and purchasing offsets to offset the remaining emissions (City of Seattle, 2011) and has maintained GHG neutrality since then. Citywide electrical GHG emissions in 2010 before offsetting were approximately 196,000 metric tons CO_2e (City of Seattle, 2011). According to the latest verified year of reporting, of the citywide emissions total, direct and indirect emissions attributable to City Light operations totaled 10,090 metric tons CO_2e in 2011 (Climate Registry, 2013).

Over 90 percent of City Light's owned or purchased electricity generation is from hydroelectric and wind power, but there are some emissions associated with market purchases. Since 2005, City Light has invested in carbon reduction projects to offset the emissions associated with its electricity purchases and operations. City Light uses GHG offsets registered with the Climate Action Reserve and other third-party organizations to offset its GHG emissions. Each year, City Light offsets 100,000 to 300,000 metric tons of carbon emissions, depending on how much electricity the utility has been able to generate from its hydroelectric resources and how much power it has to acquire elsewhere (Climate Action Reserve, 2013). Most offsets come from agricultural and landfill methane capture projects. City Light seeks projects that are local, verifiable, reasonably priced, reduce emissions beyond business as usual or regulatory requirements, can be replicated or adopted broadly, and have co-benefits to the environment and the economy.

10.1.4 Sensitive Receptors

Air quality does not affect every individual in the population in the same way, and some groups are more sensitive to adverse health effects than others. Population subgroups sensitive to the health effects of air pollutants include the elderly and the young; population subgroups with higher rates of respiratory disease, such as asthma and chronic obstructive pulmonary disease; and populations with other environmental or occupational health exposures (e.g., indoor air quality) that affect cardiovascular or respiratory diseases. Land uses and facilities such as schools, children's day care centers, hospitals, and nursing and convalescent homes are considered to be more sensitive than the general public to poor air quality because the population groups associated with these uses have increased susceptibility to respiratory distress.

[2] The abbreviation for "million metric tons" is MMT; thus, million metric tons of CO2 equivalents is written as MMTCO2e.

Parks and playgrounds are considered moderately sensitive to poor air quality because persons engaged in strenuous work or exercise also have increased sensitivity to poor air quality; however, exposure times are generally far shorter in parks and playgrounds than in residential locations and schools, and these shorter exposure times typically reduce overall exposure to pollutants. Residential areas are considered more sensitive to air quality conditions compared to commercial and industrial areas because people generally spend longer periods of time at their residences, with proportionally greater exposure to ambient air quality conditions. Workers are not considered sensitive receptors because all employers must follow regulations set forth by the Occupational Safety and Health Administration to ensure the health and well-being of their employees relative to their own operations.

Denny Substation Alternatives

The closest sensitive receptors to the proposed Denny Substation site are inventoried in Table 10-1 and are shown on Figure 8-4 in Chapter 8, Land Use and Housing. There are 10 multifamily residential buildings and assisted living facilities within 500 feet of the proposed Denny Substation site. The nearest of these would be The Brewster apartments, across Pontius Avenue North from the site, and the David Colwell building, a mixed-use building that includes apartments on the second through sixth floors, adjacent to the proposed substation site's eastern boundary. Cascade Playground is 500 feet north of the site and separated by a block of structures.

Table 10-1. Sensitive Receptors in the Denny Substation Project Vicinity

Sensitive Receptor	Receptor Type and Location	Distance from Project
David Colwell building	Residential: upper-level apartments at Denny Way and Stewart Street	50 feet
The Brewster apartments	Residential apartments across Pontius Avenue	60 feet
Seattle Cancer Care Alliance Housing	Residential facility	60 feet
Alley 24 (south tower)	Residential building	60 feet
Alley 24 (north tower)	Residential building	175 feet
Williams Apartments	Residential building	175 feet
Mirabella Seattle Retirement Community	Residential facility	225 feet
Fourplexes	Residential building	350 feet

Transmission Line Alternatives, Broad Street Substation Inductor Options and Distribution System

Although there are a number of different types of land uses adjacent to the transmission line routes (Figures 8-6 through 8-8 in Chapter 8, Land Use and Housing), the nearest sensitive receptors along the transmission line alternative routes are residential.

The land uses surrounding the Broad Street Substation are primarily office, retail, and lodging, but there is a single residential apartment building on Thomas Street, approximately 200 feet east of the Broad Street Substation and 500 feet east of the Broad Street Substation Annex.

Similar to the transmission line routes, the nearest sensitive receptors to the Distribution Network area are residential. Figures 8-10 and 8-11 in Chapter 8, Land Use and Housing, show a variety of adjacent land uses.

10.2 Construction Impacts

Short-term construction impacts related to all action alternatives would result from the temporary emissions associated with construction. Construction would generate air emissions through the use of heavy-duty construction equipment, from vehicle trips hauling materials, and from construction workers traveling to and from the project site. The assessment of construction air quality impacts considers each of these sources and recognizes that construction emissions can vary substantially from day to day, depending on the level of activity, the specific type of operation, and, for dust, the prevailing weather conditions.

These sources would also result in the emissions of GHGs, which are described in Section 10.2.5.

Emissions were calculated for every year in which an action alternative is under construction. Table 10-2 shows the “worst-case” year or the maximum annual emissions for each action alternative.

Assessing Construction Impacts

Construction-related emissions were calculated using a detailed equipment list provided by City Light for each alternative and assuming eight-hour construction work days, five days per week. Truck trips and construction worker trips calculated for the transportation analysis were used to calculate emissions from these sources. Separate calculations were conducted to estimate dust generation from grading, bulldozing, and truck loading using U.S. Environmental Protection Agency methodologies (U.S. EPA, 2011).

10.2.1 Substation Alternatives

Substation Alternative 1 (SA1)

As described in Chapter 2, Description of Project and Alternatives, construction of Substation Alternative 1 (SA1) would take approximately 24 months. During this period air emissions would be generated from the use of heavy-duty construction equipment, from vehicle trips hauling materials and from construction workers traveling to and from the project site. Mobile source emissions, primarily NO_X, would be generated from the use of construction equipment such as excavators, bulldozers, wheeled loaders, and cranes. The construction-related emissions from substation development under SA1 (Table 10-2) would be below annual emission thresholds and would be considered a minor impact on air quality.

Table 10-2. Maximum Annual Construction-related Emissions for the Denny Substation Project

Alternative (Highest year of emissions)	Maximum Annual Emissions (tons/year)				
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$
Substation Alternatives (2016)					
Substation Alternative 1 (SA1)	1.21	12.43	5.66	3.11	1.20
Substation Alternative 2 (SA2)	1.20	12.00	5.60	1.78	1.05
Substation Alternative 3 (SA3)	1.20	12.00	5.60	1.78	1.05
Transmission Line Alternatives (2018)					
Transmission Line Alternative 1 (TL1)	1.99	21.89	9.84	1.07	0.90
Transmission Line Alternative 2 (TL2)	1.88	17.69	9.31	0.87	0.83
Transmission Line Alternative 3 (TL3)	2.22	24.52	11.01	1.20	1.01
Phase 1 Build-out Area (2015)	1.71	18.76	83.43	1.05	0.77
Broad Street Substation Inductor Options (2016)					
Broad Street Substation Inductor Option 1 (BI1)	0.72	7.09	4.09	0.32	0.32
Broad Street Substation Inductor Option 2 (BI2)	0.72	7.08	4.09	0.32	0.32
De minimis threshold for Puget Sound airshed	**N/A**	**N/A**	**100**[1]	**100**[1]	**N/A**

[1] Notwithstanding the continued attainment of federal CO and PM_{10} standards, the Puget Sound region continues to be designated as a maintenance area for CO and PM_{10} and, therefore, is subject to the application of the de minimis threshold for CO and PM_{10} maintenance areas until such time that U.S. EPA changes these designations to attainment.
CO = carbon monoxide; EPA = Environmental Protection Agency; N/A = not applicable; NOx = nitrogen oxides; $PM_{2.5}$ = fine particulate matter; PM_{10} = particulate matter; VOC = volatile organic compounds

Substation Alternative 2 (SA2)

Table 10-2 shows that construction impacts related to Substation Alternative 2 (SA2) would be similar to those described for SA1, except that this alternative would take slightly less time to construct than SA1 (18 months). The same numbers and type of construction equipment would likely be employed over the course of construction. However, less excavation under SA2 would result in fewer truck trips as well as reduced truck loading operations than under SA1. The increased footprint of excavation under SA2 would result in slightly greater emissions from grading operations. As with SA1, the construction-related emissions from substation development under SA2 would be below the annual emission thresholds and would be considered a minor impact on air quality.

Substation Alternative 3 (SA3)

Substation Alternative 3 (SA3) would take approximately the same time to construct as SA2 and the impacts would be almost identical to those described for SA2, with the same number and type of construction equipment likely employed for each. The only differences would result from a larger area being graded under SA3 as a result of a slightly larger footprint. Consequently, emissions presented for SA3 in Table 10-2 would be very similar to SA2, except PM_{10} and $PM_{2.5}$ emissions would marginally increase by less than 0.01 ton per year under SA3. As with the other two alternatives, construction-related emissions from SA3 would be below the annual emission thresholds, and would be considered a minor impact on air quality.

10.2.2 Transmission Line Alternatives

Transmission Line Alternative 1 (TL1)

Impacts related to Transmission Line Alternative 1 (TL1) would result from the temporary air emissions associated with construction over a three year period. Construction would generate air emissions through the use of heavy-duty construction equipment, from vehicle trips hauling materials, and from construction workers traveling to and from the active construction portion of the transmission line route. Mobile source emissions, primarily NO_X, would be generated from the use of construction equipment such as backhoes, wheeled loaders, and cranes. Table 10-2 shows the likely emissions for the project component's worst-case year (2018). Although equipment and worker operations would be the same for all three years of TL1 construction, 2018 would have the greatest emissions because the age of the equipment and vehicle fleet would marginally improve in the subsequent two years. As with the substation, the construction-related emissions from transmission line installation would be below the annual emission thresholds and would be considered a minor impact on air quality.

Transmission Line Alternative 2 (TL2)

As shown in Table 10-2, Transmission Line Alternative 2 (TL2) would likely have fewer construction-related emissions than with TL1. Although the same equipment would be used for TL2, transmission line installation in the Downtown Seattle Transit Tunnel (DSTT) would require less excavation than with TL1 because more than 50 percent of the proposed underground line would be within an existing tunnel. The construction-related emissions from transmission line installation would be below the annual emission thresholds and would be considered a minor impact on air quality.

Transmission Line Alternative 3 (TL3)

Table 10-2 shows that Transmission Line Alternative 3 (TL3) would likely have more construction-related emissions than TL1. Installation of TL3 would require more excavation than TL1 because the overall length of the route would be approximately 12 percent longer and would take proportionally longer than TL1 to construct. Although the same construction equipment would be used as for TL1, the added length of this alternative would likely result in more truck trips, construction work trips, and truck loading to construct the transmission line.

There are more sensitive receptors along the TL3 route than along the TL1 or TL2 routes with potential for a greater number of people to be affected by nuisance dust emissions. However, given the limited construction time at any single location, and because temporary nuisance dust impacts would be minimized by construction dust control measures identified in Section 10.6, Mitigation Measures, the air quality impacts would not be considered significant. The construction-related emissions from TL3 installation would be below annual emission thresholds; and this alternative would be considered to have a minor impact on air quality.

10.2.3 Broad Street Substation Inductor Options

Broad Street Substation Inductor Option 1 (BI1)

Installation of the series inductor equipment would require excavation of up to 2,300 cubic yards of material for the Broad Street Substation Inductor Option 1 (BI1). Construction equipment associated with this activity was assumed to be similar to that for the Denny Substation site construction. Truck emissions were calculated based on the quantity of excavated material. The construction-related emissions from inductor installation under BI1 would be below the annual emission thresholds and would be considered a minor impact on air quality (see Table 10-2).

Broad Street Substation Inductor Option 2 (BI2)

Installation of the series inductor equipment under the Broad Street Substation Inductor Option 2 (BI2) would be the same as BI1, except that BI2 would require excavation of up to 2,000 cubic yards of material. As shown In Table 10-2, which assumes two additional months of construction with BI2 compared to BI1, the construction-related emissions from inductor installation under BI2 would be below the annual emission thresholds and would be considered a minor impact on air quality.

10.2.4 Distribution System

Impacts related to distribution system installation would result from construction-associated emissions. Construction would generate air emissions through the use of heavy-duty construction equipment, from vehicle trips hauling materials, and from construction workers traveling to and from the active portion of the distribution line route. Mobile source emissions, primarily NO_X, would be generated from the use of construction equipment such as backhoes, wheeled loaders, and cranes. For the assessment of construction air quality impacts, each of these sources were considered, and it was recognized that construction emissions can vary substantially from day to day, depending on the level of activity, the specific type of operation, and, for dust, the prevailing weather conditions. These sources would also result in the emissions of GHGs, which are addressed below in Section 10.2.5.

Construction-related emissions from the Phase 1 Build-out area were calculated using an equipment list provided by the Denny Substation design team (Veldee, 2013) and assuming eight-hour construction work days and a five-day work week. The same calculation methodologies for distribution system installation emissions were used as for the substation and transmission line construction emissions, except that three-block sections were assumed to be under construction concurrently. Emissions from construction in the Future Build-out area would be similar to those calculated annual emissions for the Phase 1 Build-out area.

As shown in Table 10-2, the construction-related emissions from distribution system installation in the Phase 1 Build-out area would be below the annual emission thresholds and would be considered a minor impact on air quality.

10.2.5 Greenhouse Gas Emissions – Maximum Emission Scenario

Emissions of GHGs would be generated by project construction activities. In late 2014, construction activities for the distribution system in the Phase 1 Build-out area would begin and continue into late 2016. In mid-2015, substation construction is also expected to begin. The substation would be placed in service (energized) in late 2016, when emissions from substation operation would begin, and there would be some limited construction for equipment placement in the yard continuing into early 2017. In 2016, construction activities for the substation and distribution installations would occur simultaneously with construction activities for the Broad Street Substation inductor installation, which is expected to take 6 to 12 months. Construction activities for the transmission line alternatives would occur from late 2018 through late 2020. After 2020, only operational emissions of the Denny substation would occur. Table 10-3 summarizes the annual GHG emissions estimated for each of these years. Emissions associated with SA1 construction are presented in Table 10-3 because SA1 would have the longest construction period of the three substation alternatives and would therefore have the greatest emissions.

As can be seen from Table 10-3, annual GHG emission during all construction years would be below the State of Washington GHG reporting threshold[3], which is 10,000 metric tons CO_2e per year and would be considered a minor impact.

Table 10-3. Construction Related GHG Emissions (metric tons per year)[1]

Project Component/Source	CO_2	CH_4	N_2O	CO_2e
Construction Annual				
Total 2014 Emissions (Distribution System)	503	0.02	0.01	507
Total 2015 Emissions (Substation Alternative 1 [SA1] and Distribution System)	2,693	0.09	0.04	2,709
Total 2016 Emissions (SA1, Broad Street Substation Inductor Option 2 [BI2], and Distribution System)	5,840	0.23	0.11	6,251
Total 2017 Emissions (SA1 construction and operation)	450	0.04	0.01	454
Total 2018, 2019, and 2020 Emissions (Transmission Line Alternative 3 [TL3])	2,351	0.08	0.04	2,365
State of Washington reporting threshold (stationary facilities) in MT eCO_2/yr				10,000

[1] GHG emissions represent the maximum emissions for the worst-case scenario. Other alternatives and combinations of alternatives would have fewer emissions.
CH_4 = methane; CO_2 = carbon dioxide; GHG = greenhouse gas; MT = metric tons; N_2O = nitrous oxide; CO_2e = CO_2 equivalents

[3] The State of Washington GHG reporting threshold applies only to stationary sources. However, it is used in this analysis as a relative measure of significance as it is the only quantitative threshold suggested by either U.S. EPA or the State of Washington with regard to GHG emissions. Neither U.S. EPA nor the State of Washington has established quantitative thresholds for addressing the significance of construction-related GHG emissions or mobile emissions.

10.3 Operational Impacts

10.3.1 Substation Alternatives

When operational, the Denny Substation is not expected to generate significant air emissions under any of the substation alternatives. The substation would generate few vehicle trips. There would be no employees stationed on-site, so there would be no regular emissions associated with commute trips. The only stationary source on the project site would be a backup generator. Except for during emergency conditions, this generator would be operated monthly for just 10 to 20 minutes for maintenance purposes. The proposed generator would not require a permit from the PSCAA because it would be a standby unit operated less than 500 hours per year (Williams, 2013). Operational generator emissions would be minimal (less than 0.2 ton per year for any pollutant) and below the de minimis thresholds used to assess the need for a conformity assessment with the State Implementation Plan for regions designated as maintenance areas. Operational GHG impacts are addressed in Section 10.3.5.

Assessing Operational Impacts

A variety of models were used to estimate air pollutant and GHG emissions associated with the proposed project alternatives. These included the latest publicly available air pollution models of the U.S. EPA and other state regulators.

Because there are no state or local guidelines for evaluating the degree of impact from construction pollutant emissions, criteria adopted by the U.S. EPA to determine consistency with the federal Clean Air Act were applied.

GHG emissions from both project construction and operation were summarized for a worst-case construction year and for future operational years of the project. GHG emissions for each year were compared to the State reporting threshold for GHGs. GHG emissions from project operation were also compared to City Light's long-term zero net emissions goal adopted in City Resolution 30144.

10.3.2 Transmission Line Alternatives

When constructed, there would be no operational emission sources or impacts from any of the transmission line alternatives. Routine or emergency line maintenance would generate only occasional, infrequent vehicle trips with negligible emissions.

10.3.3 Broad Street Substation Inductor Options

When constructed, the Broad Street Substation inductor would not install any stationary sources of air emissions or generate appreciable vehicle trips. The inductor equipment would include gas-insulated switchgear (GIS) that would contain SF_6, which is considered in the estimate of SF_6 load with that of the Denny Substation in this analysis (see Section 10.3.5 for more detail).

Routine or emergency maintenance of the inductor would generate only occasional, infrequent vehicle trips with negligible emissions.

10.3.4 Distribution System

When constructed, there would be no operational emission sources or impacts generated by the distribution system in either the Phase 1 Build-out area or Future Build-out areas. Routine or emergency maintenance would generate only occasional, infrequent vehicle trips with negligible emissions.

10.3.5 Greenhouse Gas Emissions – Maximum Emission Scenario

Operational GHG emissions associated with the Denny Substation would result from maintenance operations of the backup liquid propane generator, electrical usage by the substation, and potential fugitive release of SF_6 used as an insulating gas. These emissions are presented in Table 10-4. Operational electrical demand under SA1 is predicted by City Light to be twice that of SA2 or SA3 due to different overall operational energy requirements related to additional air handling, water pumping, extra lighting, and an elevator. Electrical emissions estimates are based on City Light's marginal resource[4] emission factor of 857 pounds of CO_2 per megawatt hour. As Table 10-4 indicates, annual GHG emission during operational years would be below the State of Washington GHG single-source reporting threshold, which is 10,000 metric tons CO_2e per year, and would be considered a minor impact. However, City Light has a zero net emission goal for GHGs. Consequently, mitigation is identified in Section 10.6, Mitigation Measures, to maintain consistency with this policy.

Table 10-4. Operational GHG Emissions (metric tons per year)[1]

Project Component/Source	CO_2	CH_4	N_2O	CO_2e
Operational Annual (2017 onward)				
Backup liquid propane generator	9.63	0.02	<0.01	10.58
Electrical demand Substation Alternative 1 (SA1)	467	0.18	2.21	470
Electrical demand Substation Alternatives 2 and 3 (SA2/SA3)	234	0.091	1.11	235
Fugitive SF_6 emissions[2]				542
Total SA1				1,023
Total SA2 or SA3				788
State of Washington reporting threshold (stationary facilities) in MT eCO_2/yr				10,000

[1] GHG emissions in this table represent the maximum emissions for the worst-case scenario. Other alternatives and combinations of alternatives would have fewer emissions.
[2] SF_6 emissions based on an estimated systemwide charge capacity of 10,000 pounds and an industry standard leakage rate of 0.5 percent.
CH_4 = methane; CO_2 = carbon dioxide; GHG = greenhouse gas; MT = metric tons; N_2O = nitrous oxide; CO_2e = CO_2 equivalents; SF_6 = sulfur hexafluoride

[4] To estimate the net GHG impact of using these resources, it is assumed that the emissions are primarily from natural gas plants that serve incremental increases in electricity demand in the market, the "marginal resource" discussed in City Light's Integrated Resource Plan. Current regulations and low natural gas prices support the assumption that natural gas combustion turbines are likely to be the primary marginal resource (City Light, 2012).

10.4 Impacts of No Action Alternative

Since a new substation would not have been constructed, there would have been no construction emissions for construction and no new operational emissions (such as from stationary sources or vehicle trips to the site) that would generate air quality impacts.

Air quality impacts associated with installation of an inductor at the Broad Street Substation or Annex would still occur and would be the same as shown in Table 10-2 for the Broad Street Substation inductor options. The installation of the second inductor, likely on Parcel 1, 2, or 3 at the Denny Substation site, would have construction air quality impacts similar to those shown for the Broad Street Substation inductor options in Table 10-2. Operation of the GIS that would contain SF_6 associated with the inductors at the two sites would generate a fraction of the GHG emissions estimated in Table 10-4 for the entirety of the Denny Substation.

System improvements that would be needed to continue providing network service to the existing network area south of Denny Way would likely have air quality impacts similar to those shown for the Phase 1 Build-out area in Table 10-2.

10.5 General Conformity Applicability Assessment/Cumulative Impacts

The proposed Denny Substation Project would not require any federal permits, approvals, or other federal actions related to air quality. Consequently, a general conformity applicability assessment is not required by the U.S. EPA. Notwithstanding this fact, a total sum of project emissions for a given year was developed and compared to the general conformity de minimis thresholds applicable in King County as an assessment of the cumulative air quality impact of the proposed project.

As a worst-case analysis, year 2015 emissions from SA1 in combination with emissions from installation of the distribution system were considered. Other years and alternative combinations would have fewer emissions. The construction-related emissions from all project elements would be below the annual Puget Sound airshed emission thresholds and would not result in a significant impact on air quality.

10.6 Mitigation Measures

The construction and operational air quality and GHG impacts that the Denny Substation Project might pose would be avoided or reduced by implementing general mitigation measures.

10.6.1 General Avoidance and Minimization Measures Common to All Alternatives

Construction Emissions

Although construction-related emissions would be below thresholds established by U.S. EPA, City Light would implement best construction practices to minimize PM_{10} and CO emissions in the project vicinity, which is a designated maintenance area for these pollutants. Specifically, City Light would require that contractors comply with the following practices as a condition of the construction contract:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day on days with no precipitation.

- All haul trucks transporting soil, sand, or other loose material off-site will be covered.
- All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day.
- All vehicle speeds on unpaved roads will be limited to 15 miles per hour.
- All roadways, driveways, and sidewalks to be paved will be completed as soon as possible. Building pads will be laid as soon as possible after grading unless seeding or soil binders are used.
- Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes. Clear signage will be provided for construction workers at all access points.
- All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- SF_6 filled equipment with manufactured guaranteed leakage rate of 0.1 percent will be installed. Operational GHG emissions are estimated using a conservative leakage rate based on the current standard of the International Electrotechnical Commission. Installation of such equipment could reduce estimated fugitive SF_6 emissions by 80 percent.
- An oil-filled line inductor will be installed instead of an SF_6-insulated inductor.

GHG Emissions

City Resolution 30144 established City Light's long-term goal of meeting Seattle's electrical needs with no net GHG emissions. City Light has achieved carbon neutrality by eliminating and reducing emissions, inventorying remaining emissions associated with any fossil fuels used to meet load growth, and offsetting the remaining emissions. City Light will reduce operational emissions where feasible and purchase offsets consistent with Resolution 30144.

10.6.2 Specific Mitigation Measures

With implementation of the avoidance and minimization measures described in Section 10.6.1 above, no adverse impacts with regard to air quality or GHG emissions are expected. Therefore, no specific mitigation measures are required or proposed.

10.7 Unavoidable Significant Adverse Impacts

There would be no unavoidable significant impacts with regard to construction-related or operational air quality or GHG emissions from any of the proposed alternatives.

Chapter 11: UTILITIES

11.1 Affected Environment

This section discusses the utilities currently located in the Denny Substation Project vicinity. The service providers for each utility are described, as well as the area serviced by each of the utilities. The intent of this chapter is not to provide a complete listing of all utilities in the project vicinity. Instead, the location and size of utility lines, where known, are given in relation to the project vicinity.

Utilities Key Findings

Construction of all of the substation alternatives would require utility relocations and create challenges for future maintenance work on utility lines in the immediate area. The substation, transmission line, Broad Street Substation inductor, and distribution system would all require close coordination with service providers to minimize interruptions in service during construction.

The No Action Alternative could result in significantly reduced reliability of electrical service to some areas due to the excessive load on the existing system.

No unavoidable significant adverse impacts were found with regard to conflicting utility locations, operational challenges, or the project's need for and use of utility services.

11.1.1 Electricity

City Light provides electrical service not only to the Seattle area, but also to portions of King County north and south of the city limits. Electricity to the proposed Denny Substation site is currently provided from the existing Broad Street Substation. There are both underground and overhead electrical lines along the proposed transmission line alternatives routes, in the distribution area and in the vicinity of the Broad Street Substation and Annex.

The South Lake Union area of Seattle has been experiencing rapid redevelopment over the past 15 years. Redevelopment is resulting in high electrical load density in South Lake Union and north downtown, with loads expected to approach that of the Central Business District (CBD) where network distribution is already in place. The objectives of the proposed project are to serve this recent development, serve additional future development, and provide the required system flexibility to accommodate planned and unplanned outages. For additional description of City Light's planned infrastructure improvements in the project vicinity, see Chapter 2, Description of Project and Alternatives.

11.1.2 Natural Gas

Puget Sound Energy (PSE) serves approximately 1.1 million customers with electricity and over 760,000 customers with natural gas in a 6,000-square-mile service area. In the Seattle area, PSE provides only natural gas, which comes from the western U.S. (38.5 percent) and Canada (61.5 percent). Natural gas comes into the Puget Sound area from PSE's storage facilities in Jackson Prairie, Washington, and Clay Basin, Utah, through main pipelines and is then distributed to customers in the region via 13,000 miles of service lines (PSE, 2013). There are natural gas lines adjacent to the Denny Substation site within the rights-of-way of Minor Avenue North, John Street, and Denny Way. There are also natural gas lines in various locations along the proposed transmission line alternatives routes and distribution system. There is a 12-inch gas line and a 6-inch gas line within the rights-of-way for Broad Street and Taylor Avenue North respectively, near the Broad Street Substation site.

Identifying the Affected Environment

Utilities in the project vicinity include electricity, steam, natural gas, water, storm water, sanitary sewer, and communication lines. Records obtained from City Light and Seattle Public Utilities for the potentially affected City of Seattle rights-of-way were used to identify utility service providers with existing and planned lines within the project work areas.

11.1.3 Water

Water service in Seattle is supplied by Seattle Public Utilities (SPU) to both retail and wholesale customers, including some surrounding cities and water districts. SPU uses both surface and groundwater supplies to operate their system. The entire distribution system consists of 2 treatment plants, approximately 1,700 miles of water mains, 8 reservoirs, 2 well fields, 16 pump stations, 6 elevated tanks and standpipes, 21,000 valves, 18,920 fire hydrants, and more than 188,000 service lines and meters (SPU, 2012a). There are water lines adjacent to or near the Denny Substation site and within the immediate vicinity rights-of-way. There is a 6-inch-diameter water main within Minor Avenue North, 8-inch-diameter water mains within Pontius Avenue North and John Street, and a 30-inch-diameter water main within Denny Way. There are also water lines along the transmission line alternatives routes, including a 16-inch-diameter, lead-jointed water main in Howell Street. There is a 12-inch water line within the Taylor Avenue North right-of-way near the Broad Street Substation, and water lines within the distribution system area in unverified locations.

11.1.4 Stormwater

SPU, with help from other City of Seattle (City) departments, manages the Seattle stormwater system according to the requirements of the City's National Pollution Discharge Elimination system (NPDES) Phase I Municipal Stormwater Permit (Permit). The NPDES Permit and accompanying Stormwater Management Program establish the criteria for controlling and reducing pollutants discharged from wastewater and stormwater (SPU, 2012b).

The City currently has three types of stormwater infrastructure: separate storm drains, partially separated storm drains/sewers, and combined sewer systems. Most of the South Lake Union and Denny Triangle areas fall within a combined sewer system, with portions of the waterfront area in a partially separated system. In the combined sewer system, all stormwater is diverted with other wastewater to the sanitary sewer system and then on to a wastewater treatment plant. The partially separated storm drain areas divert runoff from the streets into pipes that flow directly to receiving waters, such as Puget Sound or Lake Union. Other runoff, such as from rooftops, flow into the sanitary sewer system.

There are existing stormwater facilities at the Denny Substation site. There is a 28-inch x 42-inch brick combined sewer in Denny Way and Minor Avenue North and an 8-inch-diameter combined sewer pipeline in John Street. There are stormwater facilities, as well as combined sewer lines, in the vicinity of the Broad Street Substation, the proposed transmission line alternatives routes, and distribution system.

11.1.5 Sanitary Sewer

Seattle's sanitary sewer collection system is maintained by SPU. From SPU's system, wastewater flows into regional interceptor lines managed by King County Wastewater Treatment Division and then to one of three wastewater treatment facilities. Wastewater from downtown Seattle is conveyed to the West Point Treatment Plant (King County, 2013).

In addition to the combined sewer lines in the Minor Avenue North and John Street rights-of-way, there is also an 8-inch-diameter combined sewer line in Pontius Avenue North near the Denny Substation site. Taylor Avenue North, near the Broad Street Substation, has a 15-inch sewer line. There are also underground sewer lines in the vicinity of the proposed transmission line alternatives routes and distribution system.

11.1.6 Telecommunications

Cable television, internet connectivity, and telephone service in the project vicinity are provided by private utility companies (Comcast, Wave Broadband, Century Link, and others). Comcast and Wave Broadband have franchise agreements with the City for placement of their cable transmission lines within the public right-of-way. Transmission lines in the Seattle area include both coaxial and fiber-optic cables.

11.1.7 Steam

Seattle Steam provides district energy to portions of the CBD and First Hill neighborhoods. This privately owned utility is franchised by the City under a 50-year agreement, which was last renewed in 2004. Seattle Steam has been supplying residential, commercial, and industrial customers with both low-pressure and high-pressure steam since 1893. The steam is used primarily for heating but also for other applications such as sterilization in hospitals, humidity control, and in industrial production processes (Seattle Steam, 2013).

District Energy

District energy is a system that delivers energy from a centralized location to multiple customers within a defined service area. For example, Seattle Steam is a district energy system that produces steam at two central plants and then distributes that energy to buildings in the city for various uses (Seattle Steam, 2013).

Seattle Steam operates two steam-generating plants to supply their customers. One plant is located on Western Avenue and University Street, and the other is on Western Avenue near Yesler Way. There are over 18 miles of distribution pipeline within their service area. Both high- and low-pressure lines are located within the proposed transmission line alternatives routes and distribution system.

11.2 Construction Impacts

There is a potential for existing utilities to be affected when constructing within the road right-of-way. This section describes the type and location of impacts that could result from construction of the proposed project. Disruptions in utility service are most likely to occur where the exact location of utility lines is unclear, as is the case with some older systems.

11.2.1 Substation Alternatives

> **Assessing Construction Impacts**
>
> For the analysis of potential construction impacts, each alternative was compared to available data to assess the potential for conflicts with existing lines.

All of the proposed substation alternatives could affect existing utilities on the proposed substation site. In order to provide sufficient space within the adjacent street rights-of-way for the duct banks, some existing utilities would need to be relocated. There is the potential for temporary service outages during relocations. All service disruptions would be coordinated between the service provider and customers. Existing pipes and other facilities would be located during final design to ensure new excavations are far enough away from existing facilities to not cause damage. This may include potholing (minor excavations to precisely locate utility lines) to identify and minimize potential conflicts.

> **Getaway Duct Banks**
>
> Getaway duct banks are the underground conduit systems where the distribution lines leave the substation. The getaway duct banks have to be separated from each other by about 15 feet in order to dissipate the heat.

The water and gas mains within the Minor Avenue North right-of-way would have to be relocated to the west side of the street to create a corridor along the east side for duct banks leaving the substation site. SPU has confirmed that relocating and upsizing the water main to 12 inches in diameter would both allow space for the getaway duct banks and address their ground grid capacity concerns (City Light, 2013). The PSE gas line within Minor Avenue North would be replaced in kind. The combined sewer in this area, which is approximately 16 feet below the ground surface, would not require relocation but must be protected during construction to prevent damage to the line.

The 30-inch-diameter water main in Denny Way is a critical water supply line in the area. Where the water main nears Minor Avenue North the proposed project calls for three duct banks to cross close beneath it. This arrangement may require the replacement of a section of the water main or a temporary shutdown of a section during construction. Coordination with SPU, as well as other construction projects in the area, would be critical.

Substation Alternative 2 (SA2) and Substation Alternative 3 (SA3) both include a vacation of Pontius Avenue North. Construction within the Pontius Avenue North right-of-way between Denny Way and John Street would affect existing utility lines, unlike with Substation Alternative 1 (SA1). The water line within the Pontius Avenue North right-of-way is proposed to be abandoned and removed. The SPU sewer line in Pontius Avenue North would be abandoned. Neither of these lines is needed to provide service to the surrounding area. The existing City Light transmission line in this area would be split into two lines as part of the proposed project and be rerouted within the building structure to the applicable termination equipment. Temporary disruptions to electrical service may be required to complete this work.

As part of the proposed project, the water main within John Street would be relocated and reconstructed as part of the 12-inch-diameter main reconnection in Minor Avenue North to Pontius Avenue North (north of the substation site). The combined sewer in John Street would be relocated. The existing gas line is being relocated as part of the remediation project on Parcel 2 of the substation site. The new gas line location might not conflict with the proposed substation alternatives; however, more detailed project design may determine a need for further relocation.

Construction of the proposed ground grid on the substation site (for worker safety) would require coordination with work on both electrical and other utility lines entering the site. To avoid conflicts with other utility work at the site, the ground grid system would be constructed after completion of other utility work.

11.2.2 Transmission Line Alternatives

Construction of the transmission line would require trenching for duct banks and excavation for vault construction. This work would be accomplished primarily within the existing City rights-of-way that contain a significant amount of utility infrastructure. The alignments of new duct banks and vault locations will be designed to minimize any impact on major utilities. A 16-inch-diameter, lead-jointed water main in Howell Street would require protection where each of the proposed transmission line alternatives would cross because it is the main water supply for the surrounding area. The amount of construction and congestion of existing utilities suggests that relocations and reconstructions would likely be required. Subsequent design phases for the proposed project will identify the exact location of existing utilities and potential conflicts with the proposed new transmission line.

In some parts of downtown Seattle there are areas of thickened pavement due to previous use by trolleys. The removal of this paving causes heavy vibration impacts on water mains, sewers, and drainage lines in the immediate vicinity. Special provisions would be needed to prevent damage to existing utility lines in these areas during transmission line installation. With appropriate measures, which will be determined in the field on a case-by-case basis, any impacts are expected to be minor, and any necessary repairs would be made.

Some of SPU's existing facilities can be damaged by vibrations from construction. Cast iron water mains, brick sewers, and other structures are highly susceptible to damage from vibration. Existing pipes and other facilities would be located during final design to ensure new excavations are far enough away from existing facilities to not cause damage. This may include potholing (minor excavations to precisely locate utility lines) to identify and minimize potential conflicts.

11.2.3 Broad Street Substation Inductor Options

Installation of the inductor at the Broad Street Substation for Broad Street Substation Inductor Options 1 or 2 (BI1 or BI2) would require excavation for the basement level gas-insulated switchgear system and installation of a ground grid, as described above for the Denny Substation site. The grid would be installed at a minimum depth of 24 inches below the finished grade of the substation or annex, depending on the option. The spacing and exact placement of the ground grid will be determined during final design, after the completion of site-specific soil testing and computer analysis. The grid would extend approximately 3 feet beyond the perimeter fence line for proper protection.

Construction of the ground grid on the substation or annex site would require coordination with work on both electrical and other utility lines entering the site. To avoid conflicts with other utility work at the site, the ground grid system would be constructed after completion of other utility work.

Some utility relocations may be required for either BI1 or BI2. All relocations would be coordinated with the utility service provider during final design.

11.2.4 Distribution System

Construction of the distribution system for both the Phase 1 Build-out and Future Build-out areas would require trenching for duct banks and excavation for vault construction. This work would be accomplished primarily within the existing City rights-of-way that contain a significant amount of utility infrastructure. The alignments of new duct banks and vault locations will be designed to minimize potential impacts on major utilities. The amount of construction and congestion of existing utilities suggests that relocations and reconstructions would likely be required. Water mains are present within most streets in the project vicinity. There may be some areas where avoidance of existing utilities is not possible. Temporary disruptions in utility service might occur, which would be proceeded by all necessary communications with service providers and appropriate public notification. This would include coordinating the timing of water outages with SPU and the Seattle Fire Department to ensure fire hydrants are available. There would be planned electrical outages when service is transferred to the new distribution system. City Light would work closely with the contractor to schedule the outages and to minimize their durations. The transfers would be scheduled in advance with each customer and completed one at a time, preferably during low use hours.

As described above, some areas of downtown Seattle have areas of thickened pavement, the removal of which creates heavy vibration impacts. Special provisions would be needed to protect existing utility lines in these areas during installation of distribution lines.

Some of SPU's water mains are made of cast iron, which can be damaged by vibrations from construction. Existing pipes and other facilities would be located during final design in order to ensure new excavations are far enough away to not cause damage. This may include potholing to locate and manage conflicts.

The proposed distribution system duct bank in the Phase 1 Build-out area closely parallels an existing 16-inch-diameter, lead-jointed water main in Howell Street. If the soil is not kept in place and the water main is displaced vertically or horizontally (or a combination of both), there may be joint failure in the pipeline resulting in service disruption. If joints do not fail, SPU might require replacement of the displaced water main in advance of the distribution system construction, or additional measures to reinforce the joints to avoid future failure. Monitoring might be required before, during, and after construction in this area. As part of the distribution work, the water main being replaced in John Street for the substation (see Section 11.2.1) may also be replaced along Pontius Avenue from John Street to Thomas Street with a 12-inch water main. When the duct bank routes are determined for the Future Build-out area, City Light would work with utility providers to determine if there are areas of concern for existing utilities lines.

11.3 Operational Impacts

This section describes operational impacts on utilities related to City Light's need to access the project vicinity for maintenance or repair over the life of the project.

11.3.1 Substation Alternatives

All of the substation alternatives would be considered a new utility use; however, this use is not expected to create additional demand beyond current availability. In addition to electricity (see Chapter 13, Energy and Natural Resources, for information on electricity usage), the new substation would require connections to water, sanitary sewer, and storm drain lines. Utility usage would be estimated based on input from the architectural/engineering team on specific building features. None of the proposed relocations and alterations to existing utility lines would have adverse operational impacts on the services provided by those utilities.

City Light construction standards require that duct banks be buried with a minimum 3 feet of ground cover, which could possibly create a barrier for other utility work in the future. City Light will continue to work with SPU and other utility service providers during final design of the project to coordinate the placement of the duct banks as well as other utility lines being replaced and relocated as part of the project.

The addition of a ground grid beneath the new substation might hinder access to utility lines on the substation site. The ground grid may be either over or under other on-site utilities, depending on specific site conditions. To ensure worker safety and appropriate protection of the ground grid, any maintenance or repair work on utility lines on the site (water, gas, and telecommunication) would be facilitated by a City Light qualified worker. In all cases where non-City Light personnel need to access the interior of the site, a qualified worker would escort them to ensure their safety. If utility work needed to occur beneath the ground grid, in addition to escorting utility workers or contractors on-site and providing a safety watch, the qualified worker would do any site preparation such as insulating the ground grid with a protective cover or cutting through and then repairing the ground grid.

No impacts to utilities around the substation site relative to electric current are anticipated. City Light will be providing non-conductive pipe on all utilities leaving the substation site to avoid damage to utility line coatings in the rare event of a possible fault condition at the substation site.

Fault

In an electric power system, a fault is any abnormal electric current. For example, a short circuit is a fault in which current bypasses the normal load or conductor. An open-circuit fault occurs if a circuit is interrupted by a failure. In power systems, protective devices detect fault conditions and operate circuit breakers and other devices to limit equipment damage and in some cases attempt to minimize the extent of any outages.

11.3.2 Transmission Line Alternatives

The new transmission line would be designed and placed to minimize future conflicts with proposed utility lines. As described above for the substation alternatives, the duct banks require 3 feet minimum of ground cover, possibly creating a barrier for other utilities. City Light will continue to work with SPU and other utility service providers during final design of the project to coordinate the placement of the duct banks as well as other utility lines being replaced and relocated as part of the project.

In the event that transmission lines were installed parallel to other utility lines over long distances (at least the distance of a city block) and in very close proximity, it is theoretically possible, but unlikely, that the sustained electric or magnetic field from the line could negatively affect or corrode the other utility lines over time. However, no such long parallel distances are anticipated for the transmission line, and the bare copper conductor within each duct bank would help prevent this type of corrosion from occurring. No operational impacts to other utilities are expected.

11.3.3 Broad Street Substation Inductor Options

As with the Denny Substation, no impacts to utilities around the substation site relative to electric current are anticipated. City Light would be providing non-conductive pipe on all utilities leaving the substation site to avoid damage to utility line coatings in the rare event of a possible fault condition at the substation site. The same protections would protect utility workers accessing the Broad Street Substation site.

11.3.4 Distribution System

As described for the other project components, the duct banks require 3 feet minimum of ground cover, possibly creating a barrier for other utilities in those areas. City Light would continue to work with SPU and other utility service providers during final design of both the Phase 1 Build-out and Future Build-out areas to coordinate the placement of the duct banks as well as other utility lines being replaced and relocated as part of the project to minimize the potential for hindering access to other utility lines in the future.

11.4 Impacts of No Action Alternative

City Light would take steps to provide consistent power to existing and future customers through existing facilities, but the proposed extension of network service would not occur. City Light would be required to modify current operational standards and run existing substation equipment at higher than optimal levels in order to continue providing network service to the Broad System Capacity Improvements area, as described in Section 2.4 of Chapter 2, Description of Project and Alternatives. Doing this would have a significant risk of premature failure and/or permanent heat damage, with a significant chance of reduced reliability to customers. At the Broad Street Substation, the existing circuits exiting the facility already require a custom cooling system, and additional circuits to serve the existing network service areas would make this engineered system more challenging to manage. Additional underground distribution lines from the Broad Street and Union Street Substations would also be required to continue to provide network service to this area. The potential impacts from this work would generally be the same as described in Section 11.2.4. Inductor installation at the Broad Street Substation would require coordination with other utility providers and utility relocations similar to what is described in Section 11.2.3. Installing an inductor at the Denny Substation site would likely require work in the right-of-way to split the existing underground transmission line into two lines which would be coordinated with utility providers.

City Light's ability to reliably serve loads in the South Lake Union area would be limited under the No Action Alternative. Less reliable service could result in power disturbances and, without additional capacity in the near future, increase the likelihood of power outages during the hot summer months, even with adjustments to the system described above.

11.5 Mitigation Measures

The construction and operational utility impacts that the Denny Substation Project might pose would be avoided or reduced by implementing general mitigation measures.

11.5.1 General Avoidance and Minimization Measures Common to All Alternatives

The final design of the proposed project will take into consideration existing utility lines when determining the final location of new facilities so as to minimize conflicts with future maintenance work on those lines.

The final design and placement of ducts and vaults would require coordination with SPU to determine appropriate horizontal and vertical (minimum of 3 feet) clearance around existing water mains to allow future water services to be installed without affecting the City Light facilities.

Prior to the start of any construction, existing utilities and appurtenant facilities (catch basins, fire hydrants, etc.) would be located and field-verified where feasible to avoid conflicts with the proposed facilities.

For all alternatives, coordination with the individual utility providers would be required to determine whether or not existing and future utilities could be affected and how best to avoid or minimize those impacts. City Light would continue to work with SPU and other utility service providers during final design of the project to coordinate the placement of new facilities and ensure protection of other utilities. In some instances, vibration and settlement monitoring may be required where construction would occur near existing utilities.

Where utility relocations are required, they would be scheduled in advance so as to minimize potential service outages. City Light would develop a plan for public outreach to inform customers of potential service outages and construction schedules. The public outreach effort would be coordinated with SPU and other utility service providers.

The potential for damage to the coating of utility lines leaving the Denny and Broad Street Substations, which could occur in the rare event of a fault condition at the substation, would be avoided by the use of non-conductive pipe for those utilities. Use of this type of material would help prevent impressed currents and related corrosion, which could occur with a fault and damage those pipes.

11.5.2 Specific Mitigation Measures

With implementation of the avoidance and minimization measures described in Section 11.5.1 above, no adverse impacts to utilities are expected. Therefore, no specific mitigation measures are required or proposed.

11.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to utilities are anticipated from construction or operation of any of the alternatives, with the exception of the No Action Alternative. Under the No Action Alternative, City Light would be required to modify current operational standards and run existing substation equipment at higher than optimal levels, which would result in significant risks to equipment and service reliability. City Light would continue to investigate ways to optimize operations with the current equipment.

Chapter 12: WATER RESOURCES

12.1 Affected Environment

There are no water resources immediately adjacent to the proposed Denny Substation site, transmission line alternative routes, Broad Street Substation and Annex, and distribution system area. This analysis focuses on impacts on water bodies that receive stormwater runoff from the project vicinity: Lake Union, the Ship Canal "downstream" (west) of Lake Union, Elliott Bay (Puget Sound), and the Duwamish Waterway.

The storm drainage conveyance systems found within the distribution system area and proposed transmission line alternative routes are too extensive to characterize in detail for this EIS, and it is not necessary to do so to adequately analyze potential project impacts. Therefore, the characteristics of these conveyance systems (for example, typical water quality and flow capacity issues) were analyzed and documented at a general level. At the Denny Substation site scale, the analysis was more detailed and considered existing water quality or flow capacity problems that might exist; this level of detail allows changes in stormwater runoff quality and quantity that could occur as a result of the proposed project to be adequately addressed.

12.1.1 Substation Alternatives

Surface Water

The Denny Substation site is located within the Lake Union basin, which is within the Lake Washington/Cedar/Sammamish watershed. The site is located approximately one-half mile south of Lake Union in the highly urbanized South Lake Union area (see Figure 2-1 in Chapter 2, Description of Project and Alternatives).

The three parcels of the site and the Pontius Avenue North right-of-way (see Figure 2-5 in Chapter 2), were previously covered with impervious surface (buildings and asphalt) except for a narrow band of trees and shrubs along the north boundary of Parcel 1. During 2012 and

Water Resources Key Findings

Construction of all project components could allow sediment and other contaminants in runoff to enter the City's sewer or drainage system. With erosion and sediment controls and other pollution prevention measures, the effects of runoff downstream of the site would not be measurable.

Dewatering for excavations could increase flows in the sewer system that could lead to temporary reductions in system capacity. King County and Seattle Public Utilities would need to pre-approve these types of discharges.

Contaminated groundwater encountered during dewatering activities would be treated before discharge to the combined sewer or separated storm drainage system (depending on location).

When built, the Denny Substation site runoff would be of comparable or better water quality than existing conditions and would be released into the sewer system at lesser peak flow rates. Improvements to the Broad Street Substation Inductor site would not change the quality or quantity of site runoff compared to existing conditions.

There would be no operational effects on water resources from the transmission and distribution system improvements under any of the action alternatives.

No unavoidable adverse significant impacts to water resources are anticipated.

2013, City Light demolished and cleared Parcel 2 prior to remediation of contaminated soil and groundwater on the property. Chapter 6, Environmental Health – Hazardous Materials, provides a description of the contaminants present and the remediation effort. The soil surface elevations within Parcel 2 are generally lower than the elevations of the surrounding streets, sidewalks, and alley, which limit the potential for surface runoff to exit the site during storms. At the end of the remediation project, the site was backfilled with clean soil and topped with 6 inches of crushed rock to yield a finished ground surface close to that of the surrounding streets, sidewalks, and alley, with greater potential to generate surface runoff than during remediation construction.

An interim storm drain collection system was installed in the center and northwest portions of Parcel 2 to capture site runoff and direct it into the combined sewer in the Pontius Avenue North right-of-way. This system includes several catch basins with silt barriers, storm drain piping, and large-diameter pipes for stormwater runoff detention storage connected to an outlet control structure to slowly discharge stored runoff into the combined sewer system. Precipitation falling on the site in this condition should nearly all be captured in the interim storm drain system because the site backfill and crushed rock surfacing atop that fill was firmly compacted as it was placed across the entire site.

Parcels 1 and 3 are paved parking lots. Because these parcels are completely covered by impervious surface, they readily generate surface runoff during storm events. Runoff from Parcel 1 is collected and drained to the Minor Avenue North combined sewer. Runoff from Parcel 3 drains to an existing catch basin in the northwest corner of the site, which drains to the combined sewer in John Street. The Pontius Avenue North right-of-way is almost entirely covered with impervious roadway paving and sidewalks. The street is currently used for some residential and commercial parking. Surface runoff from the street and adjacent areas of the right-of-way drains to a combined sewer within the right-of-way.

The Denny Substation site lies at the eastern edge of a large area south of Lake Union served by a combined sewer system that collects both sewage and stormwater and conveys the combined flow to the West Point Treatment Plant. The combined sewer mainlines in John Street, Pontius Avenue North, and Minor Avenue North convey stormwater runoff from Parcel 1, Pontius Avenue North, Parcel 2, and Parcel 3 northerly to a mainline in Republican Street. This mainline conveys flow to the west in the South Lake Union neighborhood to King County (County) interceptors, which convey combined sewer flows from a large part of Seattle to the West Point Treatment Plant.

The influx of stormwater runoff into the City of Seattle (City) combined sewer system during storm events results in large fluctuations in flow between periods of dry and wet weather. To handle the potential for flows that may exceed sewer system capacity during periods of especially high precipitation, the system includes outfalls where excess flow is discharged untreated into receiving waters, including Lake Union and Elliott Bay. These discharges are referred to as combined sewer overflows (CSOs). Both the City and County are implementing long-term programs for system upgrades to reduce the frequency and volume of CSOs in accordance with state and federal regulations, which will result in no more than an average of one overflow per year per outfall on a 20-year rolling average.

Groundwater

Prior to remediation, soils underlying Parcel 2 of the Denny Substation site were composed of a 4-foot-deep to 10-foot-deep layer of non-native fill overlying interbedded clays, silts, silty sands, and sand (Aspect, 2008). Groundwater beneath the site occurs in discontinuous perched zones, at depths ranging from 7 feet to 38 feet below the ground surface (bgs) (Aspect, 2008; Aspect, 2011). Monitoring of wells installed for a Phase II site assessment (Aspect, 2008) indicates that groundwater flows west and north underneath the site, and that groundwater beneath the site is contaminated with various petroleum products and associated volatile organic compounds. A discussion of groundwater contamination is included in Chapter 6, Environmental Health – Hazardous Materials.

12.1.2 Transmission Line Alternatives

All three proposed transmission line alternatives routes extend through downtown Seattle in areas served nearly entirely by combined sewer systems. Each route traverses three drainage basins: Lake Union, Elliott Bay, and the Duwamish Waterway, which is the lower end of the Green River watershed. Eight CSO outfalls—four within the City's system and four within the County's system—are located along the Elliott Bay waterfront, downstream of the transmission line alternatives routes.

Each of the transmission line alternative routes traverses relatively small areas that drain to separate storm sewer systems that have outfalls to surface water bodies. The routes for Transmission Line Alternative 1 (TL1) and Transmission Line Alternative 3 (TL3) extend through an area in the vicinity of James Street and Yesler Way that drains via separate storm sewers to Elliott Bay. The route for TL3 extends through an additional area in the Interstate 5 (I-5) corridor between approximately South Jackson Street and South Dearborn Street that ultimately drains to the Duwamish Waterway via separate storm sewers. All three transmission line alternatives routes extend through an area south of South Royal Brougham Way that drains via separate storm sewer to an eventual outfall to the Duwamish Waterway.

The soils underlying the transmission line alternative routes likely consist of non-native fill of varying depths, with the greatest depth of fill south of Yesler Street where tidelands were filled in the late nineteenth and early twentieth centuries, and the least depth of fill in the area north of Olive Way, where large-scale excavation occurred as part of the Denny Regrade, also in the late nineteenth and early twentieth centuries. Groundwater conditions underlying all three transmission line alternatives routes are likely broadly similar to that described for the Denny Substation site, with groundwater probably occurring in discontinuous perched zones at least several feet bgs due to prevailing topography and soil characteristics. Chapter 6, Environmental Health – Hazardous Materials, presents additional information on varying depths to groundwater found in previous subsurface investigations through the length of the transmission line alternatives.

12.1.3 Broad Street Substation Inductor Options and Distribution System

The Broad Street Substation is located in a portion of the Lake Union drainage basin—this area is served by combined sewers connecting to a trunk line that conveys drainage north along Dexter Avenue and then west along the Ship Canal, and ultimately to West Point Treatment Plant. There are CSO outfalls along that trunk line that discharge to Lake Union and the Ship Canal downstream (west) of Lake Union.

The distribution system area for the proposed project consists of the following two sub-areas:

- The Phase 1 Build-out area is served entirely by a combined sewer system described previously in Section 12.1.1 under Surface Water.

- The Future Build-out area is served by combined sewers except for the eastern two to four blocks along the west side of I-5; this area is served by a partially separated stormwater system that discharges runoff from streets, sidewalks, and alleys to Lake Union. Most of the Future Build-out area that drains to the separated stormwater system is tributary to a large storm drain outfall at the south end of Lake Union located north of the Aloha Street/Fairview Avenue North intersection. Drainage from streets and parking lots in the northeastern tip of this distribution area drains to Lake Union via one or more different outfall(s).

Groundwater beneath the Broad Street Substation Inductor site is deep enough that it is not expected to be encountered during construction of the proposed inductor improvements at either location on-site. This is further described in Chapter 6, Environmental Health – Hazardous Materials. Groundwater conditions underlying the distribution system area are likely similar to those described above for the Denny Substation site and the transmission line alternatives routes due to similarities in the native soil and prevailing topography.

12.2 Construction Impacts

12.2.1 Substation Alternatives

Substation Alternative 1 (SA1)

In general, construction site stormwater runoff can readily mobilize disturbed soil and demolition material and carry it off-site, thereby degrading stormwater quality and potentially causing violations of receiving water quality standards. Turbidity, which is a measure of the clarity of water, is a regulated parameter in state marine and freshwater quality standards (Chapter 173-201A Washington Administrative Code). In addition, construction equipment or on-site storage facilities could leak or spill oil, grease, and petroleum products. Under Substation Alternative 1 (SA1), disturbed soil and construction-related contaminants could drain into the combined sewer system. If an uncontrolled spill occurred, it is possible that petroleum products could enter groundwater adjacent to the work area. If these products reached Elliott Bay at high concentrations, they could pose a risk to aquatic life.

Construction would occur during two or, at the most, three fall-winter wet seasons. Considering the large scale of the drainage areas contributing runoff to the combined sewer systems that convey runoff from the Denny Substation site, and associated pollutants inherent to the urban development in those areas, the potential effects of runoff from the construction site under SA1 would likely be minor and not measurable in receiving waters.

In general, runoff during construction would not be a water quality issue because BMPs would be used on-site to prevent off-site sedimentation, and because the runoff would be conveyed to West Point Treatment Plant and treated prior to discharge into Puget Sound. However, during periods of high precipitation, when the potential for soil erosion from exposed soils on-site is greatest, one or more CSO events could occur in downstream sewer systems. During CSO events, these impacts are expected to be negligible because, as described in Section 12.1.1, overflow events are infrequent in the portion of the City's combined sewer system and the downstream County system that convey stormwater flow from this site.

Excavation for the substation basement is likely to encounter groundwater, potentially resulting in large volumes of dewatering during construction of SA1. If not adequately controlled for peak flow reduction, dewatering discharges to the combined sewer system could cause minor adverse impacts on sewer conveyance capacity downstream of the site. If dewatering occurs in areas with contaminated groundwater and no steps are taken to treat that water, discharging it into the combined sewer system could exceed allowable contaminant limits set by the County and potentially worsen CSO impacts during heavy rain events. If such dewatering is necessary, City Light would be required to obtain permits to discharge dewatering water into the combined sewer system from the County and to coordinate dewatering discharge plans with Seattle Public Utilities (SPU), with attendant conditions on the quality and quantity of water that can be discharged. Compliance with County permit requirements and addressing any concerns SPU may have would prevent adverse impacts downstream.

Substation Alternatives 2 (SA2) and 3 (SA3)

Potential construction period impacts resulting from Substation Alternative 2 (SA2) and Substation Alternative 3 (SA3) would be similar to those described for SA1. The potential for erosion and consequent impacts would be slightly greater with SA2 and SA3 because a larger area would be disturbed by construction. The potential for impacts associated with dewatering of excavations would be considerably less in comparison to SA1 because SA2 and SA3 would not involve constructing a deep basement beneath the substation.

12.2.2 Transmission Line Alternatives

Transmission Line Alternative 1 (TL1)

Installation of the transmission line under TL1 would require ground disturbance, and stormwater runoff could readily mobilize disturbed soil and overlying material (such as paving and sub-base materials) within the active portion of the construction corridor at any time. Sediment-laden water from active trenching areas would enter combined sewers for most of the length of the TL1 route but could be discharged to Elliott Bay and the Duwamish Waterway in areas served by separate storm sewers that make up a small portion of the total route length. Trenching for duct banks and vaults could encounter shallow groundwater in places and thereby require dewatering. Potential impacts of transmission line construction on the combined sewer system would be similar to the construction impacts described for SA1 but with smaller impact areas affected at any given time and with much less dewatering of groundwater potentially involved. These smaller impact areas consist of only three contiguous city blocks of trenching that would be under construction at any given time during the installation of the transmission line over a 2-year period.

The potential impacts in areas served by separate storm sewers along the route would be minor and would likely only occur if rainfall were to coincide with trenching work in that part of the route. If control measures are not in place to prevent sediment-laden runoff from exiting the active work area, that runoff would ultimately enter Elliott Bay and the Duwamish Waterway and contribute to elevated turbidity that could cause short-term impairment to aquatic habitat in the receiving water. These impacts would be difficult to measure and attribute specifically to TL1 construction given the larger drainage areas that contribute to these separate storm sewer systems and receiving waters and their associated contributions to turbidity in storm events.

Because the transmission line would be in a highly urbanized area, soil that would be encountered during trenching or other subsurface activities might be contaminated, and these contaminants could also enter runoff that ultimately reaches Elliott Bay and/or the Duwamish Waterway if the exposed soil is mobilized. The area of disturbed ground is likely to be limited at any one time to a small fraction of the corridor length.

The TL1 route is mostly served by combined sewer systems. As with substation construction, stormwater runoff along the transmission line route is not expected to result in adverse water quality impacts in this area because the runoff would be routed to West Point Treatment Plant for treatment prior to discharge to Puget Sound. One or more CSO events in the sewer system downstream of the TL1 construction area could lead to runoff from the construction corridor entering Elliott Bay and/or the Duwamish Waterway, but the potential for adverse effects in those receiving waters is low because CSO events in the combined sewer system downstream of the transmission line route are infrequent. If a CSO event did occur in a portion of the City or County combined sewer system serving the active construction zone along the route, the contribution of construction runoff from TL1 to the resulting pollutant load from the CSO would be a small fraction of the total.

Transmission Line Alternative 2 (TL2)

Construction impacts from Transmission Line Alternative 2 (TL2) would be similar to those described above for TL1 for areas along the TL2 route that involve ground disturbance. Because much of this route is located within the existing Downtown Seattle Transit Tunnel (DSTT), the total area of exposed ground surface disturbed during construction of TL2 would be substantially less than (about one-half) the area of ground disturbance under TL1. However, vault installation work within the DSTT could result in "track-out" of soil and sediments onto surrounding streets from the tires of construction vehicles if tire cleaning measures are not implemented effectively. The portions of the TL2 route south of the DSTT that drain to separate storm sewers are smaller in scale than those draining to separate storm sewers under TL1. Therefore, potential water quality impacts of construction site runoff discharged to the Duwamish Waterway would likely be less than would occur under TL1.

Transmission Line Alternative 3 (TL3)

The construction impacts of TL3 would be associated with the same activities described above under TL2. As with TL1 and TL2, this construction activity could cause minor water quality impacts downstream if erosion and sediment control practices and dewatering controls are not sufficiently implemented. The route for TL3 passes through a proportionately greater area served by separate storm sewers than TL1 and TL2; therefore, this alternative has the greatest potential for minor water quality impacts downstream in Elliott Bay and the Duwamish Waterway.

12.2.3 Broad Street Substation Inductor Options

Broad Street Substation Inductor Option 1 (BI1)

Without the use of BMPs, stormwater runoff during pavement demolition in the Broad Street right-of-way and construction of the inductor and associated equipment under Broad Street Substation Inductor Option 1 (BI1) could readily mobilize concrete particles and disturbed soil and carry that material into the combined sewer system. The proposed schedule for these improvements would involve construction from late winter through early fall, with associated exposure to rainfall being moderate if historical precipitation trends prevail during the construction work (the wettest months in Seattle are November through January, with moderate precipitation in February through April before tapering off considerably in the summer). The potential resulting impacts in the combined sewer system would be similar to those construction impacts described for SA1 but on a smaller scale. Because the new inductor adjacent to the Broad Street Substation would be in a highly urbanized area, soil and groundwater encountered during excavation and utility trenching or other subsurface activities might be contaminated as described in Chapter 6, Environmental Health – Hazardous Materials. These contaminants could also enter runoff if the exposed soil is mobilized and/or if contaminated groundwater is discharged into the combined sewer with excavation dewatering discharges. However, as noted in the Affected Environment discussion in Section 12.1 above, groundwater dewatering is generally not expected to be a concern with construction at this site because the water table lies below the proposed depth of excavation.

As described earlier for SA1 and TL1, where construction occurs in areas served by combined sewer systems, measurable adverse water quality impacts are unlikely to occur because runoff would be routed to West Point Treatment Plant for treatment before discharge to Puget Sound. Where construction occurs in areas served by separated stormwater systems, which includes the eastern portion of the Future Build-out area, adverse impacts on water quality in Lake Union would be possible because stormwater in these separated systems is untreated prior to discharge.

Broad Street Substation Inductor Option 2 (BI2)

Potential construction period impacts resulting from Broad Street Substation Option 2 (BI2) would be similar to those described for BI1. The potential for erosion and consequent impacts would be slightly less than with BI1 because a smaller area would be disturbed by construction.

12.2.4 Distribution System

Construction of distribution system improvements in both the Phase 1 Build-out area and Future Build-out area could result in minor impacts associated with introduction of eroded soil and possibly other pollutants in stormwater runoff and dewatering discharges from ground disturbance for utility trenching work. These impacts could occur for years as the incremental trenching work occurs on a block-by-block basis in the build-out area.

As described earlier for SA1 and TL1, where construction occurs in areas served by combined sewer systems (applicable to most of the distribution system area, including nearly all of the Phase 1 area), measurable adverse water quality impacts are unlikely because runoff would be routed to West Point Treatment Plant for treatment before discharge to Puget Sound. Where construction occurs in areas served by separated stormwater systems, which includes the eastern portion of the Future Build-out area, minor adverse impacts on water quality in Lake Union would be possible because stormwater in these separated systems is untreated prior to discharge.

12.3 Operational Impacts

12.3.1 Substation Alternatives

Substation Alternative 1 (SA1)

Parcel 2, on which the Denny Substation would be constructed, is currently unused. Historically, portions of this parcel supported vehicular use (primarily buses), and the site generated runoff likely containing petroleum contaminants and other vehicle-related pollutants (see Chapter 6, Environmental Health – Hazardous Materials). Construction of the substation under SA1, which would incorporate a compacted gravel floor in the structure interior and a facility access driveway and perimeter sidewalks, would result in similar low-permeability (and in some places impermeable) surfacing on-site relative to the existing site condition following completion of soil and groundwater remediation activities. However, there would be a decrease in impervious surface coverage compared to the former site use as a bus storage and maintenance facility. Compared to the drainage characteristics that existed on Parcel 2 for decades, with almost complete impervious surface coverage and active use by buses and other vehicles, this would reduce the contributions of project site runoff to CSO events downstream, although the resultant effects on CSOs would be too small to measure given the size of the combined sewer service area upstream of the associated CSO outfalls. The substation site would primarily consist of a non-pollutant-generating structure. (With or without a partial overhead screen, precipitation would fall onto the substation floor, which would experience infrequent vehicular use and would not be considered pollutant-generating.) The short access drive leading into the north side of the substation from John Street would be the only pollutant-generating surface (approximately 1,000 square feet).

With SA1, the proposed project would provide stormwater detention (flow control) on-site in underground vaults or pipe systems. Detention facilities would be designed to control peak runoff for the 2-year and 25-year recurrence design rainfall events in accordance with City code. All vaults and spill containment pads in the substation interior would drain to an oil/water separator(s) prior to discharge into the combined sewer. Water quality treatment would otherwise not be provided because all runoff from developed site areas would be routed to the combined sewer system and treated at the West Point Treatment Plant. After construction of SA1 is complete, the volume of runoff from Parcel 2 would increase relative to the existing condition associated with remediation of soil and groundwater contamination but decrease compared to the former site condition when it was a bus storage and maintenance facility.

The other portions of the site (Parcels 1 and 3) would either be retained for a public use or surplused and sold. In either case, operation of the substation under SA1 would not affect water quality impacts from these two parcels. If some or all these parcels were developed by City Light or others in a manner that triggers stormwater code requirements, stormwater flow control to prevent adverse downstream impacts would be included in the development.

Overall, SA1 is unlikely to result in adverse operational impacts on either groundwater or surface water.

Substation Alternatives 2 (SA2) and 3 (SA3)

With SA2 and SA3, operational water quality impacts in downstream receiving waters would be beneficial in the same manner as described for SA1. Improvements in water quality and quantity would likely be somewhat greater with SA2 and SA3 because of the larger area converted from existing or historical vehicular use to mostly non-pollutant-generating substation yard and landscaping.

12.3.2 Transmission Line Alternatives

After construction is completed, the ground surface would be restored to its previous condition (for example, mostly paving where the route extends along city streets). In the long term, the extent of impervious surface and the nature of its use would likely be unchanged along the transmission line route. Therefore, operational water quality impacts and flow conditions in the combined sewer system and in shallow groundwater (associated with any incidental runoff infiltration) would also be unchanged from the existing condition. Operational, adverse water-related impacts would not result from any of the transmission line alternatives.

12.3.3 Broad Street Substation Inductor Options

Operations of the inductor installed at the Broad Street Substation or Annex would result in similar long-term impacts in the combined sewer system and downstream receiving water bodies as existing conditions. This is because the area of pollutant-generating surfaces and effective impervious surfaces subject to rainfall and runoff associated with the substation improvements would not increase. Therefore, the quantity and quality of runoff discharged from the site into the combined sewer system would be very similar as under existing conditions. As noted previously, the contribution of this site to CSO events is minor.

12.3.4 Distribution System

As with the transmission line, because the entire distribution system is expected to be placed underground in the Phase 1 Build-out area and the Future Build-out area, with surface restoration (paving, landscaping, or other) in disturbed areas expected to be generally done in-kind to match existing conditions, operational impacts on water quality and runoff flow rates within the distribution area would be similar to existing conditions. Therefore, no operational, adverse impacts on water quality or combined sewer conveyance capacity would occur.

12.4 Impacts of No Action Alternative

Under the No Action Alternative, the proposed Denny Substation and transmission line would not be built, and there would be no associated potential for construction-related erosion of exposed soil and demolition debris to affect water quality. If use of Parcels 1 and/or 3 for public parking were to continue, runoff from those parcels would continue to carry vehicle-related pollutants into the combined sewer system at levels similar to what occurred for years before Parcel 2 contamination remediation work began, and the volumes of runoff entering that system would be similar to now. Because that drainage is conveyed to West Point Treatment Plant, there is not a significant concern for downstream effects.

The construction involved with inductor and underground distribution line installation could result in stormwater runoff disturbing and mobilizing soil and demolition material into the combined sewer system and possibly into separated storm sewers, to a lesser extent. The impacts would be similar to, but lesser than, those described for the transmission line and Broad Street Substation in Sections 12.2.2 and 12.2.3.

The long-term benefits to water quality expected from converting impervious surface to either non-pollutant-generating substation facilities or landscaped area at the Denny Substation site would not occur.

12.5 Mitigation Measures

The construction and operational water resource impacts that the Denny Substation Project might pose would be avoided or reduced by implementing general mitigation measures.

12.5.1 General Avoidance and Minimization Measures Common to All Alternatives

Construction Impacts

The proposed project includes implementation of temporary erosion and sediment control BMPs and other pollution control BMPs in accordance with City code requirements. For the proposed Denny Substation, construction site runoff would be collected, stored, and treated prior to discharge to the combined sewer systems within and surrounding the site to prevent and minimize transport of soil and sediment into those conveyance systems. Temporary construction stormwater and erosion control practices for this site would be documented in a Construction Stormwater Control Plan (CSCP) in accordance with City Stormwater Code (Seattle Municipal Code Chapter 22.800) requirements. The BMPs used at this site could include restricting construction vehicle and equipment access to specific stabilized construction entrances and using sedimentation tanks with sand filters, catch basin protection, filter fabric fencing, and sediment traps to minimize discharge of sediment-laden water off-site. Additional typical upland construction stormwater BMPs that could be used for construction of substation, transmission line, and distribution network improvements where ground disturbance would occur, as required per applicable City code requirements, include the following:

- Street sweeping
- Straw or compost-filled wattles (tube-shaped erosion control and sediment containment devices) to contain and filter turbid water
- Temporary plastic or other covering on erodible material stockpiles and disturbed soil

Projects with greater than 1 acre of ground disturbance, such as would occur with construction of the Denny Substation, must obtain a Construction Stormwater General National Pollutant Discharge Elimination System (NPDES) Permit from the Washington State Department of Ecology. The NPDES permit contains requirements that avoid and minimize impacts. Although there may be an exception within the permit for sites draining entirely to combined sewers (like the Denny Substation site), City Light will obtain coverage under the general NPDES permit for Denny Substation construction.

Similarly, although construction of TL1, TL2, or TL3 will occur mostly along routes that pass through areas of combined sewers, City Light will obtain coverage for transmission line construction under the same NPDES permit noted above, and NPDES permit coverage will also be obtained by City Light for construction of the Phase 1 Build-out area of the distribution system. The Phase 1 Build-out area is located within an area almost entirely served by combined sewers while the Future Build-out area has areas that drain to combined storm sewers, and areas that drain to separated storm sewers. Since it is unknown how and when the distribution network would be built out in the Future Build-out area, it is not known whether coverage under the NPDES permit would be needed. Installing the inductor at Broad Street Substation would occur in an area served by combined sewers and would likely disturb less than 1 acre; and therefore would not trigger the requirement for a NPDES permit.

To meet the NPDES permit requirements City Light's contractor would prepare a Stormwater Pollution Prevention Plan (SWPPP) for the distribution and transmission project work. A comparable CSCP would also be prepared to comply with the City's permitting requirements in the applicable transmission and distribution improvement areas. A single document satisfying both the State and City permit requirements would likely be prepared. Commitments to implement the types of BMPs listed above would have to be made in the SWPPP/CSCP. In addition, to satisfy applicable

Construction Stormwater General NPDES Permit

Washington State Department of Ecology (Ecology) has authority for implementing regulatory programs within the state to comply the federal Clean Water Act. Among those programs is the National Pollutant Discharge Elimination System, which stems from the U.S. Environmental Protection Agency and targets municipal and industrial stormwater runoff, construction site runoff to surface waters, and municipal and industrial wastewater discharges to surface waters. To streamline permitting for construction sites, Ecology developed the Construction Stormwater General Permit. This permit imposes a standard set of compliance requirements, including erosion and sediment controls, monitoring, and reporting.

requirements in the City standard specifications for construction, the SWPPP/CSCP would include a Spill Plan that addresses prevention, containment, and control of hazardous material spills and leaks during construction.

Runoff water proposed to be discharged from any of the project's construction sites, whether at the Denny Substation site, the Broad Street Substation or Annex site, or in transmission line and distribution areas draining to combined sewers, would also be subject to control measures to satisfy City and County Wastewater Treatment Division requirements. These requirements are focused on protecting conveyance capacity in the combined sewer system—specifically preventing excess sediment transport into the combined sewer system and controlling peak flows associated with dewatering of excavations—and also on preventing high concentrations of contaminants possibly present in areas of contaminated soil or groundwater from being discharged into the combined sewer system. Permits for construction site discharges to combined sewers would be required from both the City and the County. Additional information on mitigation measures related to construction activity in areas with existing soil and/or groundwater contamination is provided in Chapter 6, Environmental Health – Hazardous Materials.

With diligent implementation of the best management practices (BMPs) described above and as required by City and County permits, it is expected that stormwater runoff and groundwater dewatering from areas under construction would not cause significant adverse impacts on water quality in Lake Union, Elliott Bay, and the Duwamish Waterway nor on the quality of groundwater. In addition, potential adverse impacts on combined sewer system conveyance capacity related to excess sediment and increased discharge volumes in site runoff would be avoided.

Operational Impacts

The proposed project includes the provision of stormwater detention on-site at the Denny Substation in underground vaults or pipe systems. Stormwater detention facilities would be sized in accordance with City standards for protection of combined sewer system conveyance capacity. All vaults and spill containment pads inside the new substation would drain to an oil/water separator(s) prior to discharge to the combined sewer system, thereby enabling capture of leaking oil or other related contaminants on-site as might occur with routine site operations. No operational impacts on stormwater runoff characteristics and receiving waters would occur in conjunction with Broad Street Substation inductor improvements, or transmission line and distribution system improvements because the areas disturbed for that construction work would be restored to generally match existing conditions, and code requirements for runoff flow control and/or treatment would apply if the improvements were substantial enough to potentially threaten downstream stormwater-related impacts. No other operational mitigation would be required because project impacts on water quantity and quality are expected to be neutral or beneficial.

12.5.2 Specific Mitigation Measures

With implementation of the avoidance and minimization measures described in Section 12.5.1 above, no adverse impacts to surface waters or combined sewer systems are expected. Therefore, no specific mitigation measures are required or proposed.

12.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to water resources are anticipated.

Chapter 13: ENERGY AND NATURAL RESOURCES

13.1 Affected Environment

The analysis of energy and natural resources considered the energy usage and associated natural resource impacts expected to occur with the Denny Substation Project by examining electricity (energy) and diesel and gasoline fuel (natural resources) usage for construction and operation of the project.

City Light uses a combination of conservation and energy-generation resources to meet its customers' energy needs. City Light's current resource portfolio includes conservation programs, its own energy-generation resources, and long-term purchase contracts with other energy providers, supplemented with power exchange agreements and near-term purchases and sales made in the wholesale power market. City Light owns transmission facilities and depends primarily on Bonneville Power Administration (BPA) for electric transmission outside its service area. Within its service area, power is distributed from principal substations to smaller distribution substations and pole transformers to reduce the voltage to required levels for customers (City of Seattle, 2005).

Over 90 percent of City Light's power is generated by hydropower. Nearly half of City Light's electricity comes from its own seven hydroelectric facilities shown in Figure 13-1: the Boundary Dam, Skagit Project (which consists of four facilities—Ross, Diablo, Gorge, and Newhalem dams), South Fork Tolt, and Cedar Falls Dam. Energy is delivered from the dams to Seattle over BPA's transmission grid, City Light's transmission lines, or Puget Sound Energy lines (City Light, 2012a, b).

Energy and Natural Resources Key Findings

Construction of the Denny Substation Project would require consumption of fuel in amounts that are not considered a significant impact. Substation Alternative 1 (SA1) and Transmission Line Alternative 1 (TL1) would require the largest amount of fuel consumption because of the below-grade work for the substation and the length of the transmission line.

Operation of the substation would require small amounts of fuel for a backup generator and electricity to power the substation for air handling, water pumping, lighting, elevator operation, and heating, ventilation, and air conditioning (HVAC) requirements. SA1 would require twice the amount of energy as Substation Alternatives 2 and 3 (SA2and SA3). The No Action Alternative would require less fuel.

No unavoidable significant impacts to energy and natural resources are anticipated.

City Light has identified its existing energy resources and a preferred energy resource portfolio for meeting anticipated customer needs in the next 20 years in City Light's Integrated Resource Plan (IRP) (City Light, 2012a) and the IRP Draft Environmental Impact Statement (City Light, 2012b). These documents contain the analyses for the facilities needed to meet new electrical load from the area to be served by the proposed project.

Figure 13-1. Seattle City Light Energy Resources

Source: City Light, 2010

13.2 Construction Impacts

13.2.1 Substation Alternatives

All of the proposed substation alternatives would require fuel to power off-road construction equipment, trucks hauling materials, and vehicles for construction workers traveling to and from the project site. The amount of fuel consumed for construction of the substation would vary under each alternative, as shown in Table 13-1. Construction of Substation Alternative 2 (SA2) and Substation Alternative 3 (SA3) would require less diesel and gasoline fuel consumption than Substation Alternative 1 (SA1). Under all alternatives, the amount of fuel used to construct the substation and split the existing East Pine-Broad Street 115-kilovolt (kV) underground transmission line into two separate circuits would constitute less than 0.05 percent of the total distillate and gasoline fuel estimated to have been consumed in Washington in 2010 (U.S. EIA, 2012a).

Assessing Energy and Natural Resources Impacts

Energy and natural resources were evaluated by amount and type of fuel used for each of the following project elements:

- Off-road construction equipment
- Truck trips for construction equipment and materials
- Car trips associated with construction workers
- Substation operation

Fuel amounts were calculated by converting construction- and operational- related data provided by City Light based on typical fuel consumption rates. Electricity required to operate the Denny Substation was based on air handling, water pumping, lighting, elevator operation, and HVAC needs, as provided by City Light. Fuel usage was based on the estimated size, type, and hours of annual operation of a back-up generator that would be located at the Denny Substation.

Table 13-1. Energy Usage from Construction of Substation Alternatives

Substation Alternative	Diesel Fuel	Gasoline Fuel
Substation Alternative 1 (SA1)	266,171 gallons	1,827 gallons
Substation Alternative 2 (SA2)	173,037 gallons	1,255 gallons
Substation Alternative 3 (SA3)	173,037 gallons	1,255 gallons

13.2.2 Transmission Line Alternatives

Construction of the transmission line for the proposed project would require trenching for duct banks and excavation for vault construction. Fuel would be required to power off-road construction equipment, trucks hauling materials, and cars for construction workers traveling to and from the active portion of the transmission line route. The amount of fuel estimated to be consumed varies under each alternative because of variations in excavation amounts. The amount of fuel usage for each alternative is shown in Table 13-2 below.

Table 13-2. Energy Usage from Construction of Transmission Line Alternatives

Transmission Line Alternative	Diesel Fuel	Gasoline Fuel
Transmission Line Alternative 1 (TL1)	693,340 gallons	1,640 gallons
Transmission Line Alternative 2 (TL2)	208,002 gallons	1,640 gallons
Transmission Line Alternative 3 (TL3)	776,540 gallons	1,837 gallons

Construction of the new transmission line under Transmission Line Alternative 2 (TL2) would require less diesel fuel than would be required under Transmission Line Alternative 1 (TL1). This is because there would be less excavation under TL2 since 53 percent of the underground line would be within an existing tunnel. Use of water trucks and ready-mix trucks for installation of backfill would also be substantially reduced compared to TL1. Construction of the transmission line under Transmission Line Alternative 3 (TL3) would require slightly more diesel and gasoline fuel than what TL1 would require because TL3 is approximately 12 percent longer in length. The added truck trips, construction work trips, and truck loading would require more fuel usage. Under all alternatives, the amount of fuel used to construct the transmission line would constitute less than 0.1 percent of the total distillate and gasoline fuel estimated to have been consumed in Washington in 2010 (U.S. EIA, 2012a).

Distillate Fuel

Distillate fuel is a light fuel oil distilled off during the refining process and used primarily for space heating, on- and off-highway diesel engine fuel, and electric power generation.

13.2.3 Broad Street Substation Inductor Options

Under the Broad Street Substation Inductor Option 1 (BI1) and Broad Street Substation Inductor Option 2 (BI2), the proposed inductor and associated equipment would be installed in the closed street right-of-way of Broad Street. Construction equipment associated with this activity was assumed to be similar to that used for transmission line construction. Truck emissions were calculated based on the quantity of excavated material, which would vary slightly under each alternative. Fuel consumption associated with the installation of an inductor and associated equipment at the Broad Street Substation is shown in Table 13-3.

Table 13-3. Energy Usage from Construction of Broad Street Substation Inductor Options

Broad Street Substation Option	Diesel Fuel	Gasoline Fuel
Broad Street Substation Inductor Option 1 (BI1)	69,825 gallons	479 gallons
Broad Street Substation Inductor Option 2 (BI2)	69,702 gallons	478 gallons

Under either alternative, this use of fuel would constitute less than 0.01 percent of the total distillate and gasoline fuel estimated to have been consumed in Washington in 2010 (U.S. EIA, 2012a).

13.2.4 Distribution System

As with the transmission line alternatives, construction of the distribution system in the Phase 1 Build-out area would require trenching for duct banks and excavation for vault construction. Fuel would be required to power off-road construction equipment, trucks hauling materials, and cars for construction workers traveling to and from the active portion of the distribution alignment. The amount of fuel estimated to be consumed during this construction is shown in Table 13-4.

Table 13-4. Energy Usage from Construction of Phase 1 Build-out Area

Distribution System	Diesel Fuel	Gasoline Fuel
Phase 1 Build-out area	1,121,984 gallons	2,642 gallons

This use of fuel would constitute 0.11 percent of the total distillate and less than 0.01 percent of total gasoline fuel estimated to have been consumed in Washington in 2010 (U.S. EIA, 2012a). The amount of diesel and gasoline fuel used for constructing the distribution system in the Future Build-out area would likely be greater because it is a larger area than the Phase 1 Build-out area: 97 acres and 59 acres, respectively.

13.3 Operational Impacts

13.3.1 Substation Alternatives

When constructed, the Denny Substation is not expected to require substantial amounts of energy nor generate significant vehicle trips, regardless of the alternative chosen. The only buildings would be a control building that houses a battery room, communications room, and critical control and protection systems equipment as well as a maintenance building that has a work area, lockers, restroom, mechanical room, and break room. The substation would generate occasional maintenance trips, but there would be no employees stationed on-site. The only source of fuel consumption on the site would be a backup liquid propane generator, which would be operated for just 10 to 20 minutes a month for maintenance purposes, except for in a possible emergency. The amount of fuel consumed by the generator would be the same under all substation alternatives and is assumed to have a generator size of 300 kilowatts (kW) and to operate for 50 hours per year, a conservatively high estimate that assumes one or more emergency uses per year. The amount of energy and fuel that would be consumed for operation of the substation is shown in Table 13-5 and described in more detail in subsequent sections.

Table 13-5. Energy Usage from Operation of Substation Alternatives

Substation Alternative	Energy (per year)	Propane Fuel (per year)
Substation Alternative 1 (SA1)	1,200 MWh	1,677 gallons
Substation Alternative 2 (SA2)	600 MWh	1,677 gallons
Substation Alternative 3 (SA3)	600 MWh	1,677 gallons

MWh = megawatts per hour

SA1 would require more energy to operate than SA2 or SA3. SA1 would be a two-story structure and, therefore, require air handling, water pumping, lighting, an elevator, and different heating, ventilation, and air conditioning (HVAC) requirements than the other substation alternatives. City Light estimates that SA1 would annually require 1,200 megawatt hours per year (MWh/yr) of energy. This usage of energy under SA1 is the equivalent of the energy used by 134 houses in Seattle (based on the average annual energy consumption of residential customers in Seattle of 8.9 MWh [City Light, 2011]). The single-story SA2 or SA3 substation would require 600 MWh of energy annually, which is approximately half the energy needed to operate SA1. This would be the equivalent of energy used by 67 houses in Seattle.

The amount of fuel to maintain the backup generator for any of the alternatives would be the same and is included in the estimates of fuel usage in Table 13-5. The amount of fuel to maintain the backup generator would be less than 0.01 percent of total liquefied petroleum gas estimated to have been consumed in Washington in 2010 (U.S. EIA, 2012a).

13.3.2 Transmission Line Alternatives

When the transmission line has been installed, some of the electricity transported over the line would be lost to resistive heating of the conducting materials and in the transformers. These losses would vary primarily based on the amount of electricity transmitted over the line at any given time relative to the size of the line installed. Generally, it is assumed that 4 to 8 percent of the electricity originally put into a transmission line at an electrical generation site is lost by the time the electricity is received by the end user (City Light, 2012c). In 2010, the overall electricity lost in the state due to transmission and distribution was 4.8 percent (U.S. EIA, 2012b) over tens of thousands of miles of transmission and distribution lines. The potential electricity loss from the addition of the approximately 2-mile transmission line from the proposed Denny Substation to the existing Massachusetts Substation would be insignificant relative to the loss across the entire system. When installed, there would be no anticipated operational impacts to energy from the transmission line.

13.3.3 Broad Street Substation Inductor Options

Operation of the inductor under either BI1 or BI2 would have no energy and natural resource impacts because no electricity or fuel usage would be required. A small amount of electricity could be necessary to power additional security lighting in the substation yard. Although lighting design has not been developed for either option, there is already security lighting at the Broad Street Substation and the Annex and any additional lighting needs are expected to be minor and therefore, have a minor energy impact.

13.3.4 Distribution System

Operation of the distribution system in the Phase 1 Build-out and Future Build-out areas would not have any energy and natural resource impacts because no electricity or fuel usage would be required.

13.4 Impacts of No Action Alternative

Construction activities associated with installation of the inductors and underground distribution lines from the Broad Street Substation and Union Street Substation would involve minimal consumption of fuel or other natural resources.

City Light's ability to reliably serve loads in the South Lake Union area would be compromised, especially considering the land uses and densities north of Denny Way anticipated by the City of Seattle's (City's) planning efforts. Customers who have invested in "network-ready" infrastructure would not have network service available and would continue with existing service. Less reliable service would result in power disturbances, which would likely be experienced by customers as power outages during the summer. Individual backup power generators may be used by some City Light customers (for example, office tenants with data centers or biotechnology companies) in the South Lake Union area during such power disturbances to avoid power interruption.

According to the U.S. Energy Information Administration, 75 percent of commercial businesses in the U.S. purchase backup generators (18 kW average size) (Zheng et al., undated) that are typically operated with diesel fuel or natural gas. Therefore, it is anticipated that diesel fuel and natural gas would be consumed by individual customers under the No Action Alternative to power backup power generators.

Under the No Action Alternative, businesses that have a substantial reliance on continuous electricity service may choose not to locate in Denny Triangle or South Lake Union. These businesses may choose to locate to other areas that have more dependable electricity service. Fuel consumption associated with these businesses would likely occur elsewhere in Washington or the U.S.

13.5 Mitigation Measures

No energy mitigation measures are anticipated to be needed for construction or operation of the proposed project. However, in keeping with City policies, the project would include energy conservation measures described below.

13.5.1 General Avoidance and Minimization Measures Common to All Action Alternatives

City Light will require their construction contractor to implement these measures to reduce fuel consumption during construction activities for the Denny Substation Project:

- Use existing power sources or alternative renewable fuel generators in lieu of diesel power where available.
- Use only construction equipment and trucks that are maintained in optimal operational condition and according to manufacturers' specifications.
- Educate users, operators, and managers of construction equipment on how to operate equipment most efficiently.
- Encourage operators to follow manufacturer-recommended warm-up and cool-down periods.
- Implement restrictions on construction truck idling (such as limit idling to a maximum of 5 minutes when not in motion).
- Reduce traffic congestion in compliance with street use permits to be issued by the Seattle Department of Transportation (SDOT), which could include the following:
    - Work with SDOT to improve traffic flow by signal synchronization.
    - Prepare haul routes that conform to local requirements to minimize traversing through congested streets.
    - Provide dedicated turn lanes for movement of construction trucks and equipment on- and off-site.
    - Schedule construction activities that affect traffic flow on the arterial system to off-peak hours where possible.

During substation operation, City Light will use the following measures to reduce fuel consumption:

- Use a blend of biodiesel and petroleum diesel or natural gas for the Denny Substation backup generator.
- Use efficient lighting fixtures and lighting controls.
- Use high-efficiency HVAC equipment.

13.5.2 Specific Mitigation Measures

No adverse impacts are anticipated to energy and natural resources; therefore, no specific mitigation measures are proposed.

13.6 Unavoidable Significant Adverse Impacts

No unavoidable significant impacts to energy and natural resources are anticipated.

Chapter 14: IMPACT SUMMARY TABLES

This chapter summarizes the impacts on all elements of the environment analyzed in the EIS and discussed in detail in the document. Unless otherwise noted, the impacts are not expected to be significant. In some cases, an impact is identified as potentially significant unless mitigation is provided. Mitigation measures summarized in this chapter include the avoidance and minimization measures that would be incorporated into the project, and additional measures that could be applied to further reduce adverse impacts. Measures not currently proposed as part of the project are marked by bold text and an asterisk in the tables. No mitigation measures have been identified for the No Action Alternative.

This chapter includes three separate tables:

- Table 14-1 addresses the substation alternatives,
- Table 14-2 addresses the transmission line alternatives, and
- Table 14-3 addresses the distribution system and Broad Street Substation Inductor options.

Denny Substation and No Action Alternatives

Table 14-1 summarizes the impacts expected from the Denny Substation alternatives. Table 14-1 also includes the impacts of not building the substation if the No Action Alternative were chosen. In general, the impacts of potential development that could occur if the substation were not built and the parcels surplused and developed are not evaluated in this EIS because they are not part of the Denny Substation Project. If the land were surplused, any such development would be subject to separate environmental review. As Table 14-1 shows, most of the measures currently identified as mitigation for impacts are already incorporated into or are proposed by the project.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Aesthetics			
Impacts			
Construction			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Operational			
• No significant aesthetic impacts are expected. The visual character of the site and streetscape would be changed by introducing large scale utility	• Similar to SA1, but with a 68% larger footprint; SA2 would have a larger footprint than any adjacent building. SA2 would have a lower screen wall than SA1 except	• Similar to SA2, but would not have taller superstructure than SA1. SA3 would have a larger footprint than any adjacent building, and would be	• Parcels 1 and 3 could revert to off-street parking lots or unused parcels could be surplused and developed. • Some portion of one of the

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
equipment inside a large screen wall. • No significant impacts related to height, bulk, and scale. Footprint would not be out of scale with some adjacent development. It would be similar in height to the smallest buildings in the area. • There would be no impact to protected views. • There would be no light and glare impacts. • Waivers would be required to allow large non-transparent walls at the street level, and larger setbacks than allowed. • The interior of the site would be visible from upper floors of adjacent buildings. An overhead screen (if used, considering technical challenges as discussed in Chapter 2), would somewhat reduce visibility of equipment from upper floors of adjacent buildings. • With proposed landscaping, the substation could represent an aesthetic improvement over existing conditions.	the superstructure (see Figures 3-20 through 3-30, Chapter 3) screens taller equipment where the total height is similar. • SA2 could have shell spaces that provide transparency required by the Land Use Code in portions of the façade. • SA2 provides the possibility for public open space on Parcel 2.	larger than SA1 or SA2. SA3 would have lower wall heights in proximity to nearest adjacent buildings than either SA1 or SA2, and sloping walls would reduce appearance of height from the pedestrian level. • SA3 could have shell spaces providing transparency required by the Land Use Code in portions of the façade. • SA3 provides the possibility for public open space on Parcel 2.	parcels could be used for an inductor.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Mitigation			
Operational			
• Work within the Design Commission review process to enhance exterior elevations and treatments to reduce or eliminate large blank walls. This would also include consideration of landscaping plan and art. • Evaluation by the Design Commission to provide primary urban design guidance.	• Same as SA1.	• Currently under review by the Design Commission. (Preliminary recommendations include development of "human-scale" details and activating areas where not well-defined along John Street and alley.)	
Noise			
Impacts			
Construction			
• Noise – Ambient noise levels would increase during use of construction equipment. The loudest impacts would be from concrete breaking (hoe ram) to install utilities in streets. If nighttime work is necessary to reduce traffic impacts, impact equipment could disturb sleep for nearby residents and without mitigation would be considered a significant noise impact. A variance form the Noise Ordinance would be required for nighttime work. • Vibration – Minor to moderate vibration from auger drilling and concrete breaking could impact residents near the substation. No damage to adjacent structures is expected.	• Noise – Similar to SA1, but with more extensive use of louder equipment (hoe ram) to remove the Pontius Avenue North roadway. SA2 would comply w/City noise limits. It would have a 6-month shorter construction duration than SA1. • Vibration – Same as SA1 except more extensive concrete removal would occur.	• Noise – same as SA2. • Vibration – same as SA2.	• Likely installation of inductor on one of the substation parcels would not have a significant noise impact.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Operational			
• High wall scenario – No perceptible noise. SA1 would meet noise standards. • Low wall scenario – No perceptible noise; however equipment noise at David Colwell building would be 1 dBA over noise standard.	• High or low wall scenario – Equipment noise at David Colwell Building would be 1 dBA over noise standard; and a maximum 2 dBA increase in ambient nighttime noise, which would not be a perceptible increase.	• High or low wall scenario – No perceptible noise and would meet noise standards.	• No operational impacts would occur.
Mitigation			
Construction			
• Noise – Use best management practices (BMPs) such as locating fixed noise generating equipment away from residents, using ambient-sensitive back-up alarms on vehicles, and scheduling nosiest work during daytime hours to the extent feasible. • Vibration – Schedule high vibration work during daytime hours to the extent feasible.	• Noise – Same as SA1. • Vibration – Same as SA1.	• Noise – Same as SA1. • Vibration – Same as SA1.	
Operational			
• Noise – Construct the substation with a high screen wall; install lower noise equipment or sound insulation; and relocate backup generator underground. • Maintenance operations of the backup generator would be conducted during the day and only run for 30 minutes.	• Noise – Install lower noise equipment and relocate backup generator >60 feet from border of the site.	• No noise reduction needed for noise standard compliance.	

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Environmental Health – Electric and Magnetic Fields (EMF)			
Characterization of Existing and Future Magnetic Fields			
Construction			
• Not applicable.	• Not applicable.	• Not applicable.	• Not applicable.
Operational			
• EMF levels would be similar to those described for SA3, but were not modeled for the EIS.	• EMF levels would be similar to those described for SA3, but were not modeled for the EIS.	• Magnetic fields would increase from existing levels in portions of the street and sidewalk locations, along the westernmost side of The Brewster apartments, and the buildings east of the substation.	• No change from existing conditions, except for possible minor changes if an inductor were installed on one of the substation parcels.
Engineering and Design Measures that Minimize EMF			
Operational			
Design the project to minimize magnetic fields off-site using measures such as: • Locate substation equipment away from the substation perimeter. • Use GIS substation equipment.	• Same as SA1.	• Same as SA1.	
Environmental Health – Hazardous Materials			
Impacts			
Construction			
• Construction could encounter contaminated soil and groundwater not removed during remediation. • Hazardous materials associated with construction activities could be released (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and	• Same as SA1 except lower risk of encountering contaminants due to shallower excavation and less benefit from removal of contaminants.	• Same as SA2.	• No impacts.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
metals in tires). • SA1 would require the greatest amount of removal of additional contaminated soil and therefore have the greatest long-term environmental benefit.			
Operational			
• Risk to workers from hazardous materials handled on-site and from potential fire from overheated equipment.	• Same as SA1.	• Same as SA1.	• No impacts.
Mitigation			
Construction			
• Employ best management practices (BMPs). • Ensure appropriate training and certification obtained for construction workers to recognize and minimize risks. • Dispose of contaminants only at approved sites. • Conduct soil, groundwater, and surface water quality monitoring during construction. • Although not likely, address potential vapor intrusion where VOCs are left in place beneath planned buildings.	• Same as SA1.	• Same as SA1.	
Operational			
• Minimize use of hazardous materials during maintenance operations. • Train workers to recognize operations and maintenance risks. • Enact safety protocols during equipment change-out to address	• Same as SA1.	• Same as SA2.	

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
de-energizing the work area, moving heavy equipment within the substation, and protection of equipment containing liquids. • Select plantings that minimize the need for pesticides. • Allow for long-term monitoring to assess progress of cleanup actions.			
Transportation			
Impacts			
Construction			
• There would be roadway lane and sidewalk closures adjacent to the site, especially during a 4- to 6-week roadway/sidewalk closure at Denny Way and at John Street during the connection of the substation to the existing transmission line. Closure of Denny Way would be a significant impact unless mitigation was provided. With mitigation, impacts would be minor to moderate. • Temporary closures of sidewalks, with pedestrian detours in place, would cause minor to moderate impacts. • Potential temporary closure or relocation of bus stop. • Potential parking restrictions. • Potential traffic disruption associated with haul and delivery of large/oversized	• Same as SA1, except that roadway access to the east entrance of The Brewster on Pontius Ave North would be eliminated, and replaced with a load zone on John Street.	• Same as SA1.	• No impacts, except for minor traffic impacts that could result if an inductor were installed on one of the substation parcels. City Light could resume leasing Parcels 1 or 3 for public parking.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
substation equipment. • Generation of construction truck and worker commute trips.			
Operational			
• There would be improved conditions for pedestrians and bicycles and at the existing bus stop and street frontage improvements. • The infrequent delivery of large equipment to substation site, resulting in oversized loads being carried on surface streets is not expected to significantly impact traffic.	• There would be improved pedestrian and bicycle conditions and infrequent delivery of large equipment would be the same as SA1. • Pontius Avenue North would be vacated which would not adversely impact traffic patterns in the area. • There would be reduced on-street parking on Pontius Avenue North (37 spaces) due to street vacation and loss of a surface parking lot (113 spaces).	• Same as SA2.	• No impacts.
Mitigation			
Construction			
• Obtain and comply with appropriate street use permit(s) from Seattle Department of Transportation (SDOT). • Coordinate with SDOT on appropriate times of travel and haul routes for construction-generated truck traffic. • During construction in Denny Way, coordinate with SDOT to determine the appropriate timing and method for constructing this element to minimize the impacts to traffic on Denny Way, and continue close coordination throughout the duration of construction. An adequate detour route does exist. • **Obtain and comply with permits or approvals**	• Same as SA1.	• Same as SA1.	

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
needed for hauling overweight and/or oversized loads (e.g., transformers) to the substation site. * • Implement maintenance of traffic plans. • Prohibit construction employees from parking on public streets within 12 blocks of the project site if required by SDOT. • Provide manual traffic control when construction occurs through an intersection. • Carefully manage construction across driveways by staging work, use of flaggers, and coordination with property owners. • Coordinate with transit providers to temporarily close or relocate bus stop(s). • Pay for lost parking revenue to take any on-street parking out of service during construction. • Coordinate construction timing with other ongoing construction. • Work with SDOT to establish a construction outreach team and work closely with affected residents and business owners to minimize construction impacts.			

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Operational			
• **Obtain and comply with permits or approvals needed for hauling overweight and/or oversized loads (e.g., transformers) to the substation site. ***	• Same as SA1.	• Same as SA1.	
Land Use and Housing			
Impacts			
Construction			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Operational			
• Plans – Consistent w/plans and policies. Waivers would be required for some development standards in Seattle-Mixed (SM) zoning district per the provisions of SMC 23.76. • Land use/housing – Utility use would differ substantially from uses surrounding the site, generating little daily use. • Land use/housing – No active streetscape, but there would be no adverse impacts to adjacent uses. • Land use/housing – Parcels 1 and 3 could be available for another City use or for private development.	• Plans – Similar to SA1 but provides more open space than SA1, which is encouraged in the adopted neighborhood plan. Waivers would be required for some development standards in SM zoning district. • Land use/housing – Similar to SA1 with improved streetscape, but Parcel 1 would not be available for surplus, and Pontius Avenue North would be vacated.	• Plans – Same as SA2. • Land use/housing – Similar to SA2, with more access for open space.	• Plans - Lower reliability of electric supply could affect ability of City to achieve goal of South Lake Union as a major technology center. • Plans - Inconsistent with policies in the Seattle Comprehensive Plan, South Lake Union Urban Center Neighborhood Plan, and City Light 6-year Strategic Plan. • Land use/housing – All or part of Parcels 1, 2, and 3 could be used by City Light (such as for an inductor), another City department, or sold for private use or development. • Land use/housing – Reliable power service in the South Lake Union neighborhood would be compromised.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Mitigation			
Operational			
• Design features would help to reduce the utilitarian character of the substation.	• Similar to SA1, but could provide some storefront/community space that would contribute to a more active streetscape.	• Same as SA2.	
Historic and Cultural Resources			
Impacts			
Construction			
• Potential vibration could occur near historic-aged buildings (The Brewster, Feathered Friends, and YouthCare buildings), but is not expected to cause damage to these structures (see Chapter 4). • No impacts on archaeological resources anticipated, but potential remains for discovery of buried cultural resources.	• Same as SA1.	• Same as SA1.	• Substation would not be built so no impacts are expected, except if an inductor is located at the substation site. Installing an inductor would require excavation and cause vibration on a smaller scale than the substation alternatives.
Operational			
• No significant impacts because no designated landmarks are present; a visual impact on the setting would occur for adjacent historic-aged buildings (The Brewster, Feathered Friends, and YouthCare buildings) but would not be significant.	• Similar to SA1, but more visual impact on the setting around The Brewster due to replacement of Pontius Avenue North with the screen wall and open space.	• Similar to SA2, but with minor differences in height and proximity of the screen wall to The Brewster.	• There is potential for visual impacts to the setting for The Brewster apartment from inductor installation if installed on one of the substation parcels.
Mitigation			
Construction			
• BMPs would be instituted to minimize impacts from dust, noise, and vibration. • An Inadvertent Discovery Plan would be prepared and implemented.	• Same as SA1.	• Same as SA1.	

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Operational			
• If during design or permitting for the substation The Brewster were found to be eligible for Seattle Landmarks designation, and the streetscape were determined by Landmarks Preservation Board to be a contributing element of the property's significance, then alterations to that streetscape would be re-evaluated and potentially redesigned to minimize impacts on the integrity of the structure's setting.	• None required.	• None required.	
Air Quality and Greenhouse Gas (GHG)			
Impacts			
Construction			
• Construction would cause temporary emissions from heavy-duty construction equipment and construction worker vehicle trips. Emissions would be below annual emission thresholds and would not cause an adverse impact.	• Similar to SA1 with fewer truck trips and shorter construction duration but slightly greater emissions from grading operations.	• Similar to SA2, but marginally greater emissions from grading operations.	• The installation of an inductor on the proposed substation site would have similar impacts to BI1 (see Table 14-3).
Operational			
• Minor emissions would occur from backup generator. These emissions would be below reporting thresholds. • Some substation equipment would use SF_6, which is a potent GHG. GHG emissions would be monitored and documented in City Light's GHG reporting process.	• Same as SA1.	• Same as SA1.	• No impacts.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Mitigation			
Construction			
• City Light would implement BMPs to minimize emissions.	• Same as SA1.	• Same as SA1.	
Operational			
• City Light will use Best Available Control Technology (BACT) gas-insulated switchgear (GIS) switchgear to reduce sulfur hexafluoride (SF_6) emissions. • GHG – City Light will offset emissions in accordance with City Resolution 30144.	• Same as SA1.	• Same as SA1.	
Utilities			
Impacts			
Construction			
• Without protections in place some water, sewer, and gas lines could be damaged by construction on and near the substation site. There is the potential for temporary service outages during relocations.	• Similar to SA1, except that water and sanitary sewer lines within Pontius Avenue North right-of-way would be abandoned.	• Same as SA2.	• Installation of an inductor would likely require work in the right-of-way that would need to be coordinated with utility providers.
Operational			
• Duct banks leaving the substation site could create a barrier for other utilities. • The ground grid beneath the substation site could hinder access to on-site utility lines. • Without design measures to address it, there could be potential for damage to coatings of utility lines under a fault condition.	• Same as SA1.	• Same as SA1.	• Ability to reliably serve loads in the South Lake Union area would be limited.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Mitigation			
Construction			
• Throughout the design process, coordinate with utility providers to determine protection and maintenance requirements for existing utilities, and clearance needed for future utility lines, when determining the final location of new facilities. • Prior to start of construction, existing utilities and appurtenant facilities would be located and field-verified where feasible. • In some instances, vibration and settlement monitoring may be required near existing utilities. • Utilities would be relocated if required. • Where relocations are required, schedule work in advance to minimize potential service outages, and inform customers of potential service outages and construction schedules. • Coordinate public outreach effort with SPU and other utility service providers.	• Same as SA1.	• Same as SA1.	
Operational			
• Coordinate w/utility providers on design of on-site utilities relative to other utilities and ensure access is provided to any relocated utilities. • Coordinate with utility providers on any access needed to substation site	• Same as SA1.	• Same as SA2.	

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
for utility work after the site is operational (to protect ground grid and utility workers). • The potential for damage to utility line coatings, which could occur under a fault condition, would be avoided with the use of non-conductive pipe for utilities leaving the substation, preventing impressed currents and corrosion on those pipes.			
Water Resources			
Impacts			
Construction			
• Stormwater would be treated before discharge to surface water, but minor water quality impacts could occur without proper controls at the project site. • Excavation could require directing large dewatering discharges into the combined sewer system, causing minor reduction in combined sewer system capacity that could in turn slightly increase potential for combined sewer overflows (CSO) (and resultant receiving water quality impacts) downstream.	• Similar to SA1 but with a greater disturbed area and increased erosion potential; lower potential for impacts associated with dewatering.	• Same as SA2.	• No impacts, except for minor impacts if an inductor were installed on one of the substation site parcels.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Operational			
• There would be increased impervious surface compared to existing use. However, there would be reduced stormwater runoff volume compared to the former site use as a bus storage and maintenance facility, resulting in slight reduction in CSO potential downstream.	• Similar to SA1 but larger areal extent would result in greater improvements in water quality and quantity.	• Same as SA2.	• If use of Parcels 1 and/or 3 for public parking resumed, runoff would carry pollutants into the CSO system at previous levels.
Mitigation			
Construction			
• Use of BMPs to prevent and minimize off-site water quality impacts and combined sewer conveyance capacity impacts. BMPs would be in compliance with National Pollutant Discharge Elimination System (NPDES) and City permits that would be required for construction. • Obtain and comply with permit to discharge construction-related water to combined sewer.	• Same as SA1.	• Same as SA1.	
Operational			
• On-site stormwater detention will reduce runoff rate during storms.	• Same as SA1.	• Same as SA1.	
Energy and Natural Resources			
Impacts			
Construction			
• Construction would require consumption of fuel in amounts that are not considered a significant impact.	• Similar to SA1 but with reduced use of fuels.	• Same as SA2.	• No impacts, except for energy needed to install an inductor.

Table 14-1. Denny Substation and No Action Alternatives – Summary of Impacts and Mitigation Measures

Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)	No Action Alternative (Substation Component)
Operational			
• No impacts anticipated, but would use more energy than other substation alternatives.	• Similar to SA1 but with half the use of energy due to lower ventilation and cooling needs.	• Same as SA2.	• Increased risk of electrical network power disturbances and/or premature system failure, possibly leading to more reliance on backup generators by consumers.
Mitigation			
Construction			
• Contractor would be required to implement measures to reduce fuel consumption.	• Same as SA1.	• Same as SA1.	
Operational			
• City Light will implement measures to reduce fuel consumption, including efficient equipment and lighting, as well as use of biodiesel for the backup generator.	• Same as SA1.	• Same as SA1.	

Transmission Line and No Action Alternatives

Table 14-2 summarizes the impacts from the transmission line alternatives and the impacts of not building the transmission line if the No Action Alternative were chosen. As with the substation component of the project, Table 14-2 shows that most of the measures currently identified as mitigation for impacts are already incorporated into or are proposed by the project.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Aesthetics			
Impacts			
Construction			
• No impacts	• No impacts	• No impacts	• No impacts

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Operational			
• There would be no impacts from underground segments. • Poles and line for potential overhead portion in the South of Downtown (SODO) area may be 50 feet taller than existing, but no adverse impacts are anticipated due to the industrial context where poles would be installed.	• Similar to TL1 at the south end (where overhead). Portions of the transmission line would be visible in the Downtown Seattle Transit Tunnel (DSTT) but would not be considered an adverse visual impact because the visible portions (those not installed below the travelways) would be similar in character to the conduits already present in the DSTT.	• Same as TL1.	• No impacts.
Mitigation			
Operational			
• None required.	• None required.	• None required.	
Noise			
Impacts			
Construction			
• Construction equipment would generate noise (residences at Stewart, Minor, and Weller streets would have 4 to 6 weeks of impacts). • If nighttime work is required to avoid traffic impacts, mitigation would be needed to avoid significant impacts from the noisiest equipment, such as concrete-breaking equipment. • Vibration from heavy equipment for breaking concrete would be below thresholds for building damage but could cause human annoyance in buildings adjacent to the project.	• Similar to TL1, though 53 percent of the route would be underground and construction noise would be shielded from aboveground sensitive receptors. • Vibration impacts would be the same as TL1, except that there would be fewer residents adjacent and therefore less risk of annoyance.	• Similar to TL1 but affecting more residences (Stewart, Minor, Weller, Dearborn Streets, and 10th and 7th Avenues would have 4 to 6 weeks of impacts). • Vibration impacts would be the same as TL1, but affecting more residences (Stewart, Minor, Weller, Dearborn Streets, and 10th and 7th Avenues), thus having a higher risk of annoyance.	• No impacts.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Operational			
• Possible corona discharge noise from overhead lines, but noise would not be significant.	• Same as TL1.	• Same as TL1.	• No impacts.
Mitigation			
Construction			
• Use BMPs to limit impacts generally, such as use of noise control for trucks and equipment, and limiting use of pneumatic tools. • Limit the noisiest types of construction activity within 500 feet of residences to daytime only, where feasible. • Provide advance notice to adjacent land uses at least one week prior to operation of impact equipment.	• Same as TL1.	• Same as TL1.	
Operational			
• None required.	• None required.	• None required.	
Environmental Health – Electric and Magnetic Fields (EMF)			
Characterization of Existing and Future Magnetic Fields			
Construction			
• Not applicable.	• Not applicable.	• Not applicable.	• Not applicable.
Operational			
• Magnetic field levels will increase near the transmission lines. • The increases would be higher for overhead line than for underground portions of the line.	• Same as TL1. • Power-frequency (60 hertz) EMF is not expected to cause electromagnetic Interference (EMI) for transit operations in DSTT.	• Same as TL1.	• No change.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Engineering and Design Measures that Minimize EMF			
Operational			
• Install underground circuits where possible. • Consider increasing Denny-Massachusetts transmission line operating voltage earlier in build-out.	• Same as TL1.	• Same as TL1.	
Environmental Health – Hazardous Materials			
Impacts			
Construction			
• Construction could encounter contaminated soil and groundwater associated with historical activities. • Hazardous materials associated with construction activities could be released (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires).	• Same as TL1, though the route would cross fewer high-impact and known contaminated properties.	• Similar to TL2, but the potential risk for managing complex contamination is lower.	• No impacts.
Operational			
• If maintenance were needed, equipment used could experience leaks or fuel spills.	• Same as TL1.	• Same as TL1.	• No impacts.
Mitigation			
Construction			
• Employ BMPs such as implementing a Health and Safety Plan, training construction workers to recognize and minimize risks from contaminated materials and spills; and disposing of contaminants only at approved sites. • Conduct targeted pre-	• Same as TL1.	• Same as TL1.	

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
characterization of soils prior to construction at identified high and moderate impact site locations to reduce the risk of unanticipated discoveries that could cause risk or delay. • Design the project to avoid intercepting known soil and/or groundwater contamination, where feasible, especially with vault placement. • Coordinate with any hazardous material remediation adjacent to the construction site to ensure project does not adversely affect other remedial activities. • Remove contaminated media on the project site that the completed project would render inaccessible or that has the potential to migrate along buried utilities (e.g., sewer, water, drainage pipes). • Address potential vapor intrusion where VOCs are left in place beneath planned enclosed spaces (e.g., buildings on the substation site, and vaults for the transmission line and distribution system).			
Operational			
• None required.	• None required.	• None required.	

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Transportation			
Impacts			
Construction			
• Transmission line installation will require temporary: o Roadway lane, bicycle lane, and sidewalk closures; o Bus stop closures or relocations; o Elimination of on-street parking; o Traffic disruption at I-5 ramps in downtown Seattle; o Disruption at roadway, alley and driveway intersections; and o Generation of construction truck and worker commute trips; • Crossing of rail yard in SODO would require coordination with BNSF and Sound Transit; if overhead, installation would require short-term suspension of rail traffic while the line is installed over the yard. If bored underground, the design would require engineering to ensure installation would not undermine tracks.	• Similar to TL1, except no disruption at I-5/I-90 ramp intersections. • Nighttime DSTT closures would be required and would result in a moderate impact to regular maintenance activities and driver training. • Closures of the DSTT would also be required for 3 to 4 weekend days and tunnel buses would be detoured to surface streets, which would have a moderate impact on transit users and minor impacts on roadway traffic operations.	• Similar to TL1 except no disruption at I-90 ramp intersections and fewer disruptions at I-5 ramp intersections.	• No impacts.
Operational			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Mitigation			
Construction			
• Implement maintenance of traffic plans.	• Same as TL1, except that coordination with Sound Transit and King County	• Same as TL1.	

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
• For principal arterials and freeway ramps requiring closures, conduct work at night and/or on weekends. • Obtain and comply with appropriate street use permit(s) from SDOT. • Coordinate with SDOT on construction-generated haul routes and schedule. • Prohibit construction work during winter holidays in streets or sidewalks located in the downtown retail core. • Provide manual traffic control when construction occurs through an intersection. • Manage construction across driveways by staging the work, use of flaggers, and coordination with property owners. • Prior to trenching through intersections with in-pavement sensors for traffic light control, possibly install alternate detection equipment such as camera detectors. Install sensors or permanent cameras as part of restoration. • Coordinate with transit providers to temporarily close or relocate bus stop(s). • To the extent possible, locate duct banks to avoid construction impacts with overhead bus trolley lines, but, if needed, work with King County Metro Power Distribution to either temporarily relocate or deactivate trolley lines	would be required for DSTT use. • DSTT closure on weekends would occur during non-event weekends. • **Weekend tunnel closures would likely require supplemental bus service for surface routes during closures.***		

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
during construction. • Prohibit work that would disrupt traffic during the designated holiday moratorium. • Coordinate construction timing with other ongoing construction. • Work with SDOT to establish a construction outreach team and work closely with affected residents and business owners to minimize construction impacts.			
Operational			
• None required.	• None required.	• None required.	
Land Use and Housing			
Impacts			
Construction			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Operational			
• No impacts.	• Same as TL1.	• Same as TL1.	• Not consistent with plans/policies. • Less reliable electrical service in the South Lake Union neighborhood.
Mitigation			
Operational			
• None required.	• None required.	• None required.	
Historic and Cultural Resources			
Impacts			
Construction			
• Line would be constructed underground through historic district, where the entire district is considered a historic resource.	• Similar to TL1, but would not intersect with any known archaeological sites.	• Similar to TL1, but would potentially affect fewer listed or designated historic properties; and would have a greater potential impact within the International	• No impacts.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
• Noise and vibration would be near to historic resources, but would not be considered significant. • Excavation could encounter belowground cultural resources. • Would intersect one known archaeological site on 6th Avenue South.		Special Review District boundaries.	
Operational			
• Possible visual impact form overhead lines on eligible historic-age properties in SODO, but not considered significant.	• Same as TL1.	• Same as TL1.	• No impacts.
Mitigation			
Construction			
• Implement BMPs; comply with Inadvertent Discovery Plan.	• Similar to TL1, but no need to consult with State Historic Preservation Officer (SHPO).	• Same as TL1.	
Operational			
• Compliance with Special Review District Conditions.	• Same as TL1.	• Same as TL1.	
Air Quality and Greenhouse Gas (GHG)			
Impacts			
Construction			
• Construction would cause temporary emissions from heavy-duty construction equipment and vehicle trips. Emissions would be below annual emission thresholds and would not cause an adverse impact.	• Similar to TL1 with fewer emissions from excavation.	• Similar to TL1 with more emissions from excavation due to longer alignment.	• No impacts.
Operational			
• No impacts.	• No impacts.	• No impacts.	• No impacts.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Mitigation			
Construction			
• City Light would implement BMPs to minimize emissions, similar to SA1.	• Same as TL1.	• Same as TL1.	
Operational			
• None required.	• None required	• None required	
Utilities			
Impacts			
Construction			
• Potential vibration impacts; relocations and reconstructions of existing utilities would likely be required. With appropriate measures, impacts are not expected.	• Same as TL1.	• Same as TL1.	• No impacts.
Operational			
• Required duct bank cover could prohibit future placement of other utilities in that area.	• Same as TL1.	• Same as TL1.	• No impacts.
Mitigation			
Construction			
• Throughout design process, coordinate with utility providers to determine protection and maintenance requirements for existing utilities, and clearance needed for future utility lines, when determining the final location of new facilities. • Prior to construction, existing utilities and appurtenant facilities to be located and field-verified where feasible. • For some existing utilities,	• Same as TL1.	• Same as TL1.	

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
vibration and settlement monitoring may be required. • Utilities would be relocated, if required. • Where relocations are required, schedule work in advance to minimize potential service outages, and inform customers of potential service outages and construction schedule. • Coordinate public outreach effort with Seattle Public Utilities (SPU) and other utility service providers.			
Operational			
• Ensure adequate clearance for and access to other utilities in proximity to transmission line.	• Same as TL1.	• Same as TL1.	
Water Resources			
Impacts			
Construction			
• Stormwater would be treated before discharge to surface water, but minor water quality impacts could occur without proper controls at the project site. • Excavation could require directing large dewatering discharges into the combined sewer system, causing minor reduction in combined sewer system capacity that could in turn slightly increase potential for CSOs (and resultant receiving water quality impacts) downstream.	• Similar to TL1 but less ground disturbance since majority of work would be in DSTT.	• Similar to TL1 but greater potential for minor water quality impacts.	• No impacts.

Table 14-2. Transmission Line and No Action Alternatives – Summary of Impacts and Mitigation Measures

Transmission Line Alternative 1 (TL1)	Transmission Line Alternative 2 (TL2)	Transmission Line Alternative 3 (TL3)	No Action Alternative (TL Component)
Operational			
• No impacts anticipated.	• Same as TL1.	• Same as TL1.	• No impacts.
Mitigation			
Construction			
• Use of BMPs to prevent and minimize off-site water quality impacts and combined sewer conveyance capacity impacts. BMPs would be in compliance with NPDES and City permits that would be required for construction. • Obtain and comply with permit to discharge construction-related water to combined sewer.	• Same as TL1.	• Same as TL1.	
Operational			
• None required.	• None required.	• None required.	
Energy and Natural Resources			
Impacts			
Construction			
• Construction would require consumption of fuel in amounts that are not considered a significant impact.	• Similar to TL1, though less fuel would be consumed.	• Similar to TL1, though with a higher level of fuel consumed.	• No impacts.
Operational			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Mitigation			
Construction			
• Contractor would be required to implement measures to reduce fuel consumption.	• Same as TL1.	• Same as TL1.	
Operational			
• None required.	• None required.	• None required.	

Distribution System, Broad Street Substation Inductor Options and No Action Alternative

Table 14-3 summarizes the impacts from the Broad Street Substation Inductor options and the network distribution system, along with the impacts of not building the network distribution system north of Denny Way if the No Action Alternative were chosen. Table 14-3 shows that most of the measures currently identified as mitigation for impacts are already incorporated into or are proposed by the project. All mitigation measures identified for BI1 would also be implemented for the No Action Alternative.

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Aesthetics			
Impacts			
Construction			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Operational			
• Minor increase in bulk and scale from new equipment. • Relocated artwork fence from Broad Street side of annex.	• Similar bulk and scale to BI1 but would be more visible to the public than BI1 at the street corner of Taylor Avenue North and Harrison Street. • No effect on artwork fence.	• No impacts.	• Same as BI1.
Mitigation			
Operational			
• Fencing will be replaced in consultation with Seattle Arts Commission.	• None required.	• None required.	
Noise			
Impacts			
Construction			
• Noise – Construction activities would generate noise, but would not exceed noise standards. • Vibration – No expected impacts.	• Same as BI1.	• Noise – Construction activities would generate noise. There are sensitive receptors throughout the Phase 1 and Future Build-out areas. Construction noise would not	• Same as BI1.

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
		be significant. • If nighttime work is required to avoid traffic impacts, mitigation would be needed to avoid significant impacts from noisiest equipment such as concrete-breaking equipment. • Vibration from heavy equipment for breaking concrete would be below thresholds for building damage but could cause human annoyance in buildings adjacent to the project.	
Operational			
• Operational noise would not be noticeable.	• Similar to BI1, except operational noise from the inductor would be reduced because the inductor would be shielded from the residential apartment building on Thomas Street.	• No impacts.	• Same as BI1.
Mitigation			
Construction			
• Use BMPs to limit impacts generally, such as use of noise control for trucks and equipment, and limiting use of pneumatic tools. • Limit the noisiest types of construction activity within 500 feet of residences to daytime only, where feasible. • Provide advance notice to adjacent land uses at least one week prior to operation of impact equipment.	• Same as BI1.	• Use BMPs to limit impacts generally, such as use of noise control for trucks and equipment, and limiting use of pneumatic tools. • Limit the noisiest types of construction activity within 500 feet of residences to daytime only, where feasible. • Provide advance notice to adjacent land uses at least one week prior to operation of impact equipment.	
Operational			
• None required.	• None required.	• None required.	

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Environmental Health – Electric and Magnetic Fields (EMF)			
Characterization of Existing and Future Magnetic Fields			
Construction			
• Not applicable	• Not applicable.	• Not applicable.	• Not applicable.
Operational			
• Anticipated to be minimal.	• Same as BI1.	• Similar to Denny Substation alternatives.	• No change to existing conditions.
Engineering and Design Measures that Minimize EMF			
Operational			
• None needed.	• None needed.	• Installing underground circuits where proposed. • Locate distribution features centrally within streets. • Locate underground circuits in the lowest possible duct. • Arrange three-phase distribution conductors together within ducts.	
Environmental Health – Hazardous Materials			
Impacts			
Construction			
• Construction could encounter contaminated soil and groundwater associated with historical activities. The site is near one high impact site. • Hazardous materials associated with construction activities could be released (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires).	• Similar to BI1, but near two high impact sites so the potential risk in managing complex contamination is higher.	• Construction could encounter contaminated soil and groundwater associated with historical activities. • Hazardous materials associated with construction activities could be released (e.g., gasoline, diesel, motor oil, transmission fluid, hydraulic oil, radiator coolant, brake fluid, and metals in tires).	• Same as BI1.

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Operational			
• Risk to workers from hazardous materials handled on-site and from potential fire from overheated equipment.	• Same as BI1.	• If maintenance were needed, equipment used could experience leaks or fuel spills.	• Same as BI1.
Mitigation			
Construction			
• Employ BMPs and train construction workers to recognize and minimize risks; dispose of contaminants only at approved sites.	• Same as BI1.	• Employ BMPs and train construction workers to recognize and minimize risks; dispose of contaminants only at approved sites.	
Operational			
• Minimize use of hazardous materials during maintenance operations. • Train workers to recognize operations and maintenance risks. • Enact safety protocols during equipment change-out to address de-energizing the work area, moving heavy equipment within the substation, and protecting equipment containing liquids.	• Same as BI1.	• None required.	
Transportation			
Impacts			
Construction			
• Generation of construction truck and worker commute trips would have a minor impact.	• Same as BI1.	• Similar to TL1 (Table 14-2), except no impacts on freeway ramps.	• Same as BI1.

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Operational			
• A portion of the previously-closed Broad Street right-of-way would need to be vacated, but no significant transportation impacts are expected since the road would already have been closed by SDOT.	• Same as BI1.	• No impacts.	• Same as BI1.
Mitigation			
Construction			
• None required.	• None required.	• Same as for TL1.	
Operational			
• None required.	• None required.	• None required.	
Land Use and Housing			
Impacts			
Construction			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Operational			
• No impacts.	• No impacts.	• No adverse impacts to land uses and housing. • Network service would be available to new and existing uses envisioned in long-term plans for the area.	• Not consistent with plans and policies supporting high density development of South Lake Union.
Mitigation			
Operational			
• None required.	• None required.	• None required.	

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Historic and Cultural Resources			
Impacts			
Construction			
• Potential to impact archaeological resources, although none are currently known in the area.	• Potential for impact on Harrison Street Regrade site and pre-contact archeological sites.	• Noise/vibration on historic resources, but not significant. • Potential for impact to buried archaeological resources.	• Same as BI1.
Operational			
• No impacts on aboveground historic resources.	• Same as BI1.	• No impacts.	• No impacts.
Mitigation			
Construction			
• Implement BMPs; comply with Inadvertent Discovery Plan.	• Same as BI1.	• Implement BMPs; comply with Inadvertent Discovery Plan.	
Operational			
• None required.	• None required.	• None required.	
Air Quality and Greenhouse Gas			
Impacts			
Construction			
• Construction would cause temporary emissions from heavy-duty construction equipment and vehicle trips. Emissions would be below annual emission thresholds and would not cause an adverse impact.	• Same as BI1.	• Construction would cause temporary emissions from heavy-duty construction equipment and vehicle trips. Emissions would be below annual emission thresholds and would not cause an adverse impact.	• Same as BI1.
Operational			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Mitigation			
Construction			
• Maintenance of Traffic Plan and BMPS.	• Same as BI1.	• Maintenance of Traffic Plan and BMPS.	

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Operational			
• None required.	• None required.	• None required.	
Utilities			
Impacts			
Construction			
• Some utility relocations may be required.	• Same as BI1.	• Potential vibration impacts; temporary disruptions in utility service might occur.	• Some utility relocations may be required.
Operational			
• No impacts to utilities around the substation site are anticipated.	• Same as BI1.	• Required duct bank cover could prohibit future placement of other utilities in that area.	• Significant risk of premature failure and/or permanent heat damage, and reduced reliability, due to increased loads.
Mitigation			
Construction			
• Notify adjacent properties and Seattle Fire Department of potential service disruptions; coordinate with utility providers; vibration monitoring may be required.	• Same as BI1.	• Notify adjacent properties and Seattle Fire Department of potential service disruptions; coordinate w/utility providers; vibration monitoring may be required.	
Operational			
• Similar to SA1.	• Similar to SA1.	• Similar to TL1.	
Water Resources			
Impacts			
Construction			
• Similar to SA1 except much smaller site, and dewatering is generally not expected for this site.	• Similar to BI1, with slightly less potential for erosion and sedimentation.	• Could result in minor impacts from eroded soil and possibly other pollutants in runoff and dewatering discharges. • Minor impacts on water quality in Lake Union would be possible because stormwater is untreated prior to discharge.	• Same as BI1.

Table 14-3. Distribution System, Broad Street Substation Inductor Options and No Action Alternative – Summary of Impacts and Mitigation Measures

Broad Street Substation Inductor Option 1 (BI1)	Broad Street Substation Inductor Option 2 (BI2)	Distribution System	No Action Alternative (BI and Distribution System Components)
Operational			
• No impacts.	• No impacts.	• No impacts.	• No impacts.
Mitigation			
Construction			
• Implement BMPs to control runoff from active work areas. • See also Environmental Health – Hazardous Materials.	• Same as BI1.	• Same as TL1.	
Operational			
• None required.	• None required.	• None required.	
Energy and Natural Resources			
Impacts			
Construction			
• Construction would require consumption of fuel in amounts that are not considered a significant impact.	• Same as BI1.	• Similar to BI1, though more fuel would be consumed.	• Same as BI1.
Operational			
• No impacts.	• Same as BI1.	• No impacts.	• Increased risk of network power disturbances and/or premature system failure.
Mitigation			
Construction			
• Contractor would be required to implement measures to reduce fuel consumption.	• Same as BI1.	• Same as BI1.	
Operational			
• None required.	• None required.	• None required.	

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No references.

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Chapter 16: DISTRIBUTION LIST

The following parties have received the Draft EIS by electronic link, compact disc or printed copy:

Federal Agencies

Bonneville Power Administration

Tribal Governments

Muckleshoot Indian Tribe

Suquamish Tribe

Duwamish Tribe

Snoqualmie Tribe

Tulalip Tribes

Regional

Puget Sound Regional Council

Puget Sound Clean Air Agency

Sound Transit

Washington State

Department of Ecology SEPA Register

Department of Ecology Stormwater Program

Department of Transportation

Department of Archaeology and Historic Preservation

Local

King County Metro

King County Industrial Waste Program

Seattle Office of the Mayor

Seattle City Council

Seattle Department of Planning and Development

Seattle Department of Transportation

Seattle Department of Public Utilities

Seattle Department of Parks and Recreation

Seattle Department of Neighborhoods, Historic Preservation Program

Seattle Design Commission

Other

Puget Sound Energy

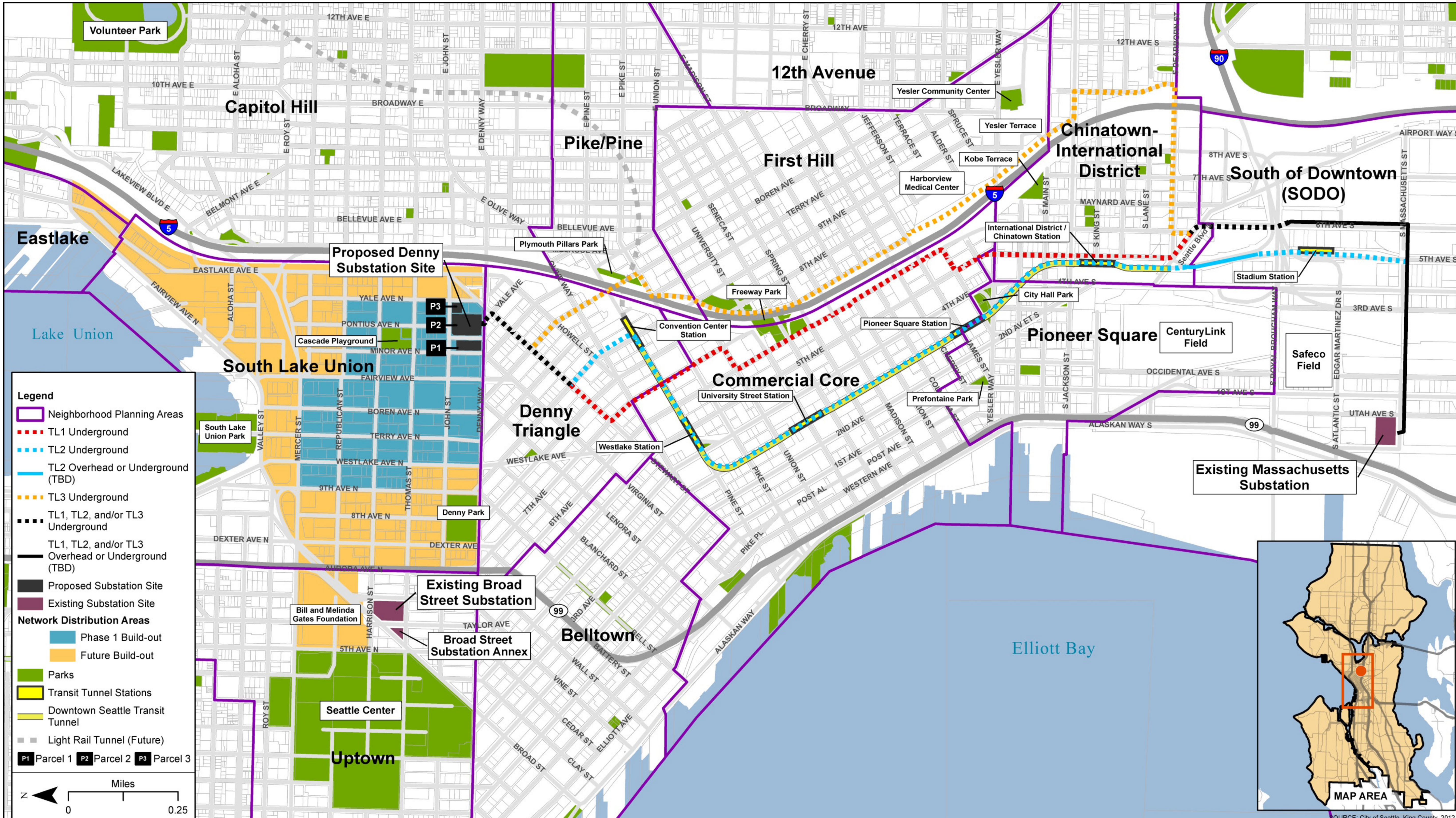
BNSF

Port of Seattle

APPENDIX A

Neighborhood Map

Figure A-1. Neighborhood Map



APPENDIX B

Pontius Avenue North Street Vacation Petition

Appendix B

PUBLIC BENEFITS MATRIX

Denny Substation Vacation Petition – Proposed Public Benefits

Site and Project Description

Current Zoning Designation: SM-125
Recently Adopted Zoning Designation[1]: SM-240/125-400
Street Classification: Pontius Avenue N – local access Street
Assessed Value of Adjacent Property:

- Parcel 246840-0035 Total Assessed Value = $4,334,400 / $120 per sq. ft.[2]
- Parcel 246840-0060 Total Assessed Value = $2,322,000 / $215 per sq. ft.[3]
- Parcel 246740-0035 Total Assessed Value = $3,888,000 / $180 per sq. ft.[4]
- Parcel 246740-0420 Total Assessed Value = $2,232,000 / $155 per sq. ft.[5]
- Parcel 246740-0430 Total Assessed Value = $9,576,800 / $693 per sq. ft.[6]
- Parcel 684970-0130 Total Assessed Value = $16,500,000 / $1,165 per sq. ft.[7]
- Parcel 684970-0145 Total Assessed Value = $53,665,200 / $5,685 per sq. ft.[8]
- Parcel 684970-0205 Total Assessed Value = $22,310,000 / $247 per sq. ft.[9]
- Parcel 684970-0075 Total Assessed Value = $1,777,000 / $185 per sq. ft.[10]
- Parcel 684970-0055 Total Assessed Value = $18,250,000 / $1076 per sq. ft.[11]
- Parcel 066000-2295 Total Assessed Value = $4,600,000 / $400 per sq. ft.[12]
- Parcel 066000-2290 Total Assessed Value = $3,560,000 / $400 per sq. ft.[13]

Size of the Project: 112,000 sq. ft.

Size of the Alley to be Vacated: 22,090 sq. ft.
Proposed Public Benefits: **Proposed Public Benefits**: The list below shows the totality of public benefits across the project site.

1. *Public Access to Open Space Plaza: The design affords access to open space consisting of paved walkways connecting the corner of Denny Way and Minor Avenue N. to the intersection of John Street and Pontius Avenue N. The walkway serves as a through block connection retaining much of the pedestrian functions currently offered by the existing Pontius Avenue N. The walkway will provide pedestrian seating and street trees to provide shelter. Additionally, an elevated walkway along the west side of the substation will provide an accessible route to assist in the grade differential between Denny Way and John Street.*

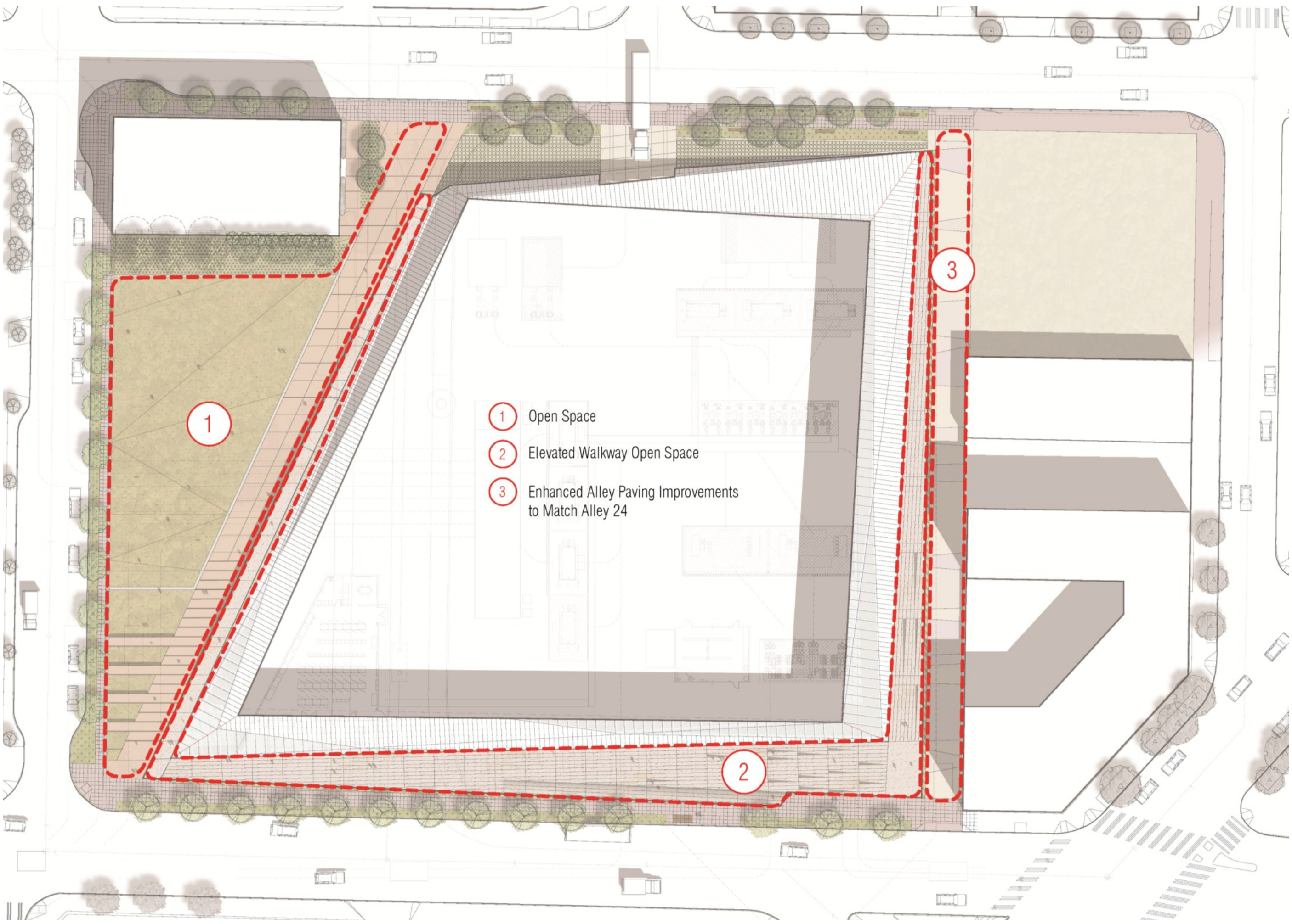
1 City council adopted zoning changes for the South Lake Union Urban Center on May 6th, 2013, which, when effective, will change the zoning designation for the project site.
2 Based upon *King County Assessor's Office* data - $4,334,400 total assessed value/36,100 sq. ft. = $120 per sq. ft.
3 Based upon *King County Assessor's Office* data - $2,322,000 total assessed value/10,800 sq. ft. = $215 per sq. ft.
4 Based upon *King County Assessor's Office* data - $3,888,000 total assessed value/21,600 sq. ft. = $180 per sq. ft.
5 Based upon *King County Assessor's Office* data - $2,232,000 total assessed value/14,400 sq. ft. = $155 per sq. ft.
6 Based upon *King County Assessor's Office* data - $9,576,800 total assessed value/13,810 sq. ft. = $693 per sq. ft.
7 Based upon *King County Assessor's Office* data - $16,500,000 total assessed value/14,160 sq. ft. = $1,165 per sq. ft.
8 Based upon *King County Assessor's Office* data - $53,665,200 total assessed value/9,440 sq. ft. = $5,685 per sq. ft.
9 Based upon *King County Assessor's Office* data - $22,310,000 total assessed value/90,360 sq. ft. = $247 per sq. ft.
10 Based upon *King County Assessor's Office* data - $1,777,000 total assessed value/9,600 sq. ft. = $185 per sq. ft.
11 Based upon *King County Assessor's Office* data - $18,250,000 total assessed value/16,967 sq. ft. = $1,076 per sq. ft.
12 Based upon *King County Assessor's Office* data - $4,600,000 total assessed value/11,500 sq. ft. = $400 per sq. ft.
13 Based upon *King County Assessor's Office* data - $3,560,000 total assessed value/8,900 sq. ft. = $400 per sq. ft.

2. *<u>Elevated Pedestrian Walkways</u>: The southern and eastern edges of the project offers pedestrian walkways that facilitate pedestrian movement along Denny Way and through the alley. By elevating the walkway, the design creates a new urban experience that affords unique views to the interior of the substation yard, and is activated by periodic vibrant art features. The intent is to create a unique pedestrian promenade that enhances the public realm. In addition, the elevated walkway contains a series of outdoor seating venues facilitating a pedestrian-friendly pedestrian experience.*

3. *<u>Enhanced Alley Pavement Treatments</u>: The alley that bounds the eastern edge of the project offers enhanced pavement treatments similar in character to the alley improvements implemented as part of the Alley 24 development. The alley is frequently used as a pedestrian way and the pavement enhancements will provide continuity of the pavement from Denny Way to John Street and provide continuity of character through Alley 24 to Thomas Street. The enhancements will create a higher quality pedestrian and urban experience.*

Figure B1 is a summary diagram of the public benefit opportunities.

Denny Substation
Street Vacation Petition



Source: NBBJ, Power Engineers, 2013

Figure B1
Public Benefit Opportunities

APPENDIX C

Sound Transit Memorandum on Use of Downtown Seattle Transit Tunnel (DSTT) for Transmission Line Alternative 2

LTK

LTK Engineering Services
Seattle Office

MEMORANDUM

To:	Justin Garrod	File:	C3632-2.521
From:	Lloyd Mack	Doc	IMR- 161 U-Link
Date:	August 6, 2013		
Subject:	SCL 230kV Transmission Line – DSTT Routing Final Report		

Background

In early January of this year, LTK was requested to review the documentation and discuss with Seattle City Light (SCL) a proposal to install a 230kV transmission line using the existing Downtown Seattle Transit Tunnel (DSTT) as the route. Since that time, LTK has met with SCL Project Management and Engineering, attended the January 17th briefing of Sound Transit and King County Metro, and reviewed City Light's *Denny to Mass 230 kV Feasibility Study* dated February 13, 2013. For specific technical information on the project, please refer to the minutes prepared by Dick Eacker after his meeting with Seattle City Light on January 15th.

LTK also reviewed the report prepared by Power Engineers and Parsons Brinckerhoff proposing another alternate. That report, dated May 25, 2010, studied the feasibility of incorporating the transmission line into the tunnel that is now being constructed to replace the Alaskan Way Viaduct (SR99). The Waterfront Tunnel project, currently underway, constructs a 52+ foot diameter tunnel with roadways on two levels and ancillary utility corridors where the transmission line was proposed to be installed remote from public areas (see circled area on tunnel graphic). We will not repeat details here, but will refer to several pertinent issues that were raised in that report.

Executive Summary

This document is an update of the original issues list that LTK developed and sent to you on January 17th. It also incorporates concerns and issues raised by Sound Transit's Safety and Quality Assurance (SQA) and Design, Engineering and Construction Management (DECM). We all concur that this is a bad idea and unworthy of further pursuit. We believe that turning a transit tunnel into a utilidor is very ill-advised. There is no code, neither NFPA 130, NFPA 70 (National Electrical Code), nor IEEE C2 (National Electrical Safety Code), stating that what they propose cannot be done. However, neither is there precedent demonstrating it to be feasible and safe. To date, Seattle City Light has not adequately responded to the questions raised by King County Metro in November 2012 nor the Sound Transit scoping comment letter. In April 2013, City Light's project manager explained that they had contracted with POWER Engineers to proceed with preliminary 30% design and requested assistance obtaining as-builts of the DSTT facility. Sound Transit and King County provided the information, but the preponderance of evidence indicates that continuing to move forward with detailed engineering would be a waste of time and resources.

The following points summarize our concerns.

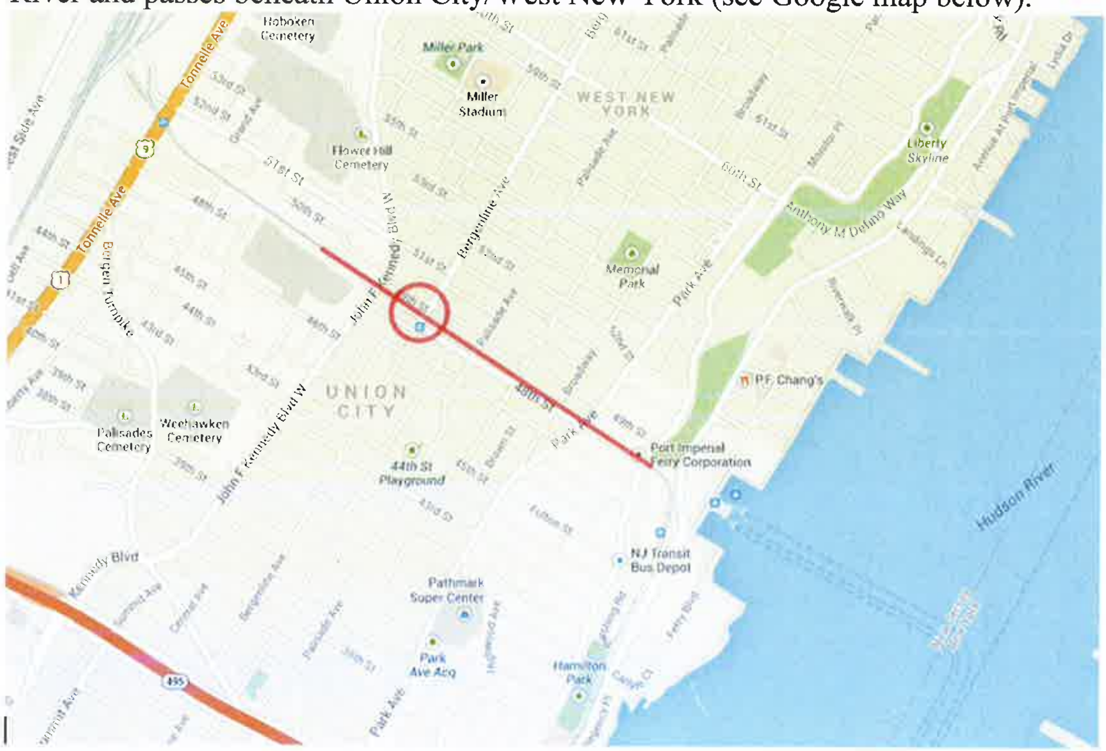
- Lack of Precedent. There simply is no experience with installation of a transmission line within a transit facility in close proximity to vehicles and passengers. The Weehawken Tunnel in New Jersey is not comparable as we discuss in the following section.
- Rejection by Other Agencies. The report submitted to Washington DOT recommended pursuing this project. However, the recommendation was rejected. If it was a potential problem for WSDOT, it is doubly a problem for Sound Transit, where the DSTT is much smaller and transit lanes and maintenance access are more constricted.
- Life Safety Hazard. The WSDOT Report discusses in some detail the hazard arising due to cable faults and we agree that explosion is not likely to occur. However, there is also a possible hazard due to derailing trains striking the cable and creating a high-impedance fault that would be slow to clear by substation relaying and could be an ignition hazard. It is hard to determine what the actual hazard would be to transit patrons, but we feel it appropriate to err on the side of caution without a precedent to look to for experience.
- Impact on Station Structures. Seattle City Light has indicated that they would go 'underground' through the stations. Trenching through the structural reinforcement was impossible to do during the DSTT Retrofit as discussed below and would be equally impossible for a transmission line.
- Reduction of Tunnel Clearances. DPD has already expressed to LTK that they would require a concrete barrier between the tunnel and the transmission line equal to or greater than required for the 26kV tunnel feeder cable. (DPD requires four inches of reinforced concrete for encasement.) That would have a significant impact on tunnel clearances from the vehicle dynamic envelope.
- Potential Damage to Rail Infrastructure. There is a potential major threat to ST's rail infrastructure due to a cable fault in the tunnel. That could require removal of the rail and replacement of the rail boot over a large area.
- Electromagnetic fields from the spaced transmission conductors would have an unknown; but likely hazardous effect on other transit systems and tunnel structure.
- Construction Impacts. Seattle City Light appears to be over-optimistic about the minimal impact to ST's facilities due to construction of the transmission line. Also, we believe that impacts in the stations would be very extensive and could not be constructed without lengthy shutdowns of transit service.
- Operational Impacts. In addition to operational impacts during construction, Seattle City Light could push for total, unrestricted access to the Tunnel in case of a cable or splice failure. Link Operations will not permit any curtailment of transit service in such an event. For a backup power source, we think this is a serious shortcoming of the proposal.
- Maintenance Impacts. Sound Transit Operations has concerns about hazards and restrictions to their maintenance activities and possible shutdown of the Tunnel caused by the EMI interfering with linear heat detectors. Also, the extent of hazard due to EMF-induced voltages on Tunnel piping and handrails is unknown but worrisome.

- Opposition by Code Enforcement Agencies and Emergency Responders. Seattle Fire Department and Seattle Department of Planning and Development have already expressed to both SQA and LTK that they are not comfortable with this idea unless it can be demonstrated to have worked elsewhere. To them, this changes the classification of the DSTT from a transit facility to a utilidor also used for transit.

Detailed Discussion of Safety and Technical Issues

The following are our major concerns with Seattle City Light's proposal:

1. Prior Experience: SQA has expressed serious reservations about this installation. Also, the WSDOT report presented this in some depth and we sought out other sources of information. Installations in transport facilities are very rare as discussed below.
   a. For road tunnels, the single example seems to be an installation in the Sannomiya Road Tunnel in Japan. There were no details on this – just a statement that information was found in the literature.
   b. For transit facilities, one example was found: New Jersey Transit's Weehawken Tunnel. It was excavated in rock beneath the Hudson Palisades west of the Hudson River and passes beneath Union City/West New York (see Google map below).



The tunnel dates back to 1886, but in the 1980's two 230kV high-pressure fluid-filled (HPFF - Okonite 'Oilostatic') cables were installed encased in concrete at the two outer corners of the tunnel. At that time, the tunnel was used only for freight service as part of the New York Central/West Shore Division. New Jersey Transit acquired the tunnel in 2002 to use for transit as part of the Hudson-Bergen Light Rail Project 'MOS 2' segment. The transmission cables were accommodated in the new tunnel design which also created a new center-platform Bergenline Avenue Station (circled above). The cables were moved to a concrete-encased ductbank at the outer reaches

of that tunneled station. The ductbank encloses the 8-inch steel HPFF conduit and conductors and communications circuits. (A typical HPFF cable is shown at right.) They were reinstalled and continue to be operated by Public Service Electric and Gas Company (PSE&G). For further information, you can refer to 'Design and Construction of the Weehawken Tunnel and Bergenline Avenue Station for the Hudson-Bergen Light Rail Transit System' by Berliner, Campo, Dickerson and Mack from *Transportation Research Circular E-C059* (9th National Light Rail Transit Conference).

Although this facility might be considered as a precedent, we would like to point out some obvious differences between it and the proposed installation in the DSTT.

a. Those cables existed under what must have been a preexisting easement and there was no economic way for NJT to require their removal.
b. The tunnel redesign and construction allowed for their presence. They were accommodated in the outer reaches of the tunnel and reinstalled similarly so they are away from emergency walkways and passenger areas.
c. The cables are steel-conduit-enclosed, fluid-filled cables that have no electromagnetic effects on adjacent transit systems or structure reinforcing.
d. Finally, there is no mention of splicing provisions anywhere in the tunnel or intervening passenger station. The total length is approximately 4,000 ft. and we believe it was installed in one length. Even if they were spliced, splicing provisions at a mid-point would be much less of an impact on tunnel or station infrastructure than the splicing provisions required for single-conductor transmission cables requiring separate splicing vaults.

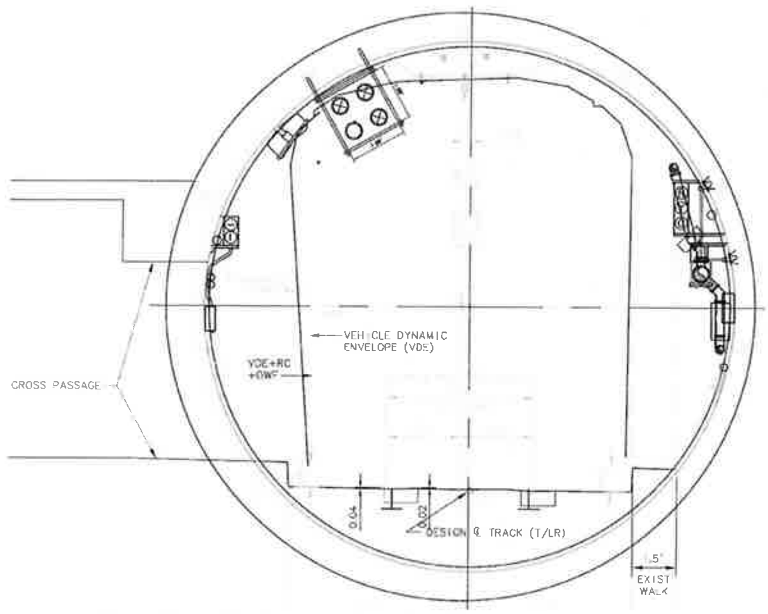
2. Structural: Based on our understanding of the DSTT station design, our opinion is that placing the transmission line conduit and splicing vaults in the existing station invert is not possible. Due to the size of conduits and vaults, the installation would require removal of significant portions of the base slab as well as cutting most of the reinforcing that provides the main tension resistance for the underground station structure. Cutting that reinforcement would sever the load path and create instability in the structural system, endangering the station structures.

3. Architectural and Station Environment: Transitions from station-invert-installed ducts (if they were not infeasible as discussed above) to tunnel wall-mounted conduits in the bored tunnels would be very large and become a major visual 'feature' of the existing stations. Despite SCL's dismissal that tunnel portal structures would be set back and less visible from the stations, the transition structures would be very unsightly assuming the conduits have a 25-foot bend radius as proposed. If splices were also made in those transition areas, the structures would be even more unattractive because of the size and physical protection required to house the splices and transition the conduits.

Based on structural problems discussed above, we believe the only feasible way to construct the pulling/splice vaults within those stations would be to construct a large central wall structure above the station inverts within the center bus lane. The vaults would have to be constructed recessed into those walls to accommodate splicing. That would essentially separate each station into two facilities separated by a monolith of concrete with unknown consequences but having major visual and operational effects. This new obstruction would require engineering review and possible redesign of the emergency ventilation system for the station. It would also require major modifications of existing utilities installed within that space as discussed below.

4. Tunnel and Station Conflicts: From first-hand experience, we know that accommodating new systems in those tunnels is very difficult. Tunnel sections show that there is very little room for installation of four new ducts of the size required and still maintain clearance from the vehicle dynamic envelope. That is a problem even without considering that they might have 20-inch diameter splices on the tunnel wall plus concrete encasement to protect cables and splices from incidental damage during tunnel maintenance. Existing tunnel inverts are unusable because of their limited size and presence of utilities. Within each tunnel invert there are 26kV feeder conduits and drainage piping.

CROSS-SECTION VIEW: LOOKING SOUTH IN TUNNEL



Sound Transit's Electrical and Track groups created an updated typical tunnel section shown at right with an assumed conduit configuration that encapsulates the conduits in a 2'x2' box and minimizes electromagnetic effects. As can be seen, the transmission line envelope impacts both the vehicle dynamic envelope and the physical limits of the light rail vehicles (LRVs) within the bored tunnels. Tunnel walls accommodate lighting equipment and wiring, emergency radio cable, light rail signals, fire zone signs, fire piping and cross passage access. This tunnel section shows clearly that there is insufficient space for a duct bank to fit within the tunnel along with the LRVs and existing tunnel infrastructure. This conflict exists in all bored tunnel sections for both the NB and SB tunnels.

International District Station: Sound Transit's East Link Extension is installing a turn-back track within IDS. The transition from a tunnel section to the elevated section above the turn-back tracks or existing NB and SB tracks would have to occur within approximately 30 feet of the tunnel portal at Jackson Street.

Pine Street Cut-and-Cover Tunnel: The transition from the tunnel wall in the cut-and-cover tunnel between Westlake and Convention Center is constrained by the existing tunnel height of 16'. The OCS contact wire is installed at 13'-10" and includes a messenger wire at approximately 14'-10" above the tunnel invert. The 2-foot deep duct bank would be in conflict with the OCS system when it transitions from the tunnel wall to the center of the tunnel. In addition there are additional utilities hanging from both the wall and ceiling which would need to be reviewed for conflict.

Other Stations: Within Westlake, University Street, and Pioneer Square Stations there are existing conditions which constrain the location of a new duct bank. Near the tunnel portals are existing electrical manholes, train signals and mechanical access doors on the outside wall. Within the center of the station there are existing 26kV ductbanks and signal systems. All of these components would constrain the placement of any underground duct bank or above-grade system within the stations. SCL would need to provide design documents on how the existing infrastructure is maintained and accessed.

5. Life Safety: SCL states that their relaying system will be very fast and would clear a fault within 0.083 seconds with primary zone 1 relays and 0.417 seconds with backup zone 2 relays. We have no details on their electrical protection schemes and relay settings but those intervals usually assume that the fault is a low-impedance connection between line phases or from phase to ground. However, it is very possible that a vehicle derailment or maintenance action could result in a high-impedance fault between phases or from phase to ground. That type of fault, with longer delay, might not clear the line quickly enough to eliminate the hazard to vehicles and passengers. It is concerns such as these that compel DPD and us to recommend a concrete barrier between transitway and high-voltage cables. Sound Transit's 26kV distribution cables are required to be protected by reinforced concrete as discussed below and those are located in the tunnel invert and unlikely to be damaged under any conceivable circumstance.

   Convention Place Station portal rollup doors are a part of the emergency ventilation system for Westlake Station and Pine Street tunnel. A ductbank penetration in this door would have to be evaluated to ensure that ventilation isolation is maintained. Future status of that door and portal once bus operation is excluded from the DSTT is uncertain.

6. Possible Damage to Rail Infrastructure: Although we assume that ground protective relaying for the line would be set to trip very quickly for any fault to ground, there is another possible scenario that concerns us. In the event that a phase conductor is damaged by a rail-supported vehicle, the fault current would pass through the rails, which are not grounded but isolated from ground by rubber rail boots. This rail isolation system could be immediately punctured at multiple points if subjected to a line-to-ground fault. The rail boot is only designed to withstand small voltage differences up to 200 Volts. Although there may be a very small chance of this occurring, the resultant effect to the rail system is catastrophic in that it would require removal of the rail and replacement of all damaged rail boot.

7. Electromagnetic Fields (EMF): Electromagnetic problems with tunnels and tunnel systems are due to two effects. One is electromagnetic interference (EMI) and the second is induction of significant voltages and currents into adjacent metallic materials. The transmission line phases are installed in separate, nonmetallic conduits. By comparison, Sound Transit's 26kV tunnel cable consists of the three phase-conductors tightly bundled together and enclosed in a metallic sheath. With increasing separation of conductors, induction effects increase. This would affect all linear metallic objects in the tunnel including OCS conductors, rails, lighting and other power conduits, signaling cables, fire protection piping, emergency communications radiating cables (Radiax), and linear heat detection circuits. Virtually the only Systems element that would not be affected would be our fiber-optic communications backbone.

   At this time, we cannot evaluate the severity of EMF effects on OCS, Radiax, and signals. Operational problems with induced alternating current into OCS and signal circuits can usually be accommodated. However, installation of our OCS along the E3 Busway and beneath SCL's 230kV overhead transmission line created a personnel shock-hazard due to magnetic coupling with the overhead lines. This requires careful bonding of the OCS and rails before maintenance. (See Operations and Maintenance Impacts below.) Mitigation of induced power-frequency currents in piping and conduits would also have to be evaluated. The effects on our rail-to-ground sensing and protection system are difficult to quantify and would require careful testing. Circulating currents may be a significant source of heating and hazard to maintenance workers. Finally, one additional source of great concern is the creation of circulating currents in the tunnel segment reinforcing grid. At power levels being proposed, circulating currents may be induced in the reinforcing steel resulting in heating of reinforcement and possible spalling of concrete near the transmission cables.

8. Construction Impacts: Although SCL believes that installation of conduit on the tunnel wall would be relatively fast and could be done within a limited construction window, impacts within the station boxes are a different matter. Even if excavation to the depths required were possible, the amount of time during which that work would be ongoing is likely to be lengthy and would impact transit operations – both light rail and bus. Also, in spite of SCL's position that they would have linemen doing the work, we do not recommend that the OCS be left energized during that period. That would pose an unnecessary risk. Night work would involve scheduled shutdown and ST confirmation that OCS is de-energized and grounded, which would reduce the construction window to a maximum of about three hours per night but subject to further restriction depending upon scheduled maintenance activities.

9. Operations and Maintenance Impacts: Operations have reviewed the proposal and have pointed out several problems from both operations and maintenance standpoints. First, is the limitation in working hours noted above. Second, repairs to cables or splices damaged in service would be restricted to the same time limitations. Access for repairs may not be possible immediately due to previously-scheduled activities. Third, any structures such as ductbanks or splicing enclosure near the tunnel portals cannot obstruct the already-restricted space available for maintenance, removal, or installation of emergency ventilation fans in those areas. Those are extremely large motors and fans that require a large amount of maneuvering room to replace should it become necessary. No structures would be allowed in that envelope. Fourth, installation of the cables on the tunnel ceiling may restrict access to the OCS attachment hardware. That hardware is regularly inspected using a bucket truck and the bucket must be free to move in all directions during inspection. The proposed line would not be allowed to foul this working envelope. Fifth, the transmission line is an electromagnetic field source and may introduce further problems with the linear heat detection system. That has been very sensitive to any EMI and they have worked on this issue for several years. When those detectors are triggered, they automatically shut down the tunnel and it takes several hours to recover. Seattle City Light would have to prove that such interference would not occur. Finally, also due to electromagnetic fields there is a potential shock hazard from induced voltages on tunnel equipment, hardware and handrails. That would require special maintenance procedures and could pose a safety hazard for maintenance workers and inspectors. In addition, it could endanger transit passengers who are expected to use Tunnel walkways and handrails for evacuation in an emergency.

Transit operations must have priority in all cases.

10. Acceptance by the Authority Having Jurisdiction: Seattle Fire Department and DPD have joint jurisdiction as to what can be done within the DSTT. They have both expressed serious misgivings about this hazard being inserted into a critical piece of regional infrastructure having broad public exposure. Discussions in the Fire/ Life Safety Meeting on May 21st and July 16th also brought up concerns by other emergency responders from outside jurisdictions who would be responding to DSTT emergencies. King County fire chiefs will be meeting soon and agreed to discuss this and consider whether to go on record against this proposal in letters to both Sound Transit and Seattle City Light.

    Seattle DPD does not like the idea of the line being in the tunnel envelope at all, but as a minimum, they have told us that power conduits would require concrete encasement. Although the National Electrical Code does not cover such an installation, it states that conduits and cables with concrete encasement are considered 'outside' of a structure. For U830, DPD insisted on four inches of reinforced concrete above our 26kV distribution cables in U-Link tunnel inverts. DPD has stated that they will not accept anything less in this case.

Please let me know if you have questions or need further information.

cc: Richard Eacker

LTK Engineering Services

Meeting Minutes

SCL DENNY SUBSTATION TRANSMISSION LINE
SCL Briefing and Discussion: DSTT Route

January 15, 2013 • 10:30 AM
Seattle Municipal Tower – 34th Floor Conference Room
Minutes by Richard Eacker • 1/16/13

Invited Attendees	Attended	Invited Attendees	Attended	Invited Attendees	Attended
Robert Risch, SCL	☒	Richard Eacker	☒		☐
John Barnett, SCL	☒		☐		☐
Nathan Scott, Power Eng.	☒		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐

OBJECTIVE: General electrical discussion/briefing on SCL's concept and ST's DSTT/transit issues.

DISCUSSION ITEMS:

1. *Discussion items below describe SCL's proposed design concept at this time and does not indicate concurrence by LTK.*
2. The proposed SCL line would provide a backup power source for the new Denny Substation north of Denny Way and between Minor and Yale Avenues.
3. DSTT is attractive as a route alternative because it is closely aligned with a direct path between the source (Massachusetts Substation on Massachusetts Street and west of 1st Ave. S.) and the new substation.
4. For the proposed DSTT routing, SCL is considering 230kV, solid-dielectric (polyethylene) insulated cable initially operating at 115kV. The solid-dielectric cable would be the most benign and compact option. Other options such as pressurized, liquid-filled cable and pressurized gas-filled cable are larger in outside diameter and pose other problems.
5. The solid dielectric cables would be run in three individual six-inch nominal (6.7-inch outside diameter) conduits along the perimeter of the tunnel. A fourth conduit is needed for any segments run in concrete, but may not be required where the conduit is exposed on the tunnel wall. Individual phases are installed in separate conduits, so those conduits cannot be metallic.
6. Nathan also discussed an option of running the cables through a fiberglass cable tray along the tunnel wall, but the intrusion into the tunnel may be too extreme. No specific dimensions were discussed.
7. Cable is usually run for about 2000 feet between splice/pull points. Splicing can be done in separate vaults/pits to reduce the vertical impact of a much larger splice vault used for all three phases.
8. Cable is costly – roughly $90/linear foot/phase – and there is an extended procurement time in case cable repair is needed.

9. Robert showed photographs of various DSTT areas to explain their general concepts for routing.
    a. At the north portal of the DSTT entering Convention Place Station, the cable would transition into the concrete driveway coming into CPS from Olive Street and continue north along 9th. At the tunnel portal, they propose to bring conduits up the north wall of the cut-and-cover structure and stay on that north wall to Westlake Station. Details of how to penetrate through the rolling fire-separation door would have to be worked out.
    b. At Westlake, they propose dropping the cable and running it through the station invert. Robert originally indicated they would have to cut about 36 inches deep through the station. Dick Eacker showed a sectional drawing of the Westlake Station box showing how the invert in that station is 8 feet thick with heavy reinforcement top and bottom to support the box walls. Basically, the only area that can be used is a shallow slab that accommodates the rails at the top of the invert.
    c. (Note to Attendees: In thinking this over, I recalled that the top slab was reduced in thickness to something more like 8 inches during the light rail retrofit. 12 inches was allowed originally, but as I mentioned, part of that was used so the rails could be lowered within the station and platforms left as they were.)
    d. At the Westlake west portal, there would have to be a transition so the conduits would run on the tunnel walls. Splicing also presents a challenge since the splices are 20 inches in diameter and would need a fairly large splice vault or box. SCL was thinking of some sort of exposed, angled metallic structure to house and protect those splices at the transition structure.
    e. The remainder of the tunnel would involve similar construction to those discussed above. Splicing vaults or enclosures would be an as-yet-unknown challenge.
10. As mentioned above, individual phases of the line would be installed in separate conduits. Because of this, the conduit runs would have to be carefully braced to handle magnetic forces during a fault event. Fault protection would be done using high-speed relaying so a fault is likely to last only a few cycles, but large mechanical forces occur during that time.
11. Maintenance should be minimal – a simple walk-through every few years and SCL would brief ST maintenance people on things to look for during their maintenance walks just in case damage is evident. Robert mentioned that SCL transmission lines are typically lightly loaded, so life expectancy for this cable would be many decades.
12. Dick brought up the fact that electromagnetic interference from the separated phases is a concern and Sound Transit would have to evaluate the effects on their traction electrification and signal systems. Telecommunications is typically not a concern since it is mostly fiber-optic.
13. On the subject of splicing, Nathan mentioned that it is conceivable that splices might be made on the wall of the tunnel by staggering the splices and spreading the cables through the splicing area. However, the splices require some mechanical protection and details would have to be worked out. Clearances are already restricted in the upper quadrants of the tunnel. They would prefer the cables be located above the lights, but Dick showed the group that tunnel clearances are typically the least at those points. A package of DSTT section drawings was given to Robert.
14. Dick mentioned that NFPA 130 would dictate that the cables be routed in fiberglass-reinforced phenolic conduit since normal fiberglass would not be permitted. Robert said that they were aware of that.
15. In terms of construction sequence and working around the light rail schedule, Robert said that they should have a lot of time before this line is required and that working in a restricted work-window would not be a problem. Also, he said that since the work would be done by licensed linemen trained to work on energized equipment, the tunnel traction power system would not have to be shut down.
16. Dick asked if Seattle Fire Department had been consulted on this issue. Our feedback from Seattle DPD indicates that they would require at least a four-inch thick concrete envelope

protecting conduits and conductors. The Fire Department may have similar requirements since they have jurisdiction in the tunnel segments. Robert said that they have not talked to SFD yet.

ACTION ITEMS:

No.	Description	Action	Status
1.	There is a follow-up meeting Thursday, January 17th to discuss issues at a higher level with ST management. Robert Risch will attend that meeting.	None	Pending
2.			
3.			

Distribution: Attendees
Aida Asuncion Justin Garrod Lloyd Mack

MEETING MINUTES May 21, 2013
FIRE/LIFE SAFETY COMMITTEE

LOCATION: Union Station, Santa Fe Conference Room
NEXT MEETING: Tuesday, July 16, 2013
MEETING CONVENED: 10:00 AM, Hamid Qaasim presiding

MEETING ATTENDEES:		
SOUND TRANSIT	**LOCAL JURISDICTIONS**	**KING COUNTY METRO**
Aviles, Gary	SeaTac FD – Napier, Jon	Rhoads, Terry
Bennett, Paul	Seattle FD – English, Gary	
Eacker, Richard	Seattle FD – Nelsen, John	
DeLalla, Craig	Seattle FD – Ziller, Dave	
Haupt, Miles	Sno County FD #1 – Westfall, John	**WSDOT**
Moniz, Andy		Mike Flood
Overly, Gene		
Papen, Vivian		**PMOC**
Qaasim, Hamid		Terry Esteb
Riley-Hite, Mari		
Sleavin, John		
Stahl, Dana		

	MEETING AGENDA ITEMS	RESPONSIBLE PARTY
1.	Review of Action Items	All
2.	East Link Tunnel Ventilation	Paul Bennett
3.	South Link Safety Certification	Vivian Papen
4.	NFPA 130 Comments	All
5.	SCL Proposed 230kV Cross Country Transmission Lines in DSTT	Hamid Qaasim

Handouts

1. Action Item List
2. E-Link FLS Update Powerpoint
3. FLSC Members Compiled Comments List on NFPA 130 Revision
4. SFD NFPA 130 Revisions, newest revision

MINUTES

1. **Review of Action Items:**

#82 – Fire Protection on the Floating Bridge: Paul Bennett reported on design updates on ventilation, egress and standpipe location for E-Link depicted on handout #2. A preferred alternative has not yet been decided; Operations and Safety issues continue to be worked out and the Fire Departments have observed progress. Discussion included tunnel geometry, Mercer Island & Mt. Baker Tunnels layout, existing ventilation systems and ventilation alternatives being considered, egress analyses, and standpipe options being considered.

Alternatives for ventilation systems in Mercer Island & Mt. Baker Tunnels are; 1) Separate longitudinal ventilation systems by constructing a wall in the center of the tunnel. 2) Twin track longitudinal system without center wall, and 3) Twin track extraction system using fans for exhaust.

Egress analyses for Mt. Baker Tunnel Mercer Island Tunnel measured passenger loading crush load, train exiting via all doors with additional exit walkways, maneuvering the LRV floor height, and tunnel exiting in both directions. Based on the analyses, the Mercer Island Tunnel using an extraction system and evacuation in both directions is estimated to evacuate in approximately 11 minutes. Mt. Baker Tunnel using twin track longitudinal system evacuation is estimated at approximately 14 minutes. This meets the NFPA 130 requirements for evacuation time. However there is some concern regarding trains in opposite directions being in the same tunnel at the same time when a fire occurs and the resulting evacuation necessary. It was recommended that a study be done that evaluates how often this scenario occurs.

Studies to meet the NFPA 130 requirement for standpipe to supply water on the floating bridge were conducted and considered how to provide water to the bridge as well as distribution of water on the bridge. Alternatives include; 1) automatic utility fed hydrant system, 2) automatic utility filled hose valve system, 3) fire pump fed hydrant system, 4) dry hose valve system, 5) draft water from lake, 6) mobile water tanker truck, or 7) do nothing. All of these are viable options to get water to the bridge, the problem remains how to distribute the water on the bridge. Due to structural constraints, weight/balance requirements, the dynamic envelope of the LRV, and WSDOT's 10' wide maintenance road, options 1 through 5 are not viable. Currently the preferred alternative is option 6, the mobile water tanker truck.

ST will meet with WSDOT in June 2013 to discuss whether their tunnel fans are available for ST use, what the structural impacts are if extraction system is used, and sharing power for center roadway. Preliminary Hazard Analysis will be underway June 2013. Presentation to the East Link Leadership team will take place June 2013 where an alternative recommendation may be made.

This action will remain open for further updates.

#92 – LRV Headlight used for Emergency Egress: Meetings with all related Fire Districts have been held and agreement has been reached that the LRV headlight provides sufficient light for emergency egress on the elevated guideway. The SOP will be revised when the final car of the fleet is retrofitted. This action item is closed.

#94 – System-wide Confidence Testing: KCM and SFD met to confirm that adequate confidence testing is being performed and reported. SFD reported that KCM's documentation of the program is satisfactory and periodic updates have been provided to SFD. This action item is closed.

2. **East Link Tunnel Ventilation:**

This item was discussed as part of Action Item #82 (above).

3. South Link Safety Certification:

Miles Haupt reported that overall design is approximately 70%. Utility relocation has begun and foundation work is expected to begin in July. The Parking Garage RFQ will be submitted this month. Roadway improvements, including upgrading the intersection at S. 200th and Military Rd.

Vivian Papen reported Safety Certification status for South Link. Preliminary Hazard Analysis (PHA) was performed May 2013, which revealed several hazards not previously recorded. ST and HDR are collectively preparing a PHA Report. A follow up meeting may be required to determine mitigation measures. HDR is actively working on completing the Criteria Conformance Checklists, subsequently PCL will prepare the Specification Conformance Checklists and Integration Tests reports. Operations will take part with SOP updates (if necessary), and Fire Departments will participate in safety drills (if necessary). All this data will be compiled to create the Safety Certification Conformance Verification Report.

4. NFPA 130 Comments:

Handout #3 is the compiled comments of FLSC members on the "NFPA 130 as amended by SFD" provided by SFD last month.

John Nelsen, SFD, explained that Handout #4 is current and approved version of revisions to "NFPA 130 as amended by SFD", and that it differs from the version that was reviewed and commented on by the FLSC members. The approved version includes only the previously accepted amendments from 2010. The version reviewed by the FLSC members included new verbiage that will be in the next edition of the NFPA 130, 2014, which will not be available for some time. The comments will not be considered at this time due to time constraints to incorporate comments into next NFPA 130 edition and the new SFD Fire Code, and that future light rail design work will not be within the SFD jurisdiction. Action Item #95 was assigned to Mari Riley-Hite to schedule a meeting with SFD, SnoCoFD, ST SQA, and ST Systems to discuss the upcoming changes to 2014 NFPA 130 and the comments that were provided by FLSC members. Action Item #96 was assigned to Mari Riley-Hite to schedule a meeting with BFD regarding NFPA 130 requirements related to station exiting and smoke exhaust.

Not on the Agenda

Dana Stahl recommended a table top drill for joint Emergency Response to an incident in the South End. Action Item #97 was assigned to schedule a safety drill at SeaTac Station for autumn 2013. Action Item #98 was assigned to schedule meetings at LCC Training Room with the Fire Districts to discuss joint response to a major event, with a follow up table top exercise.

5. SCL Proposed 230kV Cross Country Transmission Lines in DSTT:

There was discussion regarding proposed action by Seattle City Council that SCL use the DSTT to SCL has two transmission lines currently serving an area at the SW corner of Seattle, but needs back up power. A new substation is going in on Denny for SLU area need back up. They suggested using the DSTT as a conduit for the additional 230 kV transmission lines. ST is required to meet City electrical standards which require our 26kV cable protected under concrete in the invert. The proposed plan for the 230kV Transmission Lines involves three large cables in conduit on the tunnel wall. Other concerns include the location and routing of the transmission lines in the stations, and the pole boxes, which are required at every station, are approximately 20-feet long. Personal safety of rail passengers in the event of a derailment and of maintenance crews' possible contact with the transmission lines is of utmost importance. The general consensus of the FLSC members was that implementing this project would not be prudent. ST will prepare a Hazard Analysis in defense of this position. It was recommended that SCL be asked to provide supporting evidence that implementing this configuration in the DSTT poses no safety risks to transit patrons, vehicles and/or maintenance workers (the proposal prepared by PB for the viaduct project does not relate to the DSTT). There will be further discussion on this topic in the future

Minutes Recorded & Written by: Mari Riley-Hite
Project Admin Specialist, Safety & Quality Assurance (SQA)

Minutes Reviewed & Approved by: Hamid Qaasim
Safety and Quality Assurance (SQA) Director

MEETING MINUTES July 16, 2013
FIRE/LIFE SAFETY COMMITTEE

LOCATION: Union Station, Santa Fe Conference Room
NEXT MEETING: Tuesday, September 17, 2013
MEETING CONVENED: 10:00 AM, Hamid Qaasim presiding

MEETING ATTENDEES:		
SOUND TRANSIT	**LOCAL JURISDICTIONS**	**KING COUNTY METRO**
Bennett, Paul	SeaTac FD – Hill, Mark	Sherry, Keith
Bennett, Rae	SeaTac FD – Napier, Jon	Smith-Jones, Vicki
Bisping, Lori	Seattle FD – English, Gary	
Clark, Joshua	Seattle FD – Havner, J.M.	
Eacker, Richard	Seattle FD – Nelsen, John	**WSDOT**
Haupt, Miles	Seattle FD – Ziller, Dave	
Moniz, Andy		
Papen, Vivian		**PMOC**
Qaasim, Hamid		
Riley-Hite, Mari		
Stahl, Dana		
Walser, John		

	MEETING AGENDA ITEMS	**RESPONSIBLE PARTY**
1.	Review of Action Items	All
2.	Safety Drills Discussion	Dana Stahl/Lori Bisping
3.	South Link Safety Certification	Vivian Papen
4.	SCL Proposed 230kV Cross Country Transmission Lines in DSTT	Hamid Qaasim
5.	NFPA 130 (2010) Tunnel Requirements Code Review	John Nelsen/Gary English
6.	Bellevue Transit Center Station Ventilation	John Walser
7.	Emergency Response/Evacuation Plans	Miles Haupt/Paul Bennett

Handouts

1. Action Item List
2. (Draft) 3 Year Drill & Exercise Plan
3. SQA (Draft) Investigation Report - Safety Concerns Over Installation of 230kV in DSTT

MINUTES

1. Review of Action Items:

#82 – Paul Bennett reported that the ST has completed an internal review and written a report which identifies fire protection alternatives on the Floating Bridge. The report will be forwarded to the Fire Departments for comments this month. This action will remain open for further updates.

#95 – This action item was discussed as part of agenda item #5 today.

#96 – This action item was discussed as part of agenda item #5 today. This action item is deferred.

#97 – This action item was discussed as part of agenda item #2 today and, pursuant to that discussion, this action item is closed.

#98 – A planning meeting to determine requirements for a joint response to a major event was scheduled for Tuesday, July 23, 2013. This exercise will be an opportunity for the North and the East Side Fire Districts to become familiar with Light Rail procedures during an emergency as well as work together with other Fire Districts. A larger regional response is becoming more imminent as the Light Rail System expands into more districts. Dana Stahl will incorporate this activity into the Drills and Exercises Plan (attachment #2). This action item is closed.

2. Safety Drills Discussion:

Dana Stahl referred to handout #2, a summary of Sound Transit drills and exercises planned for the next 3 years.

S-Link: 2013 – A Tabletop drill will be scheduled for October to test new Run Card. SeaTac FD will review their training schedule to coordinate this drill accordingly. ST will schedule the drill when SeaTac FD confirms a date.
S-Link 2014 – A “Boots-on-the-Ground” drill will be scheduled for south of the SeaTac Airport Station on the elevated guideway. This drill will include a rescue train scenario will be included. SeaTac FD will include this drill on their training calendar.
S-Link 2015 – A “Boots-on-the-Ground” drill will be scheduled for fire at or near the Angle Lake Station, requiring a rescue train.

Seattle 2013 – A Tabletop drill will be scheduled this year for a scenario involving release of a biological agent in an underground station.
Seattle 2014 - A “Boots-on-the-Ground” drill will be scheduled to be held in the Beacon Hill Tunnel Station to test communication with Unified Command during evacuation of the station.
Seattle 2015 - A “Boots-on-the-Ground” drill will be scheduled to be held in the Beacon Hill Tunnel to test passenger evacuation and the use of a rescue train. There was some discussion about using a DSTT station for the evacuation drill instead, because the evacuation procedure for Beacon Hill is unique. Budget and schedule concerns may dictate that decision.

3. South Link Safety Certification:

Vivian Papen reported that a Preliminary Hazard Analysis (PHA) was performed in May 2013 and the PHA is expected to be finalized August 2013. SeaTac FD, Port of Seattle FD, Operations, and Systems Engineering will be included in the meeting to review and finalize the PHA. Safety Certification Training will be provided for the Construction Management Team. The Spec Conformance Checklists for S. 182nd-NAE Line Detour IFC Submittal will serve as a pilot for inputting data into Safety Link by the CM Team.

4. SCL Proposal for 230kV in DSTT:

Hamid Qaasim reported that ST SQA has prepared a Draft Investigation Report (attachment #3) regarding their position on safety concerns with SCL's proposal to install 230 kV in the DSTT. Tracy Reed reported SCL finished their environmental scoping in December and that installing the new transmission line in the DSTT was one of three alternatives. Since that time, they dropped from the study the alternative to route the line up Capitol Hill, and added an alternative for underground installation "next to I-5". In February 2013 SCL determined that the DSTT route alternative was "feasible" and initiated preliminary engineering work by their consultant (POWER). Kathleen Fendt is the lead on their SEPA environmental review process. ST has requested part of the EIS records from Kathleen Fendt. Sound Transit DECM is completing a due diligence study of the DSTT route alternative and, when the study is complete later this month, intends to write SCL a letter with our independent evaluation of feasibility. LTK, ST's Systems Engineering consultant, will review both the DECM report and the SQA report for inclusion in their report. The FLS Committee members expressed concern for the facilities staff and passengers who would be exposed to this additional hazard, and they do not support this option. Discussion included: per the building and electrical requirements, installing 230kV in the DSTT would effectively change the tunnel "use" determination from a transportation tunnel to a utility corridor/vault. The SR-99 tunnel is a more appropriate location for this line since it already includes a utility corridor separated from the public. SCL had proposed installing this line in the SR-99 tunnel, but the proposal was not accepted. The DSTT does not have a utility corridor and if this proposal was not accepted for the SR-99 it should not even be considered for the DSTT where it does pose life/safety risks. Electrical standards regarding unqualified electrical workers access to high voltage areas may prohibit this type of configuration due to the tunnel maintenance crew responsibilities to access the equipment throughout the plenum and crawl spaces. Electrical code also requires that high voltage transmission lines of this proportion are embedded under 7 - 9 feet of cover or located overhead with approximately 20 feet separation. It was recommended that SCL provide engineering proof of equivalency of separation inside the tunnel as a verification of safety. NFPA 130 does not specifically address high voltage requirements in an occupied space because it has not ever been considered as a reasonable, viable option by any transit district. The Fire Chiefs present at the FLS meeting do not support this proposal and will discuss this proposal at the upcoming KC Fire Chiefs' Meeting and indicate their concerns. The Draft EIS is currently being prepared. Objections can be made as safety related comments in the Public Safety Section of the EIS. Members stated that they would definitely indicate their lack of support and identify additional items of concern during the public comment period. SFD will contact SCL environmental lead and ask to be included in their EIS review process.

5. Bellevue Transit Center Station Ventilation:

John Walser displayed a map of the alignment and reported status of the design. The downtown Bellevue Tunnel is 2537 ft long, cut-and-cover segments at both ends of the tunnel. Ventilation requirements are addressed with niches at the north and south ends of the tunnel with stacked jet fans, and jet fans over the ceiling at the tunnel midpoint, without a vent shaft. Smoke will be exhausted out the north end or south end of the tunnel depending on the train's location. A fire-rated center demising wall will divide the tunnel and includes 3 fire-rated doors at approximately 600 ft apart. There was some discussion regarding the doors being interlocked with traction power and signals to stop trains if doors are opened. However, if the doors are interlocked with traction power to shut down power when the door is breached, a rescue train scenario is not an option. Due to cost saving negotiations, the tunnel station has been moved and reconfigured to be, in effect, a "tunnel, at-grade, elevated station". Station entry plaza is below the guideway, intermediate level for power and communications, and platform level begins at grade and launches into an elevated structure where it crosses 112th St. One end of the station is essentially an open air station, similar to the Mt. Baker Station, the other end of the station more like a tunnel station. CFD analyses are currently being developed for smoke and exiting. The CFD studies are expected to be complete by the end of August 2013 and will be reviewed with Bellevue FD and Building Dept.

6. NFPA 130 Code (2010) Tunnel Requirements:

Underground station ventilation requirements include maintaining tenability for occupants in the trainway for a minimum of 1 hour. The goal is to provide enough air volume and pressure to prevent smoke back layering. The design requirement for maximum heat load is typically driven by one rail car, which is roughly 13 megawatt design fire size for the 93 ft cars. Due to recent studies of passenger baggage adding to the heat load, SFD endorses raising that maximum heat load requirement. Regarding multiple trains in a ventilation zone between vent shafts, the NFPA 130 requirement is moving toward becoming more performance based with fewer prescriptive requirements. Analyses demonstrating there is no negative impact with two trains in the same ventilation zone, and/or modification of operational procedures and signaling procedures can be used as mitigation. One of three options for the Mt. Baker Tunnel design concept has no center wall, 2 trains going opposite directions will be in the same ventilation zone, however, SFD has not yet seen this design configuration. Preliminary Hazard Analysis for the Mt. Baker Tunnel is underway and this scenario is one that is being evaluated. Modeling is demonstrating that trains will only be in the tunnel for approximately 45 seconds.

The Mt Baker Tunnel walkway is located in the center of the tunnel and on both sides of both trains, which will accommodate NFPA 130 requirements for exiting for trains in the opposed direction.

John Nelsen, SFD reported that local NFPA 130 amendments that currently before the NFPA Council for approval, are the same as those we have used for the last couple of years. The 2013 edition of the NFPA 130 standard is expected to be published in August – September 2013. After it is published, work will begin towards incorporating new amendments from comments provided earlier.

7. Emergency Response/Evacuation Plans:

A plan is in work to have the S-Link RE and CM team work with the SeaTac FD to develop an emergency response plan in the event of an emergency on the alignment. Miles Haupt reported that emergency response communication has been discussed with ST, City of SeaTac, PCL and Port of Seattle, with resulting action required to improve notification trees.

Paul Bennett deferred this discussion of an emergency response plan for East Link until sometime in the future, as a preferred configuration has not yet been decided. Three alternatives are being considered and each one will require a different emergency response plan.

U-link Tunnel Rescue and emergency response plan has been in place for some time with no changes.

Not on the Agenda

DECM issued a new revision to the Design Criteria Manual.

Minutes Recorded & Written by: Mari Riley-Hite
Project Admin Specialist, Safety & Quality Assurance (SQA)

Minutes Reviewed & Approved by: Hamid Qaasim
Safety and Quality Assurance (SQA) Director

APPENDIX D

Planned Infrastructure and Development Projects

Several major infrastructure and development projects will be constructed in the area affected by the distribution and transmission line networks. Table D-1 summarizes the major infrastructure projects that are expected to be completed during the Denny Substation Project construction period (also see Figure D-1).

Table D-1. Planned Infrastructure Projects

Project Name	Description	Expected Completion	Agency
Alaskan Way Viaduct Replacement Project	Replace the AWV with a bored tunnel. Key work that would affect South Lake Union area includes construction of the north portal of the tunnel, decommissioning the Battery Street Tunnel, and reconstructing the north surface streets across SR 99.	2015 – Tunnel open 2016 – Viaduct demolition and Battery Street Tunnel decommission 2018 – Surface street complete	WSDOT
Sound Transit Link Extension to University of Washington	Extend Link light rail from downtown Seattle to University of Washington at Husky Stadium.	2016	Sound Transit
Sound Transit Link Extension to Northgate	Extend Link light rail to Northgate. It is expected that buses will need to be removed from the DSST with more frequent light rail service associated with this extension.	2021	Sound Transit
Sound Transit East Link Extension to Bellevue	Construct new Link light rail line to Bellevue, connecting to the existing Link light rail line at the International District/Chinatown station.	2021 (target date)	Sound Transit
First Hill Streetcar	Construct new streetcar line from Pioneer Square to Capitol Hill. Alignment crosses I-5 at Jackson Street.	2014 (Spring)	SDOT
Mercer West Project	Widen Mercer Street between 5th Avenue and Dexter Avenue and convert to two-way traffic. Convert Mercer Street and Roy Street west of 5th Avenue to two-way traffic.	2015	SDOT

AWV = Alaskan Way Viaduct; DSST = Downtown Seattle Transit Tunnel; I-5 = Interstate 5; SDOT = Seattle Department of Transportation; SR = State Route; WSDOT = Washington State Department of Transportation

Source:

Washington State Department of Transportation (WSDOT). 2013. Construction Hotspot Map and Schedule Database. Available: http://www.wsdot.wa.gov/Construction/Planning/2014#Seattle. Accessed: August 12, 2013.

Sound Transit. 2013. Projects and Plans. Available: http://www.soundtransit.org/Projects-and-Plans. Accessed: August 12, 2013.

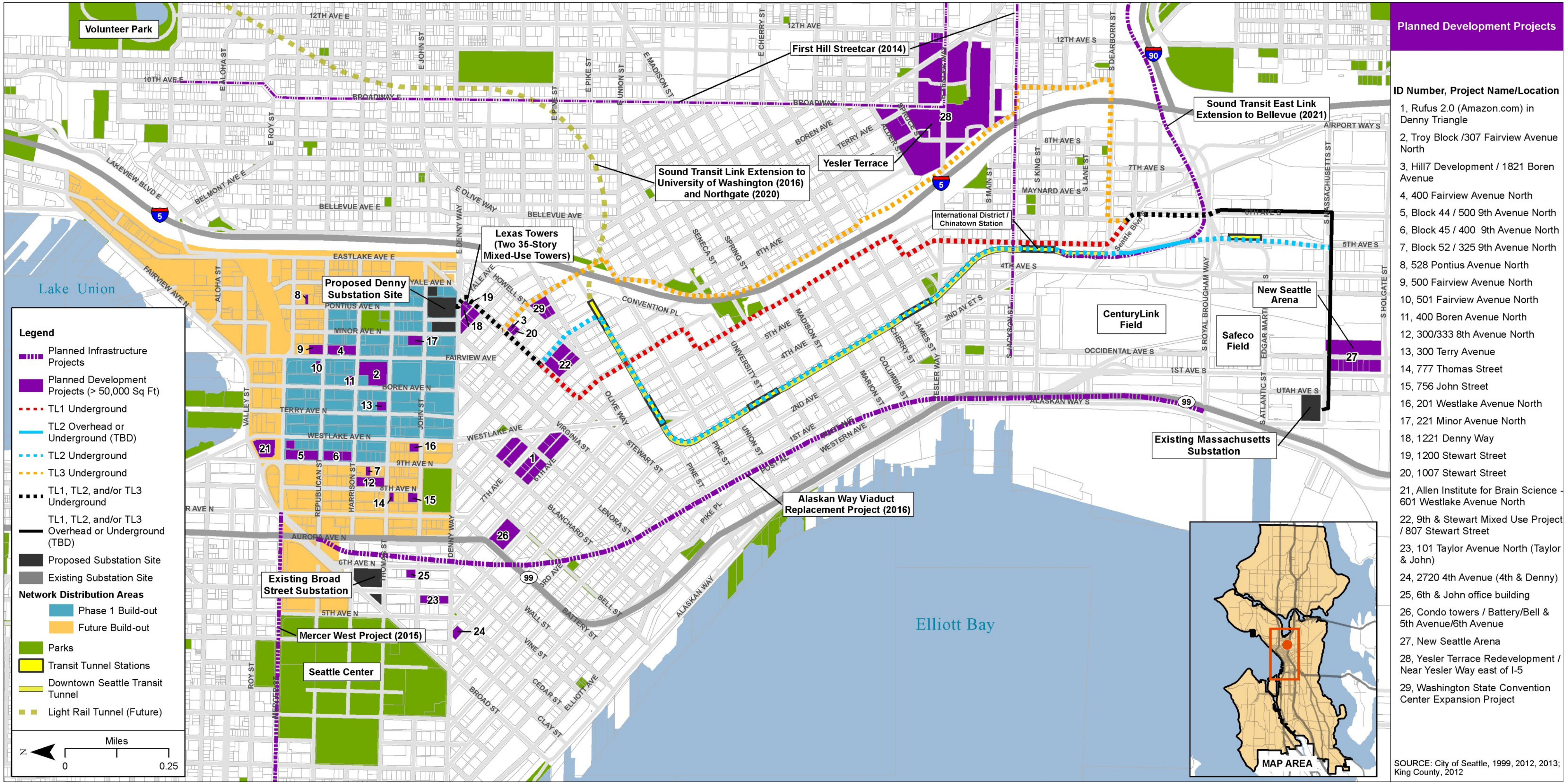
There are many planned development projects within the Denny Substation Project vicinity. Large projects (more than 50,000 square feet of space) that are planned as of September 2013 are summarized in Table D-2 (also see Figure D-1). The list indicates the substantial number of projects that could be under construction concurrent to the distribution or transmission line systems and may require coordination for elements such as street use permits and staging areas.

Table D-2. Planned Development Projects

ID Number	Project Name/Location	Description
1	Rufus 2.0 (Amazon.com) in Denny Triangle	Three new office towers
2	Troy Block /307 Fairview Avenue North	New office building
3	Hill7 Development / 1821 Boren Avenue	New hotel and office buildings
4	400 Fairview Avenue North	New office building
5	Block 44 / 500 9th Avenue North	New office building
6	Block 45 / 400 9th Avenue North	New office building
7	Block 52 / 325 9th Avenue North	New office building
8	528 Pontius Avenue North	New apartment building
9	500 Fairview Avenue North	New biomed / office building
10	501 Fairview Avenue North	New office building
11	400 Boren Avenue North	New mixed use/apartment building
12	300/333 8th Avenue North	New office building
13	300 Terry Avenue North	New hotel
14	777 Thomas Street	New apartments with retail
15	756 John Street	New mixed-use low-income housing
16	201 Westlake Avenue North	New apartment building
17	221 Minor Avenue North	New apartments/mixed use
18	1221 Denny Way	New apartment building
19	1200 Stewart Street	New hotel and apartment towers
20	1007 Stewart St	New office building
21	Allen Institute for Brain Science - 601 Westlake Avenue North	New biotech building
22	9th & Stewart Mixed Use Project / 807 Stewart Street	New convention hotel plus residential
23	101 Taylor Avenue North (Taylor & John)	New mixed use building
24	2720 4th Avenue (4th & Denny)	New mixed use tower
25	6th & John office building	New office building
26	Condo towers / Battery/Bell & 5th Avenue/6th Avenue	New condominium/mixed-use tower
27	New Seattle Arena	New Basketball/Hockey Arena
28	Yesler Terrace Redevelopment / Near Yesler Way east of I-5	Large redevelopment with residential, office, retail, and social services
29	Washington State Convention Center Expansion Project	Expansion of existing Convention Center.

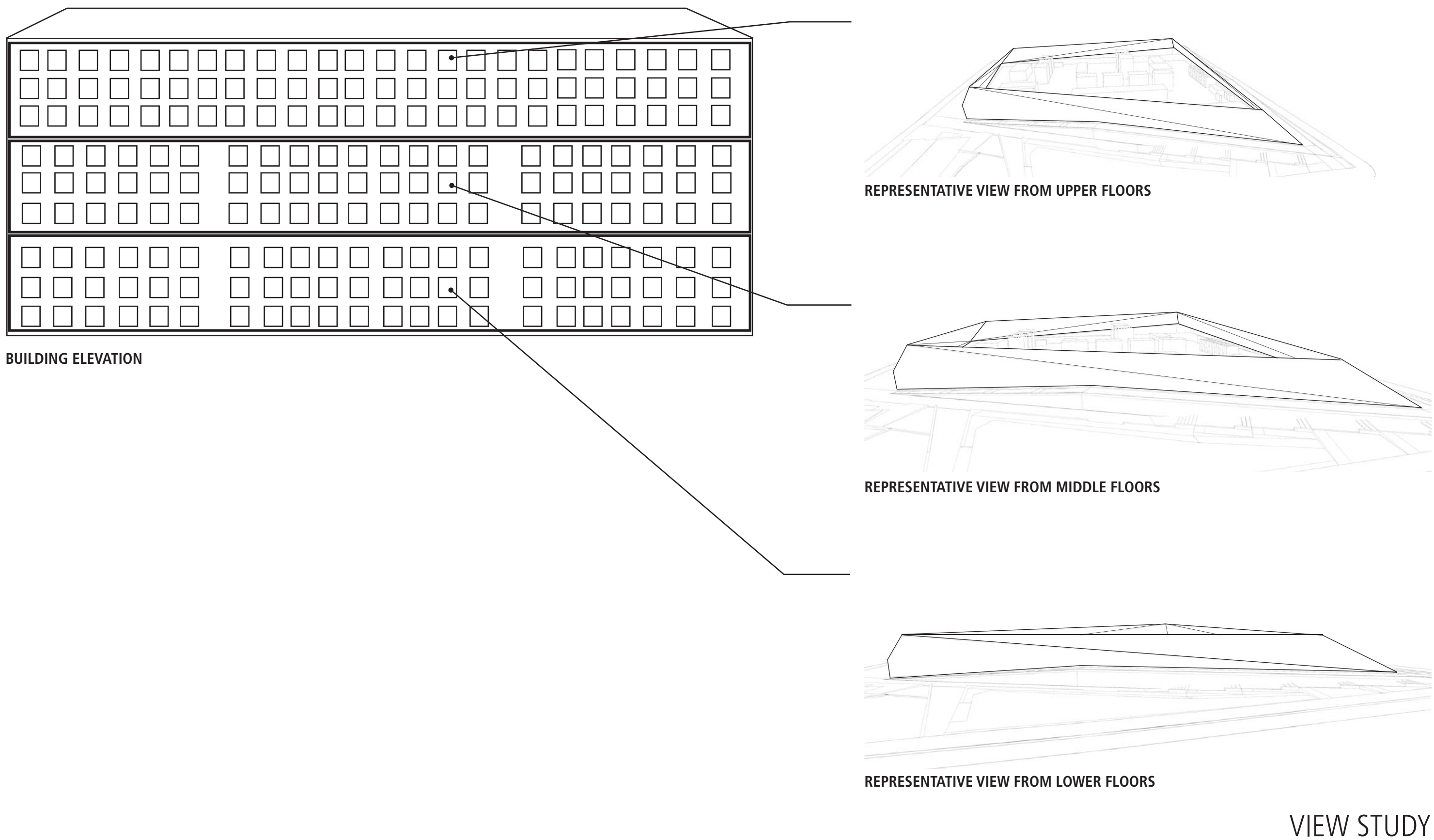
Source: Downtown Seattle Association, Seattle Department of Transportation, and Heffron Transportation, Inc. Downtown Access Strategy, Phase 1, Context Setting: Projects to be Constructed in the Next 10 Years, September 25, 2013.

Figure D-1. Planned Infrastructure and Development Projects



APPENDIX E

Private Views of Substation Yard



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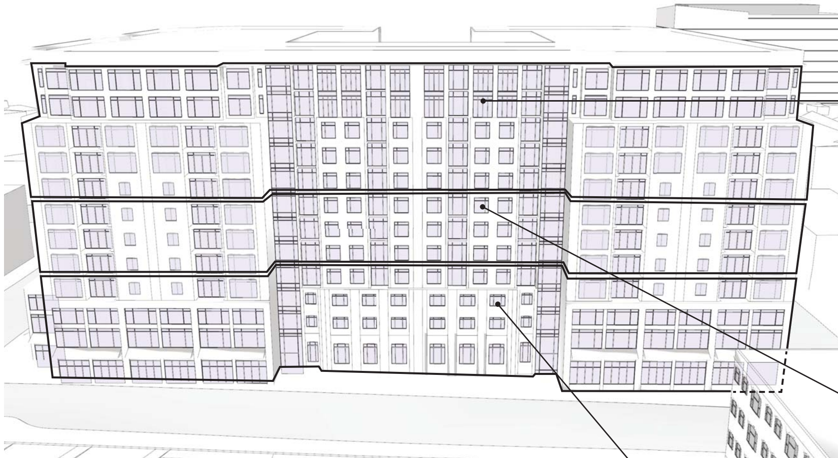
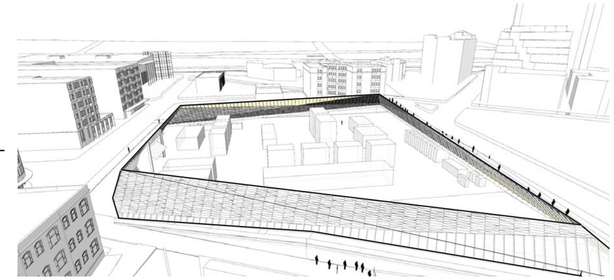
SOURCE: NBBJ, 2013.

Appendix E- 1

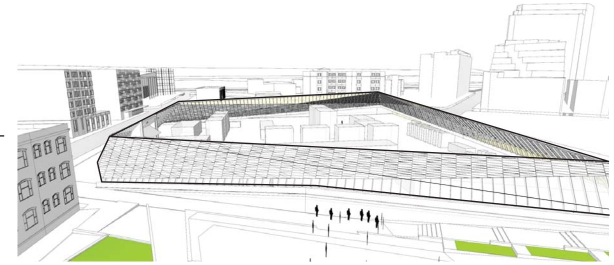
Private Views of Substation Yard

Seattle, Washington

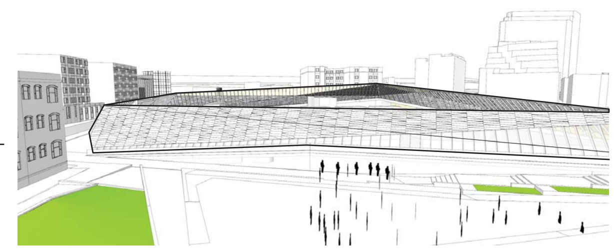




REPRESENTATIVE VIEW FROM FLOORS 7-11



REPRESENTATIVE VIEW FROM FLOORS 5-7



REPRESENTATIVE VIEW FROM FLOORS 1-4

VIEW STUDY - MIRABELLA

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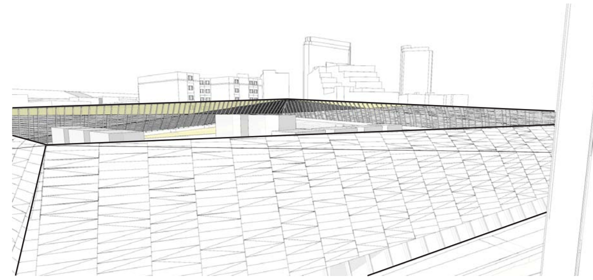
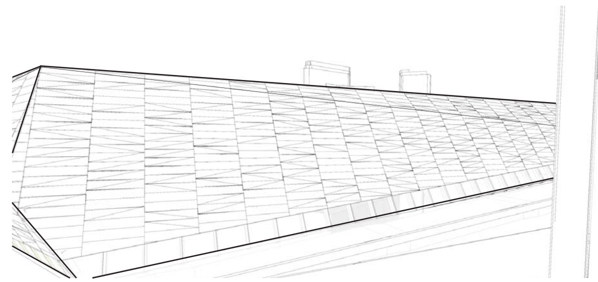
SOURCE: NBBJ, 2013.



REPRESENTATIVE VIEW FROM FLOOR 3



REPRESENTATIVE VIEW FROM FLOORS 1-2

VIEW STUDY - BREWSTER

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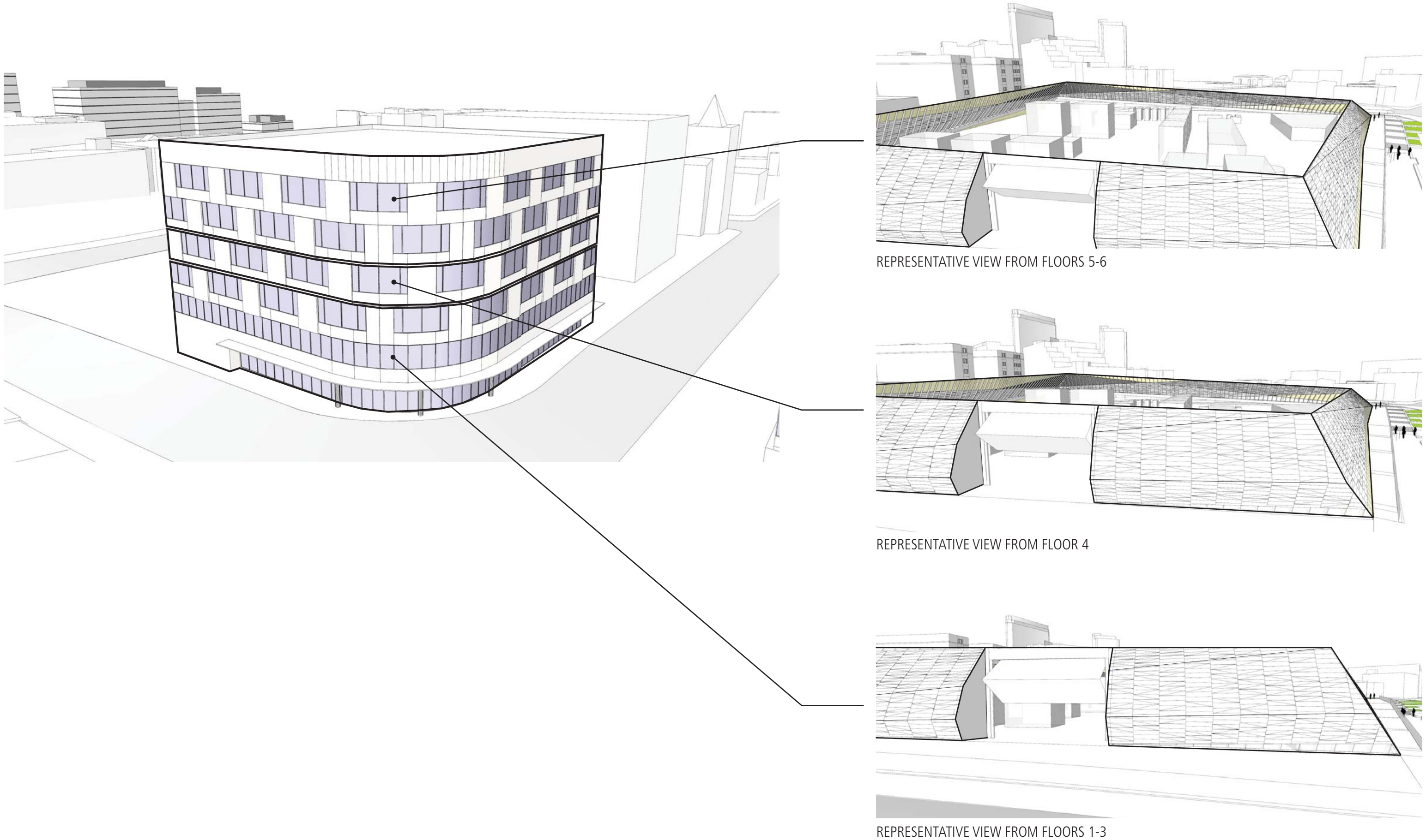


VIEW STUDY - SCCA

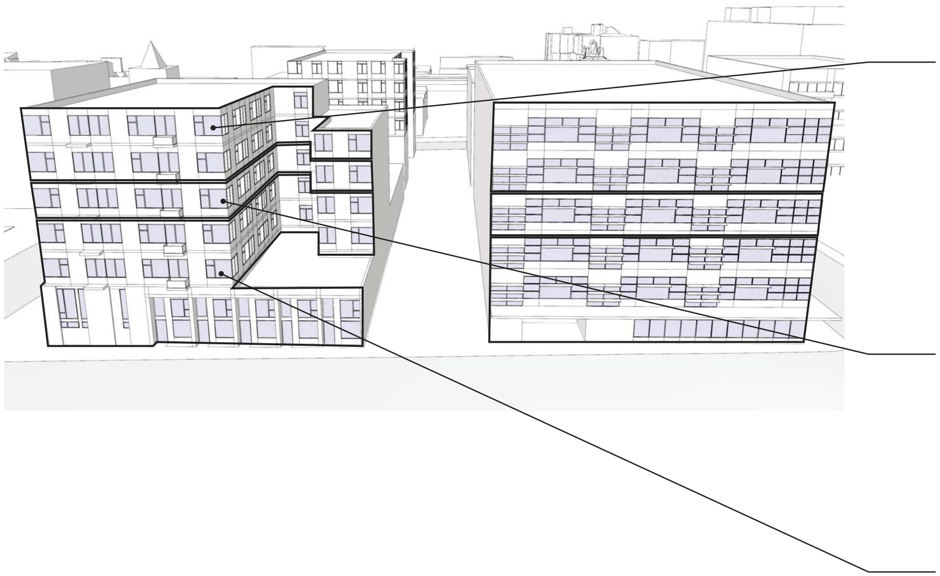
SOURCE: NBBJ, 2013.

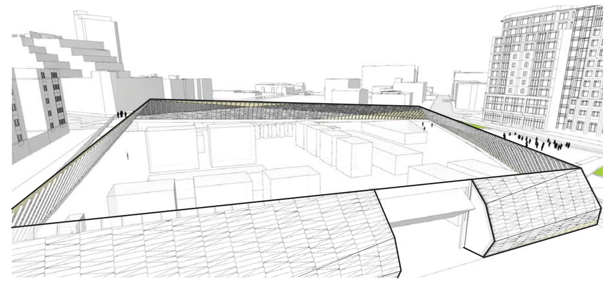
Denny Substation . 120792

Appendix E- 4

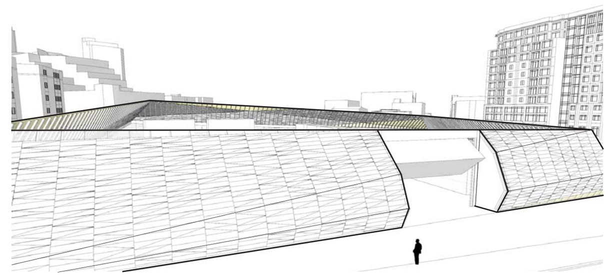
Private Views of Substation Yard

Seattle, Washington

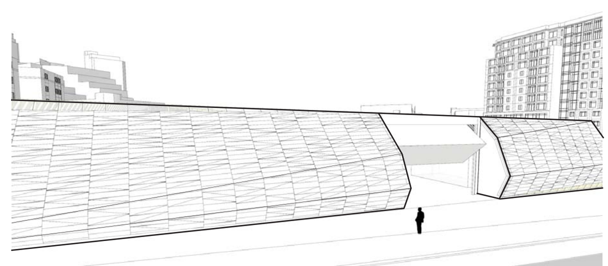




REPRESENTATIVE VIEW FROM FLOORS 5-6



REPRESENTATIVE VIEW FROM FLOOR 4



REPRESENTATIVE VIEW FROM FLOORS 1-3

VIEW STUDY - ALLEY 24

SOURCE: NBBJ, 2013.

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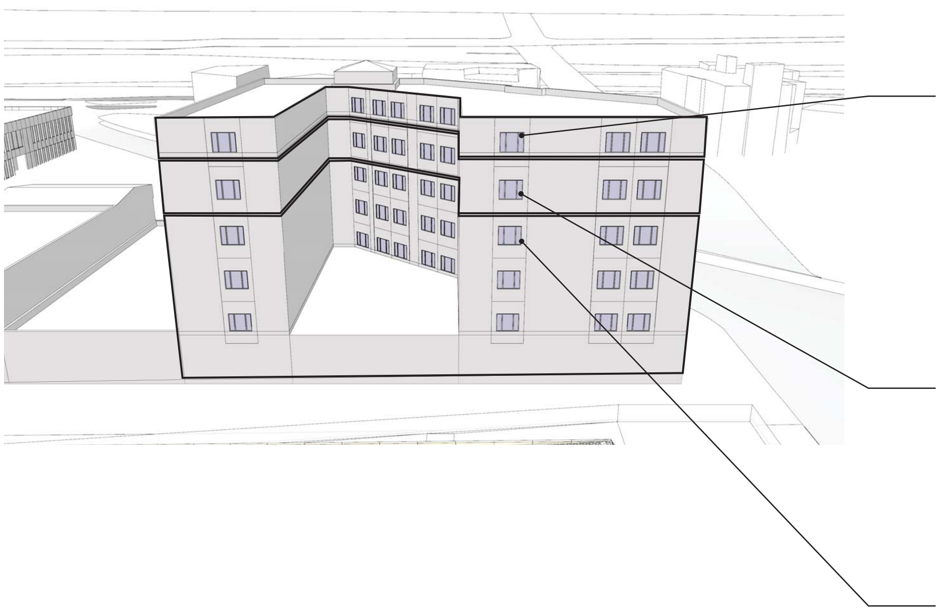
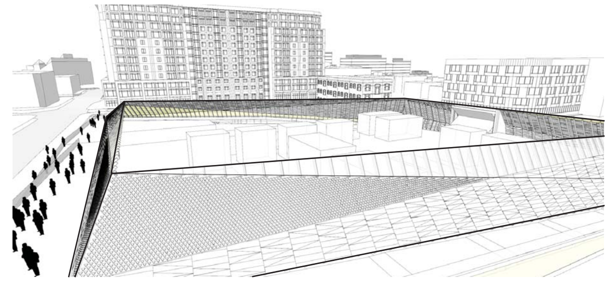
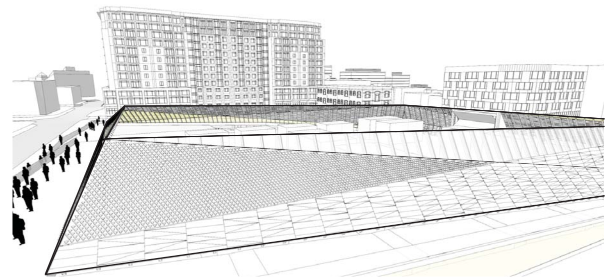
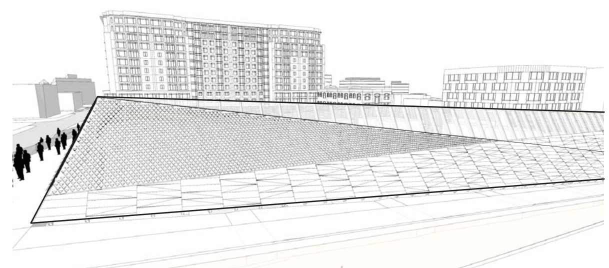




REPRESENTATIVE VIEW FROM FLOOR 6



REPRESENTATIVE VIEW FROM FLOORS 5



REPRESENTATIVE VIEW FROM FLOORS 1-4

VIEW STUDY - COLWELL

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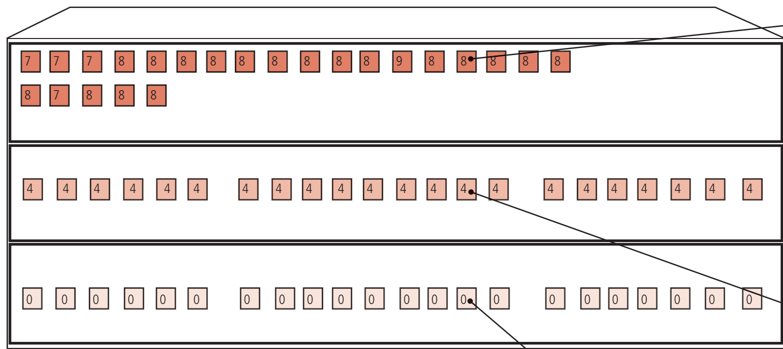
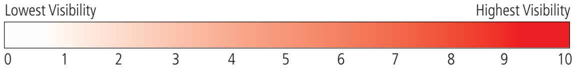
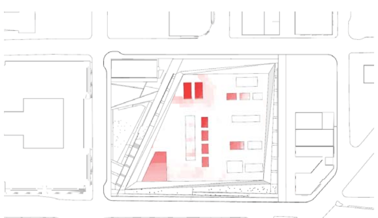
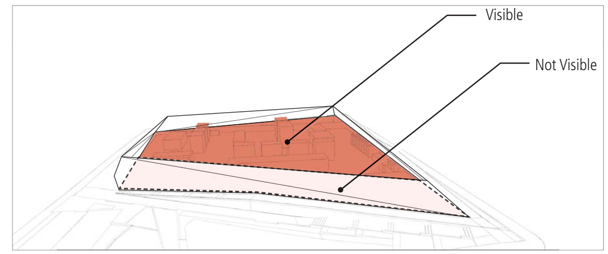


Numbers are scaled from 0-10 to indicate windows with highest visibility of yard to lowest visibility of yard

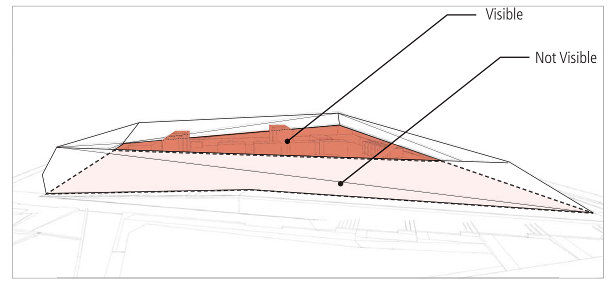




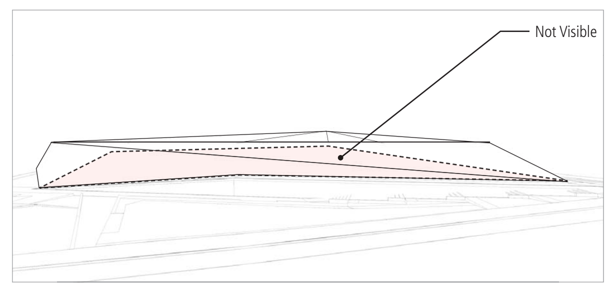
Gradient indicates areas of yard that are most visible to least visible from building



REPRESENTATIVE VIEW FROM UPPER FLOORS



REPRESENTATIVE VIEW FROM MIDDLE FLOORS

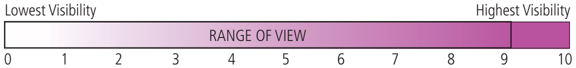


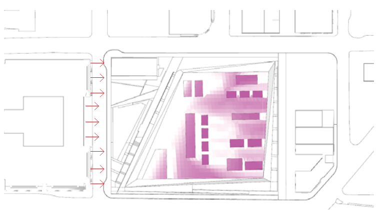
REPRESENTATIVE VIEW FROM LOWER FLOORS

VIEW ANALYSIS

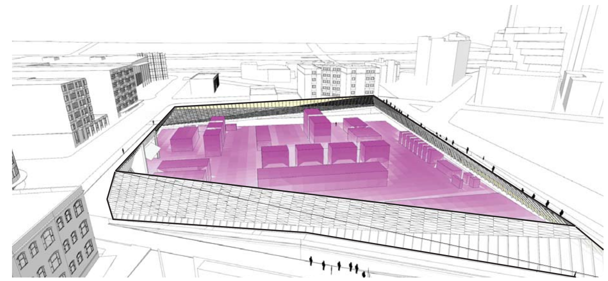
SOURCE: NBBJ, 2013.

VISIBILITY OF SUBSTATION YARD

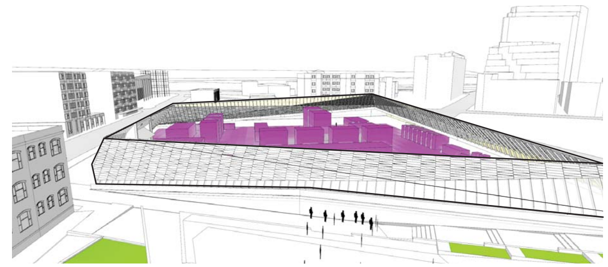




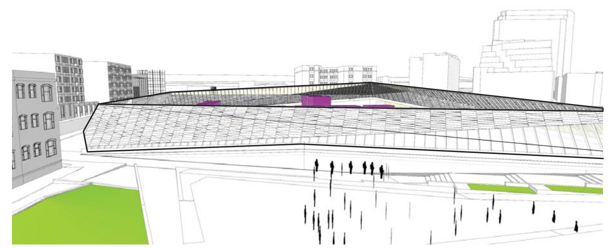
OVERALL VISIBLILITY FROM MIRABELLA



REPRESENTATIVE VIEW FROM FLOORS 7-11



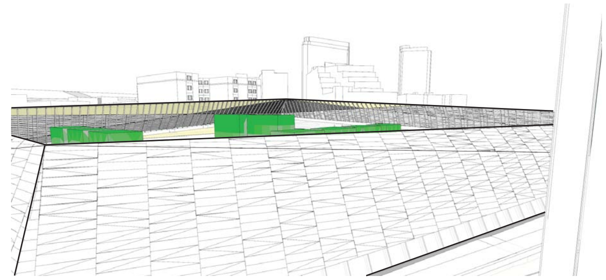
REPRESENTATIVE VIEW FROM FLOORS 5-7



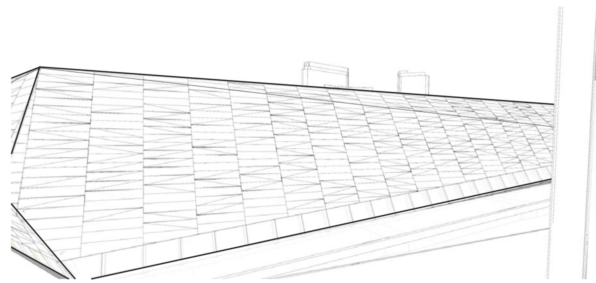
REPRESENTATIVE VIEW FROM FLOORS 1-4

VIEW ANALYSIS - MIRABELLA

SOURCE: NBBJ, 2013.



REPRESENTATIVE VIEW FROM FLOOR 3



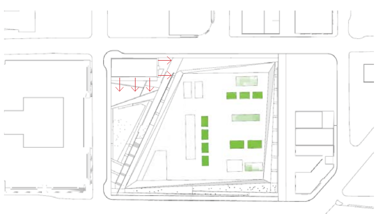
REPRESENTATIVE VIEW FROM FLOORS 1-2

VISIBILITY OF SUBSTATION YARD

Lowest Visibility — Highest Visibility

RANGE OF VIEW

0 1 2 3 4 5 6 7 8 9 10



OVERALL VISIBLILITY FROM BREWSTER

Least Visible — Most Visible

VIEW ANALYSIS - BREWSTER

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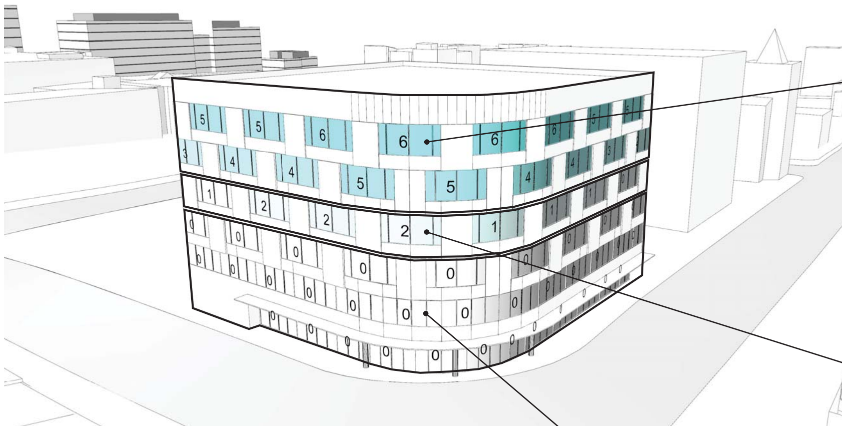
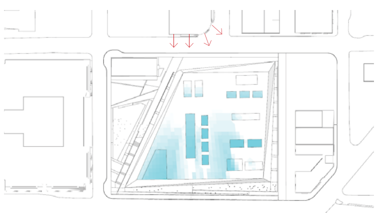


VISIBILITY OF SUBSTATION YARD

Lowest Visibility — Highest Visibility

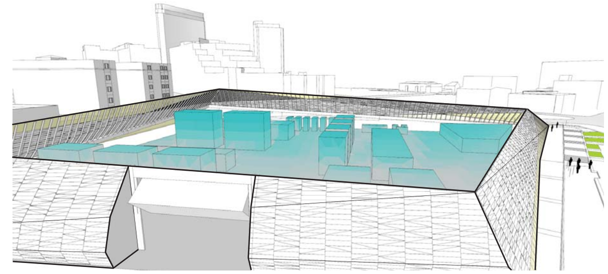
RANGE OF VIEW

0 1 2 3 4 5 6 7 8 9 10

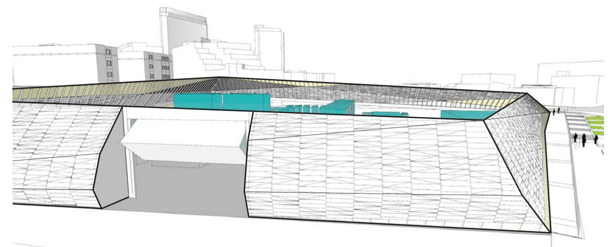


OVERALL VISIBLILITY FROM SCCA

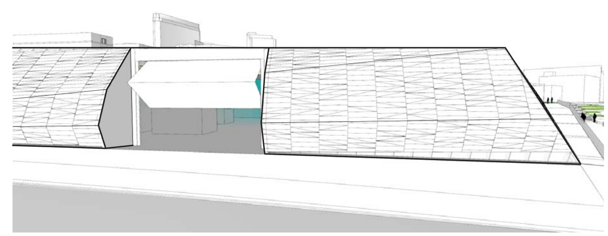
Least Visible — Most Visible



REPRESENTATIVE VIEW FROM FLOORS 5-6



REPRESENTATIVE VIEW FROM FLOOR 4



REPRESENTATIVE VIEW FROM FLOORS 1-3

VIEW ANALYSIS - SCCA

FILE NAME: ... Graphics\Nov 2013 NBBJ View Studies\AppendixE_ViewStudy.ai / CREATED BY: DLD / DATE LAST UPDATED: 01/30/2014

SOURCE: NBBJ, 2013.

Appendix E-10

Private Views of Substation Yard

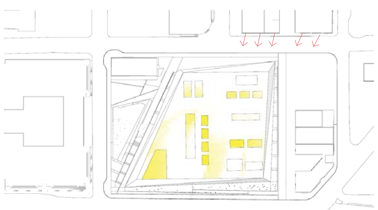
Seattle, Washington

VISIBILITY OF SUBSTATION YARD

Lowest Visibility — Highest Visibility

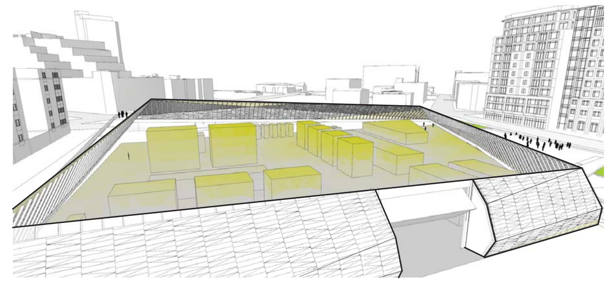
RANGE OF VIEW

0 1 2 3 4 5 6 7 8 9 10

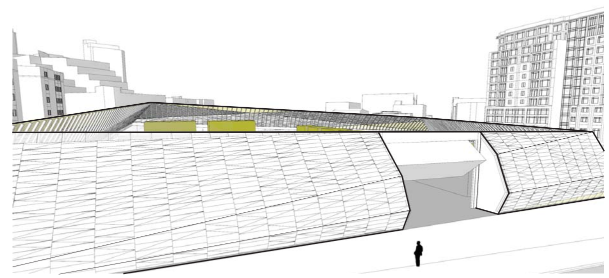


OVERALL VISIBLILITY FROM ALLEY 24

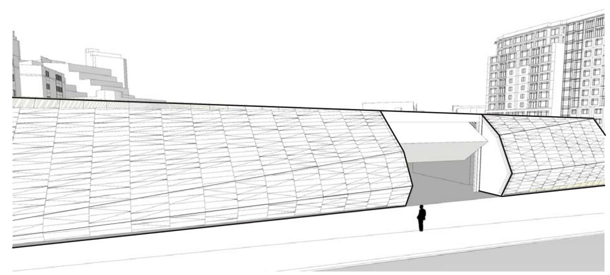
Least Visible — Most Visible



REPRESENTATIVE VIEW FROM FLOORS 5-6



REPRESENTATIVE VIEW FROM FLOOR 4



REPRESENTATIVE VIEW FROM FLOORS 1-3

VIEW ANALYSIS - ALLEY 24

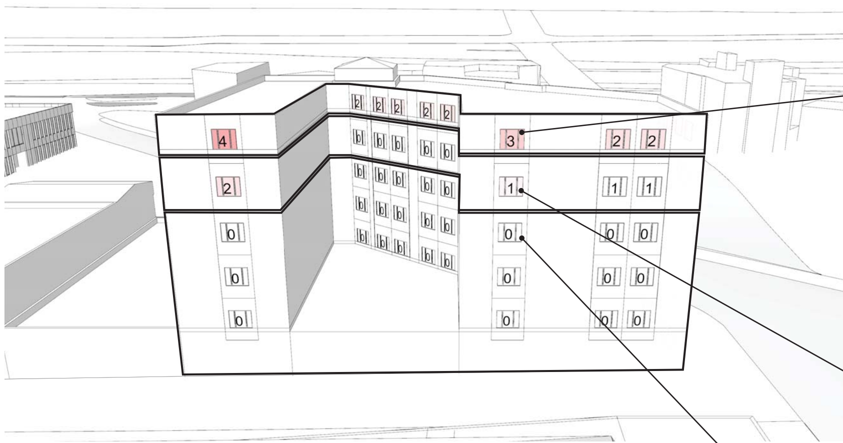
FILE NAME: ... Graphics\Nov 2013 NBBJ View Studies\AppendixE_ViewStudy.ai / CREATED BY: DLD / DATE LAST UPDATED: 01/30/2014

SOURCE: NBBJ, 2013.

Appendix E-11

Private Views of Substation Yard

Seattle, Washington

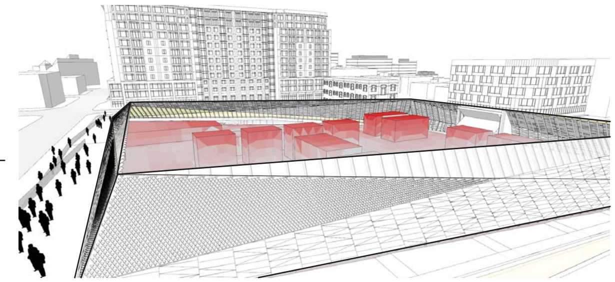


VISIBILITY OF SUBSTATION YARD

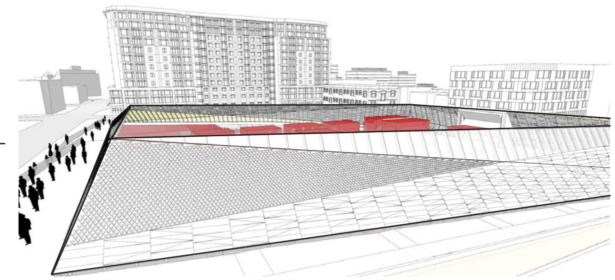
Lowest Visibility — Highest Visibility

RANGE OF VIEW

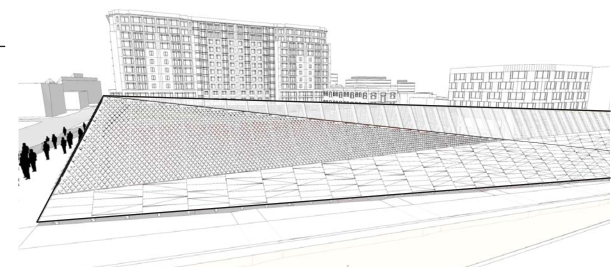
0 1 2 3 4 5 6 7 8 9 10



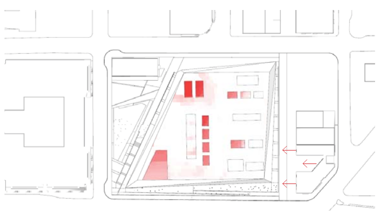
REPRESENTATIVE VIEW FROM FLOOR 6



REPRESENTATIVE VIEW FROM FLOORS 5



REPRESENTATIVE VIEW FROM FLOORS 1-4



OVERALL VISIBLILITY FROM COLWELL

Least Visible — Most Visible

VIEW ANALYSIS - COLWELL

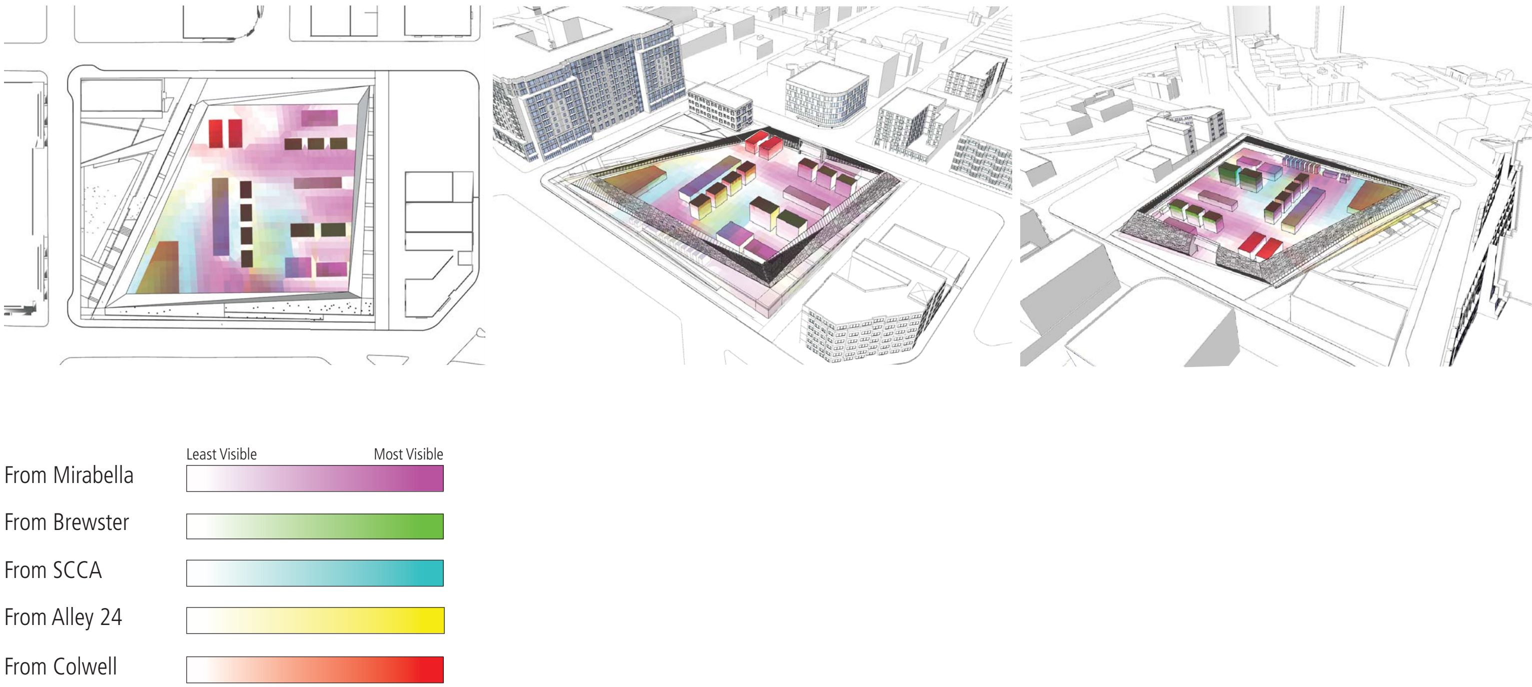
SOURCE: NBBJ, 2013.

Denny Substation . 120792

Appendix E-12

Private Views of Substation Yard

Seattle, Washington



VIEW ANALYSIS - OVERALL VISIBILITY

SOURCE: NBBJ, 2013.

APPENDIX F

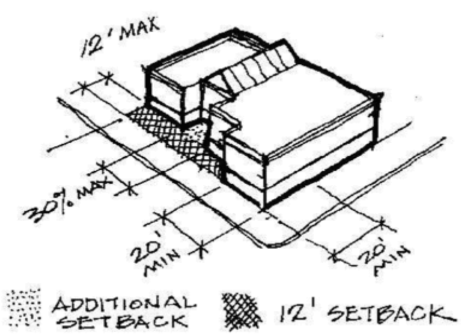
Summary of Substation Alternatives Zoning Analysis Matrix

Denny Substation Project (NBBJ, 2014)

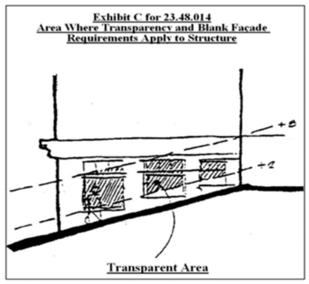
Zoning Analysis Matrix
Seattle Municipal Code Land Use Summary

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
Title 23 Chapter 23.48 - Subtitle III Land Use Regulations				
SMC 23.32.006; SMC Zoning Map	SM-240/125-400; South Lake Union Urban Center	The project will comply with SM-240/125-400 zoning requirements as changed under Ordinance 124172.	Compliant, except as noted below.	The project site is not designated environmental critical area.
SMC 23.48.004	All uses are permitted outright, either as principal or accessory uses, except those specifically prohibited by Section 23.48.006 and those permitted only as conditional uses by Section 23.48.008	Utility Service Use (SMC 23.84A. Definitions)	Compliant.	Project consists of an open-air substation structure with a control building, maintenance building and shell spaces.
SMC 23.48.010-A	General structure height	Maximum Height 240'.	Compliant.	
SMC 23.48.012	Upper-level setback requirements.	Structure height will not exceed the 75' height at which setback is required.	Compliant.	Structure is less than 75' high as measured along Denny Way. (Re: 23.86.006-B and Director's Rule 4-2012 measurement requirements - General Rule Formula 2 (Enclosing Rectangle) will be utilized for height measurements.
SMC 23.48.014-A.1	Primary Pedestrian Entrance - a primary building entrance shall be required from the street or street-oriented courtyards and shall be no more than three (3) feet above or below the sidewalk grade.	The Primary Pedestrian Entrances at the SW Shell Space (adjacent to the public benefit open space) and at the SE Shell Space (at Denny Way and adjacent alley) will comply. (The Substation is exempt from this requirement, since it is unoccupied and inaccessible to the public.)	Compliant.	
SMC 23.48.014-A.2	Minimum Façade Height	On Class 2 Pedestrian Streets, as shown on Map B, all facades shall have a minimum height of twenty-five (25) feet. On all other streets, all facades shall have a minimum height of fifteen (15) feet. **The Enclosure height along Denny Way is less than the required 25'.**	**Departure** *Southwest corner of enclosure wall is less than 25' high.*	**A Council Waiver is requested** for this City facility based on a Seattle Design Commission approved architectural response to a unique utility use not specifically addressed in Seattle Mixed Development Standards.
SMC 23.48.014-A.3	Permitted Setbacks	Street-level Setback. Except on Class 1 Pedestrian Streets, as shown on Map B, structures may be set back up to twelve (12) feet from the property line subject to the following (Exhibit 23.48.014 B). **Setbacks exceed the maximum 12' requirement.**	**Departure** *Enclosure wall structure is setback more than 12' from John Street and Minor Avenue due to substation program requirements and public open space provision.*	**A Council Waiver is requested** for this City facility based on a Seattle Design Commission approved architectural design which has been a response to public benefit and urban merit features and SCL program requirements.

Exhibit B for 23.48.014: Street level setback



SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
SMC 23.48.014-D	Transparency and Blank Façade Requirements	Facade transparency and blank facade requirements shall apply to the area of the facade between two (2) feet and eight (8) feet above the sidewalk (Exhibit 23.48.014 C).		
	Exhibit C for 23.48.014: Area Where Transparency and Blank Façade Requirements Apply to Structure			.



SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
SMC 23.48.014-D.1	Façade Transparency Requirements	Transparency requirements apply to all street-facing, street level facades, except for portions of structures in residential use, as follow: a. For Class 1 and Class 2 Pedestrian Streets and Neighborhood Green Streets, shown on Map A for 23.48.014, a minimum of 60 percent of the street facing facade must be transparent. b. For all other streets not specified in subsection 23.48.014.D.1.a, a minimum of 30 percent of the street facing facade must be transparent. c. If the slope of the street frontage of the facade exceeds 7.5 percent, the required amount of transparency shall be reduced to 45 percent of the street facing facade on Class 1 and Class 2 Pedestrian Streets and Neighborhood Green Streets, shown on Map A for 23.48.014, and 22 percent of the street facing facade on all other streets. d. Only clear or lightly tinted glass in windows, doors, and display windows are considered transparent. Transparent areas shall allow views into the structure or into display windows from the outside.	*Item d states that only clear or lightly tinted glass is considered "transparent". We are considering a white frit between clear glass layers, which yields a translucent glass, to be transparent.*	
SMC 23.48.014-D.1	Façade Transparency Requirements	Denny Way transparency is 73%, which complies with the 60% Class 2 Pedestrian Street requirement. Minor Ave. transparency is 84%, which complies with the 30% requirement. (Alley transparency, which has no requirement, is 56%.) **John Street transparency is 15%, which does not comply with the 60% Green Street facade transparency requirement.**	**Departure TBD** *The 15% transparency on John Street would be due to glass in the service door.*	**A Council Waiver is requested** for this City facility based on a Seattle Design Commission approved architectural design which meets the code intent of an active and visually accessible street.
SMC 23.48.014-D.2	Blank Façade Limits	Any portion of the facade which is not transparent shall be considered to be a blank facade.	Compliant. *Given our interpretation of transparency.*	

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
SMC 23.48.014-D.2.a	Blank Façade Requirements for Class 2 Pedestrian Streets	**2.** Blank Facade Limits for Class 1 and 2 Pedestrian Streets. **a.** Blank facades shall be limited to segments fifteen (15) feet wide, except for garage doors which may be wider than fifteen (15) feet. Blank facade width may be increased to thirty (30) feet if the Director determines that the facade is enhanced by architectural detailing, artwork, landscaping, or other similar features that have visual interest. The width of garage doors shall be limited to the width of the driveway plus five (5) feet. **b.** Any blank segments of the facade shall be separated by transparent areas at least two (2) feet wide.	Compliant.	The sloped stainless steel curtain wall cap wil be 1'-4" high to comply with the 30' blank façade width provision. **A Director's Determination is requested** for a blank façade width of 30', based on the project's visual interest, architectural detailing, and incorporation of artwork and landscaping.
SMC 23.48.014-D.2.b	Blank Façade Requirements for Other than Class 1 and 2 Pedestrian Streets	**3.** Blank Facade Limits for all other streets. **a.** Blank facades shall be limited to segments thirty (30) feet wide, except for garage doors which may be wider than thirty (30) feet. Blank facade width may be increased to sixty (60) feet if the Director determines that the facade is enhanced by architectural detailing, artwork, landscaping, or other similar features that have visual interest. The width of garage doors shall be limited to the width of the driveway plus five (5) feet. **b.** Any blank segments of the facade shall be separated by transparent areas at least two (2) feet wide. **c.** The total of all blank facade segments, including garage doors, shall not exceed seventy (70) percent of the street facade of the structure on each street frontage; or seventy-eight (78) percent if the slope of the street frontage of the facade exceeds seven and one-half (7 1/2) percent.	Compliant.	
SMC 23.48.014-H.1	Through-block pedestrian connections for large lot developments	Through-block pedestrian connections for large lot developments 1. A through-block pedestrian connection meeting the standards of subsection 23.48.014.G.2 is required in the SM 85/65-125, SM 85-240, SM 85/65-160, SM 160/85-240, and **SM 240/125-400** zones for development described as follows: (a) Within the block defined as the area enclosed by street rights-of-way, the lot area of the development is a minimum of 60,000 square feet, except that the area of lots separated only by an alley right-of-way may be combined for the purposes of calculating the minimum required lot area; (b) **The lot area of the development abuts the two north-south avenues** for a minimum linear distance of 120 feet along each avenue.	Compliant.	Since the development does not abut two north-south avenues, it does not meet the descritpion requiring a through-block pedestrian connection.

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
SMC 23.48.024-A.2 (SMC 23.86.019)	Green Factor	Landscaping that achieves a Green Factor score of .30 or greater, pursuant to Section 23.86.019, is required for any lot with development containing more than 4,000 sqare feet of nonresidential uses.	**Departure**	Project site environmental conditions preclude Green Factor point opportunities. **A Council Waiver is requested** for this facility based on a Seattle Design Commission approved architectural design which has been a response to public benefit and urban merit features and SCL program requirements.
SMC 23.48.024-B	Screening and landscaping standards for specific uses	Where screening or landscaping is required for specific uses in subsection 23.48.024.C, the following types of screening and landscaping shall be provided: 1. Three foot high screening on street lot lines. The required screening may be provided as either: a. A fence or wall at least 3 feet in height; or b. A hedge or landscaped berm at least 3 feet in height. 2. Landscaping for setback areas and berms. Each setback area or berm required shall be planted with trees, shrubs, and grass or evergreen groundcover. Features such as pedestrian access meeting the Washington State Rules and Regulations for Barrier-Free Design, decorative pavers, sculptures or fountains may cover a maximum of 30 percent of each required landscaped area or berm. Landscaping shall be provided according to standards promulgated by the Director. Landscaping designed to provide treatment for storm water runoff qualifies as required landscaping.	Compliant.	Item 1 - compliance is provided by the architectural enclosure. Item 2 - compliance is provided by (a) the SDOT accepted street tree design and project setback along Denny Way, (b) the landscape design along Minor Avenue and John Street, and (c) the walkway landscaping and accessibility.
SMC 23.48.024-C.4	Screening for Specific Uses	Fences or free-standing walls associated with utility services uses may obstruct or allow views to the interior of a site. Where site dimensions and site conditions allow, applicants are encouraged to provide both a landscaped setback between the fence or wall and the right-of-way, and a fence or wall that provides visual interest facing the street lot line, through the height, design or construction of the fence or wall, including the use of materials, architectural detailing, artwork, vegetated trellises, decorative fencing, or similar features. Any fence or free-standing wall for a utility service use shall provide either: a. A landscaped area a minimum of 5 feet in depth between the wall or fence and the street lot line; or b. Architectural detailing, artwork, vegetated trellises, decorative fencing, or similar features to provide visual interest facing the street lot line, as approved by the Director.	Compliant.	The Seattle Design Commission approved design of the substation perimeter screenwall meets the screening standards and the visual interest intent. Civil and Landscapte consultants have worked with SDOT to reach an acceptable street tree design and project setback along Denny Way.

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
SMC 23.48.024-D	Street trees requirements.	Street trees shall be provided in all planting strips. If it is not feasible to plant street trees according to City standards, either a landscaped setback a minimum of 5 feet deep is required along the street lot line, or landscaping other than trees may be located in the planting strip according to Department of Transportation standards. The street trees shall be planted in the landscaped area at least 2 feet from the street lot line if they cannot be places within the planting strip.	Compliant.	While issues such as underground transmission lines have impacted the planting of street trees, Civil and Landscape consultants have worked with SDOT to find an acceptable street tree design.
SMC 23.48.026 (SMC 23.47A.018-B.1)	Noise standards.	Utility Service Use is not classified as a Major Noise Generator per SMC 23.47A.018 Noise Standards.	Compliant.	
SMC 23.48.026 (SMC 23.47A.018-B.2)	Noise standards.	Exterior heat exchangers and other similar devices (e.g., ventilation, air-conditioning, refrigeration) are considered major noise generators.	Compliant.	Rooftop equipment within the substation will comply with noise standards based on SEPA EIS acoustical consultant report.
SMC 23.48.028 (23.47A.020)	Odor standards.		Compliant.	
SMC 23.48.030 (23.47A.022 A)	Light and glare - Exterior lighting shielding	Exterior lighting will be shielded and directed away from adjacent uses.	Compliant.	
SMC 23.48.030 (23.47A.022-D.1)	Light and glare - Exterior lighting pole height & maximum exterior lighting level	Exterior lighting on poles is permitted up to a height of forty (40) feet from finished grade, provided that the ratio of watts to area is at least twenty (20) percent below the maximum exterior lighting level permitted by the Energy Code.	Compliant.	
SMC 23.48.030 (23.47A.022-E)	Light and glare - Glare diagrams	Glare diagrams that clearly identify potential adverse glare impacts on residential zones and on arterials will be provided.	Compliant.	Glare analysis study indicates glare will not be an issue for east or westbound Denny Way traffic.
SMC 23.48.032 (SMC 23.54.015)	Required parking and loading.	Per SMC 23.54.015 Table A - line I, There is no minimum requirement for nonresidential uses, except hospitals, in urban centers or the Station Area Overlay District (3).	Compliant.	The substation is unoccupied - no defined parking will be provided. SCL maintenance staff will utilize on-street parking or equipment service access space within the substation screen wall.
SMC 23.48.034	Parking and loading location, access and curb cuts.	Per SMC 23.54.015 Table A - line I, there is no minimum vehicle parking requirement for nonresidential uses, except hospitals, in urban centers or the Station Area Overlay District (3).	Compliant.	Loading and substation access will be provided along John St. for (a) for the existing Brewster Apartments, and (b) substation equipment access and maintenance.
SMC 23.48.034 (23.54.030)	Parking and loading location, access and curb cuts.	Driveways and curb cuts will comply.	Compliant.	Driveways and curbcuts will comply.
SMC 23.48.034-E (SMC 23.54.030-F.2)	Curb cut width and number	Per SMC 54.030-F.2, for two way traffic, the minimum width of curb cuts is 22 feet, and the maximum width is 25 feet, except that the maximum width may be increased to 30 feet if truck and auto access are combined.	Compliant.	Documentation will be provided for the proposed curb cut location and width to demonstrate compliance with requirements.

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
Title 23 Chapter 23.54 - Quantity and Design Standards for Access, Off-Street Parking, and Solid Waste Storage				
SMC 23.54.015 Table A line I for Section 23.54.015 Required parking.	Off-street motor vehicle parking	Per Table A line I for Section 23.54.015, no vehicle parking is required.	Compliant.	No vehicle parking is required - per Table A line I.
SMC 23.54.015 Table E for Section 23.54.015 Required parking.	Parking for Bicycles	Per Table E for Section 23.54.015, foot note (1) - If a use is not shown on this Table E, there is no minimum bicycle parking requirement.	Compliant.	No bicycle parking is required - per Table E (footnote 1).
Title 23 Chapter 23.76 - SubChapter I General Provisions				
SMC 23.76.004 (Table A for 23.76.004)	Land use decision framework	Council Land Use decisions Type IV required for Change/Establishment of Use to Electrical Transmission/Distribution Substation use.	**Departure**	**Council action required under MUP application to change use to Electrical Transmission/Distribution Substation.**
Title 23 Chapter 23.76 - SubChapter II Master Use Permits				
SMC 23.76.006	Master Use Permits required.	Change/Establishment of Use to Electrical Transmission/Distribution Substation use.	Compliant.	Provided under MUP Application
SMC 23.76.062-D	Type V Council land use decisions.	Council Decision. In making a Type V Council land use decision, the Council shall consider the oral and written testimony presented at the public hearing, as well as any required report of the Director. The City Council shall not act on any Type V Council land use decision until the end of the appeal period for any applicable determination of nonsignificance (DNS) or final EIS or, if an appeal is filed, until the Hearing Examiner issues a decision affirming the Director's DNS or EIS decision.	**Compliance TBD**	**Type V Council land use decision required under MUP application.**
SMC 23.76.064-B	Approval of City Facilities	City Facilities Not Meeting Development Standards. The Council may waive or modify applicable development standards, accessory use requirements, special use requirements or conditional use criteria for City facilities.	**Compliance TBD**	**Council Waivers are requested** for this City facility based on a Seattle Design Commission approved architectural response to a unique utility use not specifically addressed in Seattle Mixed Development Standards. **The Council Waivers are requested for: (a) primary pedestrian entrance, (b) minimum facade height, (c) permitted street-level setbacks, (d) facade transparency, (e) blank facade requirements and (f) screening and landscaping standards.**
Title 23 Chapter 23.84 - Definitions				
SMC 23.84	Utility Service Use	"Utility services use" means a utility use that provides the system for transferring or delivering power, water, sewage, storm water runoff, or other similar substances. Examples include electrical substations, pumping stations, and trolley transformers.	Compliant.	

SMC Code Reference	Development Standards	Analysis/**Relevant Scope**	Compliant/**Departure** *Comment*	Justification/**Requested Action**
Title 25 Chapter 25.08 - Noise Control				
SMC 25.08.410-A	Exterior sound level limits	Commercial exterior sound level limit is 60 dB(A) (Leq)	Compliant.	Rooftop equipment within the substation will comply with noise standards based on SEPA EIS acoustical consultant report.
SMC 25.08.410-B	Exterior sound level limits	During a measurement interval, Lmax may exceed the exterior sound level limits shown in subsection 25.08.410.A by no more than 15 dB(A).	Compliant.	Rooftop equipment within the substation will comply with noise standards based on SEPA EIS acoustical consultant report.
SMC 25.08.420-B	Modifications to exterior sound level limits	For any source of sound that has a pure tone component, the exterior sould level limits established by this subchapter are reduced by 5 dB(A); provided, however, this 5 dB(A) reduction shall not be imposed on any electrical substation.	Compliant.	Rooftop equipment within the substation will comply with noise standards based on SEPA EIS acoustical consultant report.
SMC 25.08.420-C	Modifications to exterior sound level limits	For any source of sound that is impulsive and not measured with an impulse sound level meter, the exterior sound level limits established by this subchapter are reduced by 5 dB(A).	Compliant.	Rooftop equipment within the substation will comply with noise standards based on SEPA EIS acoustical consultant report.

APPENDIX G

Summary of Adopted Design Guidelines for the Substation Area

The table below summarizes the design criteria from the 2010 Seattle Design Guidelines and the 2012 South Lake Union Neighborhood Design Guidelines. Not all design criteria are shown. Design criteria from the Seattle Design Guidelines (Seattle, 2010) include top headings only. All South Lake Union Neighborhood Design Guidelines are listed, except those with no relevance to this project (such as references on the design of residential structures). While these design guidelines are not applicable to the substation, they are provided for context, since most new development adjacent to the substation would be subject to them.

Relevant Design Criteria
CS 1 - Natural Systems and Site Features Use natural systems and features of the site and its surroundings as a starting point for project design.
CS 2 - Urban Pattern and Form Strengthen the most desirable forms, characteristics, and patterns of the streets, block faces, and open spaces in the surrounding area.
CS 3 - Architectural Context and Character Contribute to the architectural character of the neighborhood.
PL1 - Public Space If public space is provided or authorized by law, its design should complement and contribute to the network of public spaces around the site and the connections among them.
PL 2 - Walkability Create a safe and comfortable walking environment that is easy to navigate and well-connected to existing pedestrian walkways and features.
PL3 - Street-Level Interaction Encourage human interaction and activity at the street-level with clear connections to building entries and edges.
PL4 - Active Transportation Incorporate design features that facilitate active forms of transportation such as walking, cycling, and use of transit.
DC 1 - Project Uses and Activities Optimize the arrangement of uses and activities on site.
DC 2 - Architectural Concept Develop an architectural concept that will result in a unified, functional and harmonious design that fits well on the site and within its surroundings.
DC 3 - Open Space Concept Where open space is required, integrate its design with the building.
DC 4 - Exterior Elements and Finishes Use appropriate and high quality elements and finishes for the building and its open spaces.

Relevant Design Criteria
CS 1 - Responding to Site Characteristics 1. Encourage provision of “outlooks and overlooks” for the public to view the lake and cityscapes. Examples include provision of public plazas and/or other public open spaces and changing the form or facade setbacks of the building to enhance opportunities for views.
CS 2 - Height, Bulk, and Scale 1. Address both the pedestrian and auto experience through building placement, scale and details. 2. Encourage stepping back an elevation at upper levels for development taller than 55 feet 3. Relate proportions of buildings to the width and scale of the street.
CS 3 - Height, Bulk, and Scale 1. Articulate the building facades vertically or horizontally in intervals that relate to the existing structures or existing pattern of development in the vicinity. 2. Consider using architectural features to reduce building scale.
CS 3 - Architectural Context 1. Support the existing fine-grained character of the neighborhood with a mix of building styles. 4. Respond to the history and character in the adjacent vicinity in terms of patterns, style, and scale. Encourage historic character to be revealed and reclaimed, for example through use of community artifacts, and historic materials, forms and textures. 6. Respond to the unique, grass roots, sustainable character of the Cascade neighborhood. Examples of elements to consider include: ■ community artwork; ■ edible gardens; ■ water filtration systems that serve as pedestrian amenities; ■ gutters that support greenery.
PL 1 - Human Activity 1. Keep neighborhood connections open, and discourage closed campuses. 2. Reinforce pedestrian connections both within the neighborhood and to other adjacent neighborhoods. Transportation infrastructure should be designed with adjacent sidewalks, as development occurs to enhance pedestrian connectivity. 3. Design for a network of safe and well-lit connections to encourage human activity and link existing high activity areas.
PL1 - Landscaping To Reinforce Design Continuity With Adjacent Sites Support the creation of a hierarchy of passive and active open space within South Lake Union. This may include pooling open space requirements on-site to create larger space.
PL 1 - Pedestrian Open Spaces and Entrances New developments are encouraged to work with the Design Review Board and interested citizens to provide features that enhance the public realm, i.e. the transition zone between private property and the public right of way.

Relevant Design Criteria
PL 2 - Streetscape Compatibility The vision for street level uses in South Lake Union is a completed network of sidewalks that successfully accommodate pedestrians. Streetscape compatibility is a high priority of the neighborhood with redevelopment. Sidewalk-related spaces should appear safe, welcoming and open to the general public. 1. Encourage provision of spaces for street level uses that vary in size, width, and depth. Encourage the use of awnings and weather protection along street fronts to enhance the pedestrian environment. 2. Provide pedestrian-friendly streetscape amenities, such as tree grates, benches, and lighting.
PL 2 - Personal Safety and Security Enhance public safety throughout the neighborhood to foster 18-hour public activity. Methods to consider are: ■ enhanced pedestrian and street lighting; ■ well-designed public spaces that are defensively designed with clear sight lines and opportunities for eyes on the street; ■ police horse tie-up locations for routine patrols and larger event assistance.
PL 3 - Human Activity 1. Create graceful transitions at the streetscape level between the public and private uses. 4. Create businesses and community activity clusters through co-location of retail and pedestrian uses as well as other high pedestrian traffic opportunities.
DC 1 - Design of Parking Lots Near Sidewalks Providing parking below grade is preferred.
DC 2 - Architectural Concept and Consistency Design the “fifth elevation” — the roofscape — in addition to the streetscape. As this area topographically is a valley, the roofs may be viewed from locations outside the neighborhood such as the freeway and Space Needle. Therefore, views from outside the area as well as from within the neighborhood should be considered, and roof-top elements should be organized to minimize view impacts from the freeway and elevated areas.
DC 3 - Landscaping to Reinforce Design Continuity with Adjacent Sites 1. Encourage landscaping that meets LEED criteria. This is a priority in the Cascade neighborhood. 2. Where appropriate, install indigenous trees and plants to improve aesthetics, capture water and create habitat. 3. Retain existing, non-intrusive mature trees or replace with large caliper trees. 4. Water features are encouraged including natural marsh-like installations. 5. Reference the City of Seattle Right Tree Book and the City Light Streetscape Light Standards Manual for appropriate landscaping and lighting options for the area.
DC 3 - Landscaping to Enhance the Building and/or Site Consider integrating artwork into publicly accessible areas of a building and landscape that evokes a sense of place related to the previous uses of the area. Neighborhood themes may include service industries such as laundries, auto row, floral businesses, photography district, arts district, maritime, etc.
DC 3 - Landscape Design to Address Special Site Conditions Landscaping should be designed to take advantage of views to waterfront and downtown Seattle.

APPENDIX H

Electric and Magnetic Fields Supplemental Information

MODELING ASSUMPTIONS

DOWNTOWN SEATTLE TRANSIT TUNNEL SYSTEMS, EQUIPMENT AND GENERAL SPECIFICATIONS

Modeling Assumptions

The following is a list of key assumptions used to model power-frequency magnetic fields for the Substation Alternative 3 (SA3) and Transmission Line Alternatives 1, 2 and 3.

General Assumptions:

- The substation model is based upon the 30 percent preferred electrical design submittal (issued 7/2/2013).
- The electrical layout of the designated preferred SA3 and feeder getaways at the property boundary is similar to the electrical layout that would be required for Substation Alternative 1 and 2 (SA1 and SA2). This electrical layout is the basis for assessing future EMF that could result from construction of a new substation and transmission in the project vicinity
- Average projected loads for 2017, 2020, and 2035 as estimated by City Light are used. These are 50 megavolt ampere (MVA) (initial energization), 125 MVA (transmission added), and 405 MVA (ultimate build-out).
- Balanced load on individual phases for each distribution circuit.
- Balanced output load on the 13.8-kilovolt (kV) and 26-kV underground feeders is compared to unbalanced output load (50 percent variation / randomly assigned), representing optimal vs more typical conditions (roughly based on Broad Street Substation feeders).
- Existing overhead and underground distribution lines along Pontius Avenue North within the substation site would be removed / relocated under the designated preferred design. (This might not occur if Pontius Avenue North is not vacated, as proposed under SA1.)
- Gas-insulated switchgear (GIS) cabinets assume an 80 percent magnetic field shielding reduction due to the metal cabinets and conduits surrounding each individual phase conductor

Substation Equipment by Phase:

- The 2017 computer model assumes the following:
    - three 115/13.8 kV oil-insulated transformers,
    - one 115 kV inductor (GIS or oil-filled),
    - three 115 kV GIS switchgear bays,
    - twelve 13.8 kV metalclad switchgear bays,
    - four 13.8 kV metalclad air-insulated capacitor banks, and
    - twelve 13.8 kV underground distribution feeder cables in service.
- The 2020 computer model builds upon the 2017 model and assumes the addition of the following:
    - new Denny-Massachusetts 115 kV underground line,
    - four 115/13.8 kV oil-insulated transformers,
    - four 115 kV GIS switchgear bays,
    - one 115 kV inductor (GIS or oil-filled),

    - twenty-four 13.8 kV metalclad switchgear bays,
    - eight 13.8 kV metalclad air-insulated capacitor banks, and
    - twenty-four 13.8 kV underground distribution feeder cables in service.
- The 2035 computer model builds upon the 2020 model and assumes the addition of the following:
    - Denny-Massachusetts 115 kV underground line upgraded to 230 kV voltage,
    - the new Denny-Canal 115 kV underground line in service,
    - the Denny-East Pine 115 kV HPFF underground line upgraded to a 230 kV XPLE underground line,
    - two 115 kV inductors (GIS or oil-filled),
    - six 115 kV GIS switchgear bays,
    - four 115/13.8 kV oil-insulated transformers,
    - thirty 13.8 kV metalclad switchgear bays,
    - eight 13.8 kV metalclad air-insulated capacitor banks,
    - two 230 kV GIS switchgear bays,
    - two 230/115 kV oil-insulated transformers,
    - three 115/26 kV oil-insulated transformers,
    - three 26 kV metalclad switchgear bays,
    - four 26 kV metalclad air-insulated capacitor banks,
    - thirty 13.8 kV underground distribution feeder cables, and
    - twelve 26 kV underground distribution feeder cables in service

Source: Enertech Consultants. 2014. Seattle City Light. Denny Substation Project. Magnetic Field Evaluation. March.

Downtown Seattle Transit Tunnel Systems, Equipment and General Specifications

Table H-1 provides a list of existing DSTT systems, equipment and general specifications. Included are tunnel and vehicle power supply, backup battery power, video monitoring, radio and fiber optic communications, track signaling and switching, vehicle barriers and arm gate operation, and ground fault monitoring. City Light would verify the electromagnetic compatibility of the proposed transmission line cable with existing electrical equipment in the DSTT to evaluate any EMI risk. The following would be addressed:

Table H-1. Existing Downtown Seattle Transit Tunnel Systems, Equipment and General Specifications

System	Manufacturer	General Specification Info
Radio	Motorola/Axell Wireless/CommScope NICE	700 (Transit) & 800 MHz (KCRS) HELIAX/RADIAX coaxial cable/fiber optic Dry contact 24 VDC
CCTV	Nice Vision	Video 0-6 MHz over RG6 – Ethernet/fiber optic – dry contacts 24 VDC
PA	GETS - CobraNet + various	120 VAC Digital Audio – Ethernet/fiber optic
VMS	GETS - Data Display Ltd	120 VAC Serial – RS485 (115 kbps)
Fire Panel	GE – Security/Edwards	EST3 - Ethernet/fiber optic (1 Gbps) Dry contact 24 VDC
SCADA	GETS	24 VDC Rx7i & Rx3i – Ethernet/fiber optic (1Gbps) GENIUS Bus 38.4 kbps Dry contact 24 VDC Current loop 2-20 mA
PET/ETEL	EMCOM	EMVista Ethernet/fiber optic (10/100 Mbps) Dry contact 24 VDC
PBX	Cisco	Call Manager - Ethernet/fiber optic (10/100 Mbps)
Signaling ATP	Union Switch & Signal Inc	60 Hz, 100 Hz + 2340 to 4950 Hz
Signaling TWC	GETS/Phillips	80 to 120 KHz
Signaling Bus Processor/Antenna	GETS/TransCore	902-924 MHz RS232/485
Traction Power	Siemens	1500VDC
OCS	Siemens	1500VDC

System	Manufacturer	General Specification Info
OCS Ground Fault Monitor	Oerlikon Contraves	10.5-80 VDC
26kV AC Distribution	Siemens	26KV AC 125 VDC Dry contact 24 VDC Current loop 2-20 mA
Network	Brocade MOXA GarrettCom	Fiber optic (1/10 Gbps) Ethernet (10/100/1000 Mbps)
LRV Communication	GeoFocus/KinkiSharyo	UWB: 10 KHz to 1 GHz RUN-R network 100 Mbps Ethernet RS422/RS485
Wayside Communications System	Hanning & Kahl	90-100 KHz RS232/RS485 Dry contacts 24 VDC
Impedance Bond	GETS	60 Hz, 100 Hz + 2340 to 4950 Hz
LED Track Signals	Rail Development Group	60 Hz
Ground Fault Monitor	Bender	3-793 VAC, 50-400 Hz 0-650 VDC
Switch Machine	ConTec Transportation Systems	12/24 VDC 230 VAC, 60 Hz
Vital Relay Driver	GETS/Harmon Industries	8-16 VDC Dry contact 24 VDC
Vital Logic Gate	GETS/Harmon Industries	8-16 VDC RS232/RS482 Dry contacts 24 VDC
VHLC	GETS/Vital Harmon	12/24 VDC RS232/RS485 1200-300 bps 120 VAC, 60 Hz Dry contact 24 VDC
Switch Controller	GETS	24 VDC Dry contact 24 VDC
SmartPass System	TransCore	18 V (DC/AC) 902-924 MHz RS232/422 Dry contact 24 VDC
Bus Detection	Wheatland Systems	18 V (DC/AC) RS232/422 MODBUS
Infrared Switches	Allen Bradley	24 VDC Dry contact 24 VDC

System	Manufacturer	General Specification Info
Small Logic Controller	Crouzet Allen Bradley	24 VDC Dry contact 24 VDC
Vehicle Barrier	Delta Scientific Corp.	120 – 208 – 460 VAC 24 VDC Dry contact 24 VDC
Power Supplies	Various	120-208 VAC 24 VDC 12 VDC
Battery backup	Various	24 VDC 12 VDC
Current monitor	National Rail Supply	9-60 VDC Dry contact 24 VDC
UPS	PowerWare/Eaton	208/240 VAC 192 VDC Dry contact 24 VDC RS232
Access Control	GE Security GE InterLogix	24 VDC Ethernet Dry contact 24 VDC
Motorized Switches	Union Switch & Signal	120-208 VAC 24 VDC Dry contact 24 VDC
Arm Gates	Western-Cullen-Hayes	120-208 VAC 24 VDC Dry contact 24 VDC
Laser Intrusion Detection	Molinari & Associates	24 VDC RS232 Dry contact 24 VDC

APPENDIX I

Hazardous Materials Supplemental Information

HIGH IMPACT PROPERTIES AND ASSOCIATED CHEMICALS OF CONCERN

HAZARDOUS MATERIALS FIGURES

High Impact Properties and Associated Chemicals of Concern

This section provides supplemental information on high impact sites and chemicals of concern for Chapter 6 Environmental Health – Hazardous Materials for the Transmission Line Alternatives and Broad Street Substation Inductor Options.

Transmission Line Alternatives

High Impact Site Summary

Table I-1 provides the number of high impact sites by segment for the three transmission line alternatives routes. Site-specific details found in the Washington State Department of Ecology (Ecology) file reports (accessed by Power Engineers) are provided below for each transmission line alternative (most sites included in the table did not have Ecology files to review).

Table I-1. Summary of High Impact Site Numbers among Transmission Line Alternatives

	Transmission Line Alternative 1 (TL1)		Transmission Line Alternative 2 (TL2)		Transmission Line Alternative 3 (TL3)	
Study Area Segment	**Release Reported**	**No Release Reported**	**Release Reported**	**No Release Reported**	**Release Reported**	**No Release Reported**
Northern	2	4 (2)[1]	2	4 (2)[1]	2	5 (2)[1]
Central	0	9 (9) [1]	0	2 (2) [1]	0	1 (1)
Southern	0	8 (3)	0	6 (2)	1	2 (2)
Subtotal	2	21 (14) [2]	2	12 (6) [2]	3	8 (5)[1]
Total	**23 (14) [2]**		**14 (6) [2]**		**11 (5) [1]**	

Notes: Numbers in parentheses reflect historical gas stations that have not been characterized. Numbers in brackets reflect historical dry cleaners that have not been characterized.

Further evaluation of chemicals of concern at the sites catalogued above is presented below. Note that many of the identified sites are found on multiple alternative alignments. The actual number of sites within the study area for all transmission line alternatives is an estimate because most sites are identified as potentially contaminated and, therefore, would need full evaluation to confirm levels of contamination.

High Impact Sites or Potentially Contaminated Properties and Associated Chemicals of Concern

Transmission Line Alternative 1 (TL1)

Listed below are the properties of concern related to the construction of TL1, their historical use, and typical chemicals associated with these properties (Power Engineers, 2013):

- **Greyhound Lines, Inc., 1250 Denny Way (see Figure I-6 – Map ID 007300-2002-001).** This site was a bus maintenance facility for more than 60 years. Historical operations included fueling, parts washing, vehicle maintenance, vehicle washing, painting, and paint removal. Contaminants include petroleum hydrocarbons; benzene, toluene, ethylbenzene, and xylenes (BTEX); naphthalene; and volatile organic compounds (VOCs) associated with waste oil, parts washing, and/or paint stripping (acetone, 2-butanone, and perchloroethene [PCE]). The right-of-way along John Street is confirmed to have petroleum hydrocarbon and BTEX contamination and a high potential for contamination from mineral spirits and chlorinated VOCs associated with adjacent sites. The right-of-way along Minor Street has a moderate potential to contain petroleum hydrocarbon and BTEX contamination associated with adjacent sites. The right-of-way along Denny Way is confirmed to have petroleum hydrocarbon contamination associated with the site and a moderate potential for contamination from BTEX associated with adjacent sites.
- **Goodyear Service Store, 1105 Stewart Street (see Figure I-6 – Map ID 007300-2015-001).** Historical maps indicate the property contained a gas station in 1930 and 1951 and an auto garage in 1958 and 1969. The Goodyear Store has operated on the property since at least 1987. Chemicals of concern include petroleum products.
- **Touchstone Stewart & Boren/Jeanette Robinson, 1013 Stewart Street (see Figure I-6 – Map ID 007300-2020-001).** Historical maps document use of the property as a garage, machine and auto body shop, and tire shop between 1930 and 1969. Chemicals of concern include petroleum products.
- **Union Station, 401 South Jackson Street and 505, 605, 625 and 705 5th Avenue South (see Figure I-5 – Map ID 009300-2002-001).** Features depicted on the 1904–1905 Sanborn map indicate that a manufactured gas plant historically operated on the portion of the property subsequently developed as the train station. Typical chemicals of concern include heavy metals, VOCs, semivolatile organic compounds, polychlorinated biphenyls (PCBs), phenols, cresols, and petroleum products.
- **Truck Radiator Works/Former Rainier Heat & Power Company, 510 5th Avenue South (see Figure I-5 – Map ID 009100-2003-002).** Historical Sanborn maps show that the Rainier Heat & Power Company operated a steam plant on this parcel and a portion of the east-adjacent parcel, which in 1950 included a Dutch boiler. In the early 1900s (1904 to 1905), railroad tracks ran across this property. Chemicals of concern include petroleum products.
- **Container Care of Seattle/BNSF Railway, 51 South Massachusetts Street, (see Figure I-5– Map ID 009300-2058-001).** Historical maps indicate that the property has supported rail lines and a freight yard since before 1950. Typical chemicals of concern include heavy metals, semivolatile organic compounds, and petroleum products.

- **BNSF/Amtrak/West King Street Yard (see Figure I-5– Map ID 009300-2081-001).** Historical Sanborn maps indicate the property has been used since at least 1969 as a material storage yard by the railroad. Typical chemicals of concern include heavy metals, semivolatile organic compounds, and petroleum products.
- **King County Metro Central Base, 640 South Massachusetts Street (see Figure I-5– Map ID 009300-1044-001).** Sanborn maps dated 1950 and 1969 show that this property was developed and used as a foundry, forge, machine shop, and boiler shop by Washington Iron Works. The property is currently used by King County Metro as their Central Base for bus parking and maintenance and transit operations. Chemicals of concern include petroleum products, heavy metals, and solvents.
- **Historical gas station sites.** The primary chemicals of concern at the 14 historical gas station sites are petroleum products (i.e., gasoline, diesel, heavy oils, and waste oil).
- **Historical dry cleaner sites.** The primary chemicals of concern at the two historical dry cleaner sites are solvents (i.e., Stoddard [a petroleum-derived clear, transparent liquid], PCE, trichloroethylene, dichloroethylenes, and vinyl chloride).

Transmission Line Alternative 2 (TL2)

Listed below are the properties of concern related to the construction of TL2, their historical use, and typical chemicals associated with these properties (Power Engineers, 2013):

- **Greyhound Lines, Inc., 1250 Denny Way (see Figure I-6 – Map ID 007300-2002-001).** See TL1 above.
- **Goodyear Service Store, 1105 Stewart Street (see Figure I-6 – Map ID 007300-2015-001).** See TL1 above.
- **Touchstone Stewart & Boren/Jeanette Robinson, 1013 Stewart Street (see Figure I-5 – Map ID 007300-2020-001).** See TL1 above.
- **Union Station, 401 South Jackson Street and 505, 605, 625 and 705 5th Avenue South (see Figure I-8– Map ID 009300-2002-001).** Same as TL1 above.
- **Truck Radiator Works/Former Rainier Heat & Power Company, 510 5th Avenue South (see Figure I-8– Map ID 009100-2003-002).** Same as TL1 above.
- **Container Care of Seattle/BNSF Railway, 51 South Massachusetts Street, see Figure I-5 – (Map ID 009300-2058-001).** Same as TL1 above.
- **BNSF/Amtrak/West King Street Yard see Figure I-5 – (Map ID 009300-2081-001).** Same as TL1 above.
- **Historical gas station sites.** The primary chemicals of concern at the six historical gas station sites are petroleum products (i.e., gasoline, diesel, heavy oils, and waste oil).
- **Historical dry cleaner sites.** The primary chemicals of concern at the two historical dry cleaner sites are solvents (i.e., Stoddard, PCE, trichloroethylene, dichloroethylenes, and vinyl chloride).

Transmission Line Alternative 3 (TL3)

Listed below are the properties of concern related to the construction of TL3, their historical use, and typical chemicals associated with these properties (Power Engineers, 2013):

- **Greyhound Lines, Inc., 1250 Denny Way (see Figure I-6 – Map ID 007300-2002-001).** See TL1 above.
- **Goodyear Service Store, 1105 Stewart Street (see Figure I-6 – Map ID 007300-2015-001).** See TL1 above.
- **Touchstone Stewart & Boren/Jeanette Robinson, 1013 Stewart Street (see Figure I-6 – Map ID 007300-2020-001).** See TL1 above.
- **Auto Link, 1331 Stewart Street (see Figure I-9– Map ID 007300-2000-002).** Currently operating as Greg's Japanese Auto, this property was developed in 1924 as an auto service garage throughout its history. Chemicals of concern include petroleum products.
- **Seattle City ESD, 801-901 South Dearborn Street (see Figure I-11 – Map ID 009300-1005-001).** The only reported release was on a property currently owned by the City used for engineering shops. The 1950 Sanborn map depicts a gas station and auto service facility on the northeast corner of this parcel, and the 1969 Sanborn map depicts gas and oil dispensers associated with a motor equipment service area on the northwest portion of the parcel, both adjacent to the TL3 route. The regulatory file documents gasoline in soil and groundwater; the majority of petroleum-impacted soils were removed during UST decommissioning, with residuals addressed using a soil vapor extraction system since 1992. The current status of the cleanup activities was not available from documents reviewed.
- **Container Care of Seattle/BNSF Railway, 51 South Massachusetts Street (see Figure I-5 – (Map ID 009300-2058-001).** Same as TL1 above.
- **BNSF/Amtrak/West King Street Yard see Figure I-5 – (Map ID 009300-2081-001).** Same as TL1 above.
- **King County Metro Central Base, 640 South Massachusetts Street (see Figure I-11 – Map ID 009300-1044-001).** Same as TL1 above.
- **Historical gas station sites.** The primary chemicals of concern at the five historical gas station sites are petroleum products (i.e., gasoline, diesel, heavy oils, and waste oil).
- **Historical dry cleaner sites.** The primary chemicals of concern at the one historical dry cleaner site are solvents (i.e., Stoddard, PCE, trichloroethylene, dichloroethylenes, and vinyl chloride).

Broad Street Substation Inductor Options

High Impact Sites or Potentially Contaminated Properties and Associated Chemicals of Concern

Broad Street Substation Inductor Option 1 (BI1)

One property of concern is related to BI1 (Aspect, 2013):

- **Cabeens Jim Service/Rolon Motors, 516 Broad Street (see Figure I-12 – Map ID 007200-1022-002).** The property adjacent to the west of the BI1 location was historically used as a service station.

Petroleum hydrocarbons and lead could be encountered in the soil and/or groundwater in the study area.

Broad Street Substation Inductor Option 2 (BI2)

Two properties of concern are related to BI2 (Aspect, 2013):

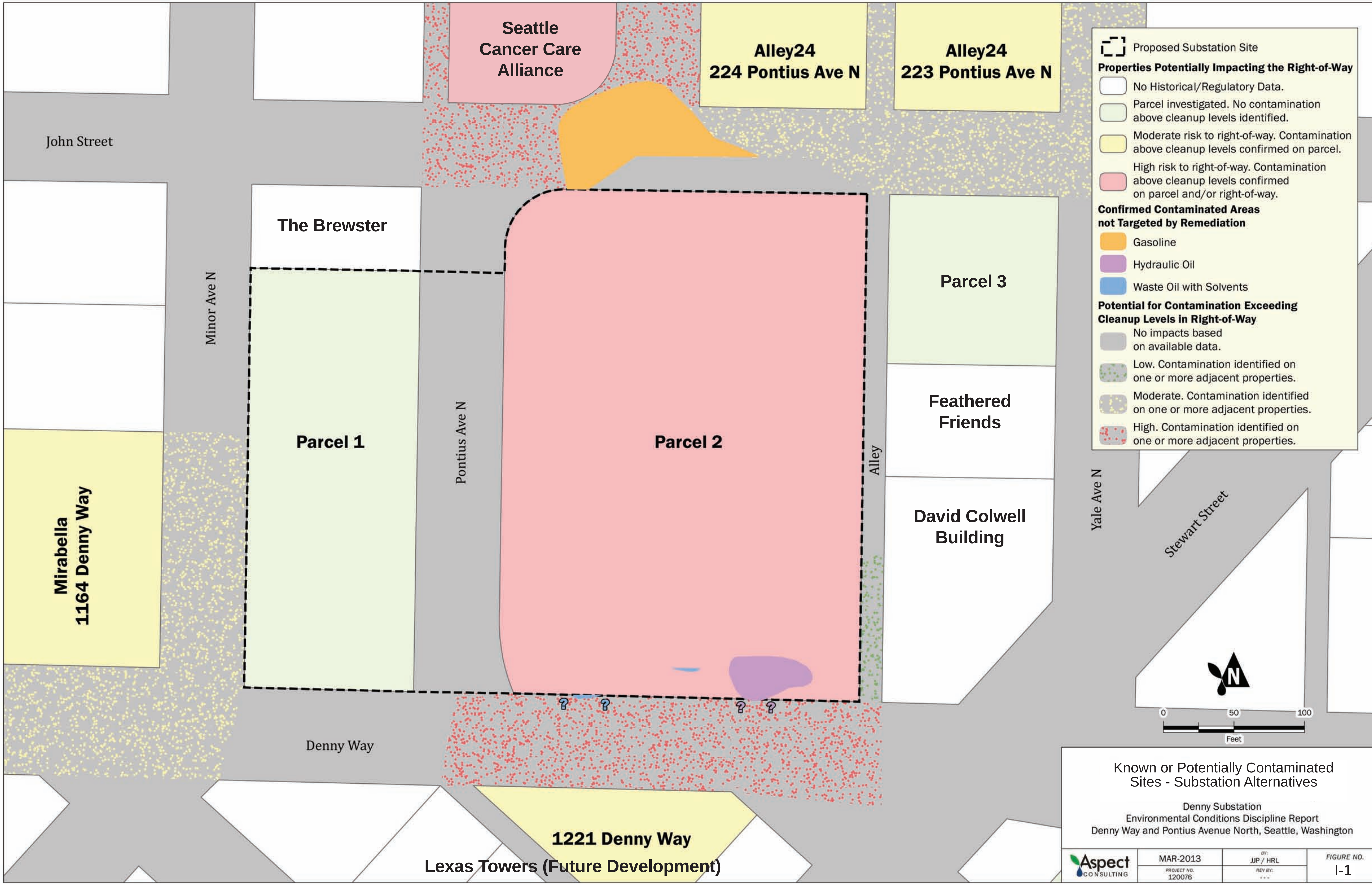
- **Skips Carter Service/Seattle City Broad Street Substation, 319 6th Avenue North (see Figure I-12 – Map ID 007200-1023-001 and 007200-1026-001).** The Broad Street Substation property was formerly used as a service station on the western side and as a commercial utility transfer yard on the eastern side.
- **Basil Lee Property/Harrison Dry Cleaners, 505 Harrison Street (see Figure I-12 – Map ID 007200-1022-001).** This former dry cleaner had documented solvent contamination in soil above MTCA levels at depths of 10 feet to 30 feet bgs. Significant soil and potential groundwater contamination (solvents) are present approximately 200 feet to the west.

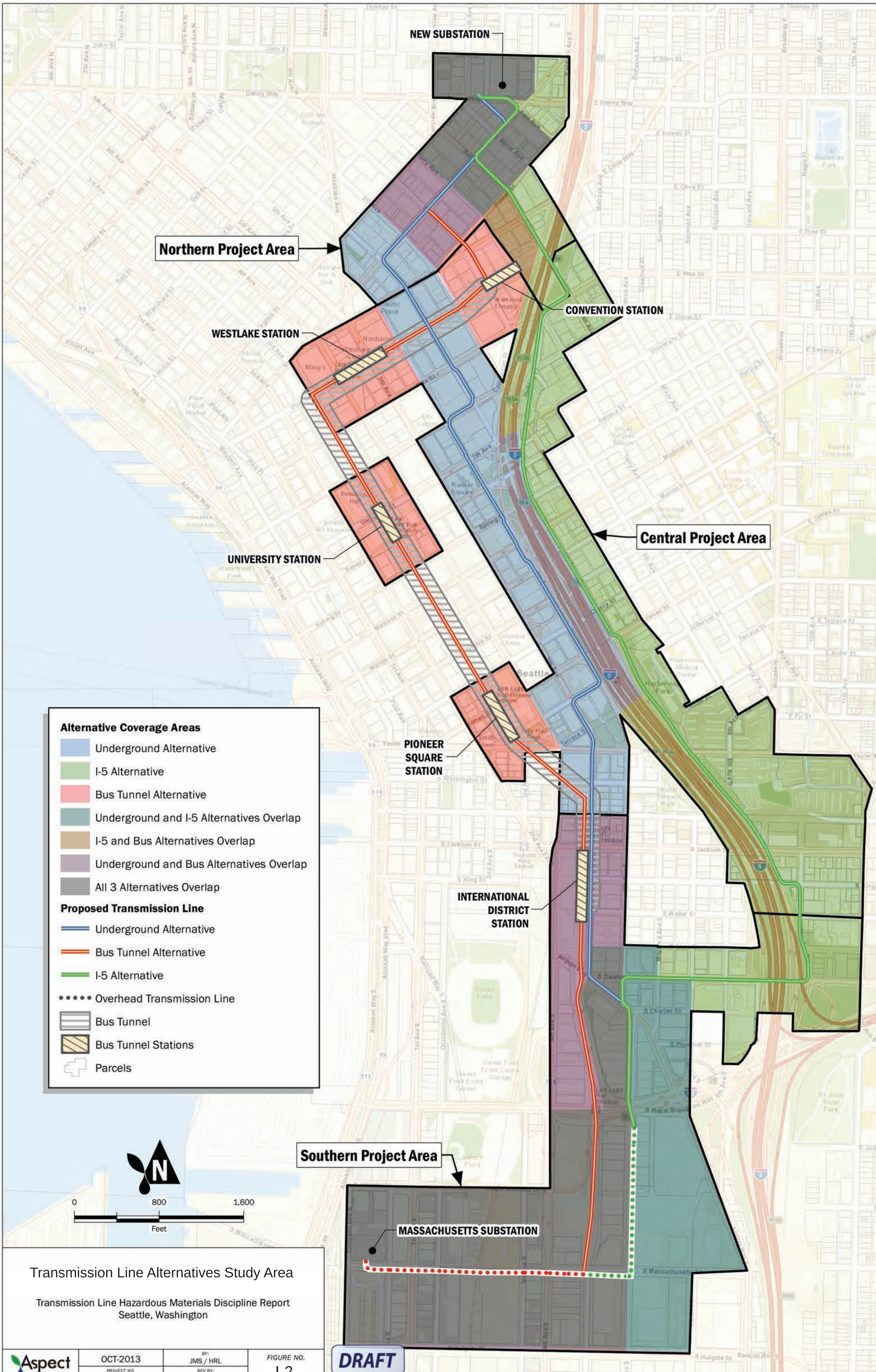
Petroleum hydrocarbons, lead, and PCBs could be encountered in the soil and/or groundwater on the Substation property; dry cleaner solvents (i.e., Stoddard, PCE, trichloroethylene, dichloroethylenes, and vinyl chloride) may have migrated from the Basil Lee property to the west.

References

Aspect Consulting, LLC. 2013. Draft Broad Street Substation Environmental Site Assessment - 319 - 6th Avenue North, Seattle, Washington. Prepared for Seattle City Light. August 23.

Power Engineers. 2013. Denny Substation Project Transmission Line Alternatives Draft Report. Prepared by Aspect Consulting, LLC. Prepared for Seattle City Light. November 1.

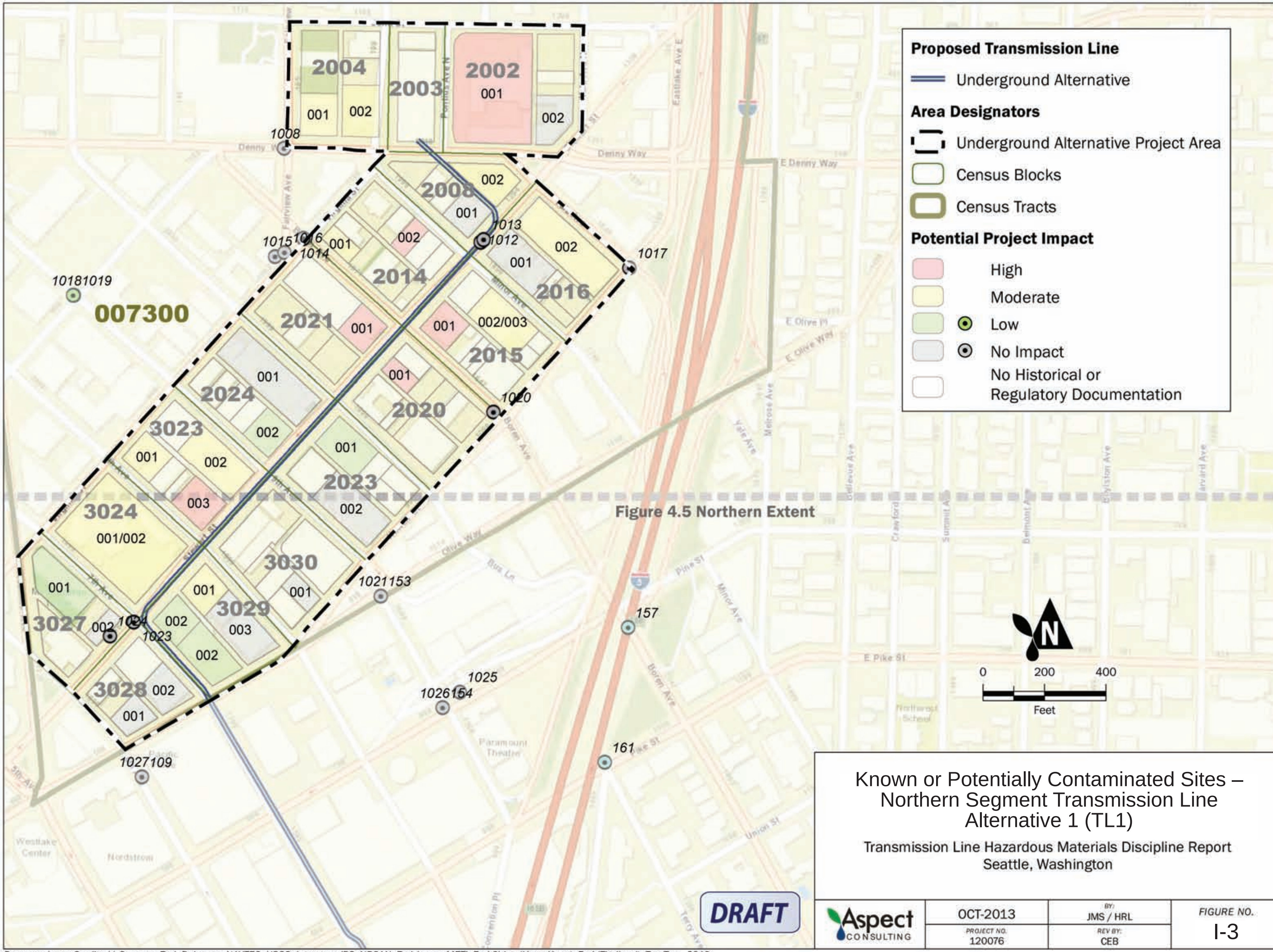

Seattle Cancer Care Alliance
Alley24 224 Pontius Ave N
Alley24 223 Pontius Ave N
John Street
The Brewster
Minor Ave N
Pontius Ave N
Alley
Yale Ave N
Stewart Street
Parcel 1
Parcel 2
Parcel 3
Feathered Friends
David Colwell Building
Mirabella 1164 Denny Way
Denny Way
1221 Denny Way
Lexas Towers (Future Development)
Proposed Substation Site
Properties Potentially Impacting the Right-of-Way
No Historical/Regulatory Data.
Parcel investigated. No contamination above cleanup levels identified.
Moderate risk to right-of-way. Contamination above cleanup levels confirmed on parcel.
High risk to right-of-way. Contamination above cleanup levels confirmed on parcel and/or right-of-way.
Confirmed Contaminated Areas not Targeted by Remediation
Gasoline
Hydraulic Oil
Waste Oil with Solvents
Potential for Contamination Exceeding Cleanup Levels in Right-of-Way
No impacts based on available data.
Low. Contamination identified on one or more adjacent properties.
Moderate. Contamination identified on one or more adjacent properties.
High. Contamination identified on one or more adjacent properties.
N
0 50 100
Feet
Known or Potentially Contaminated Sites - Substation Alternatives
Denny Substation
Environmental Conditions Discipline Report
Denny Way and Pontius Avenue North, Seattle, Washington
Aspect CONSULTING
MAR-2013
PROJECT NO. 120076
BY: JJP / HRL
REV BY: - - -
FIGURE NO.
I-1



Transmission Line Alternatives Study Area

Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect CONSULTING	OCT-2013	BY: JMS / HRL	FIGURE NO.
	PROJECT NO. 120076	REV BY: CEB	I-2



Known or Potentially Contaminated Sites – Northern Segment Transmission Line Alternative 1 (TL1)

Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect CONSULTING	OCT-2013 PROJECT NO. 120076	BY: JMS / HRL REV BY: CEB	FIGURE NO. I-3

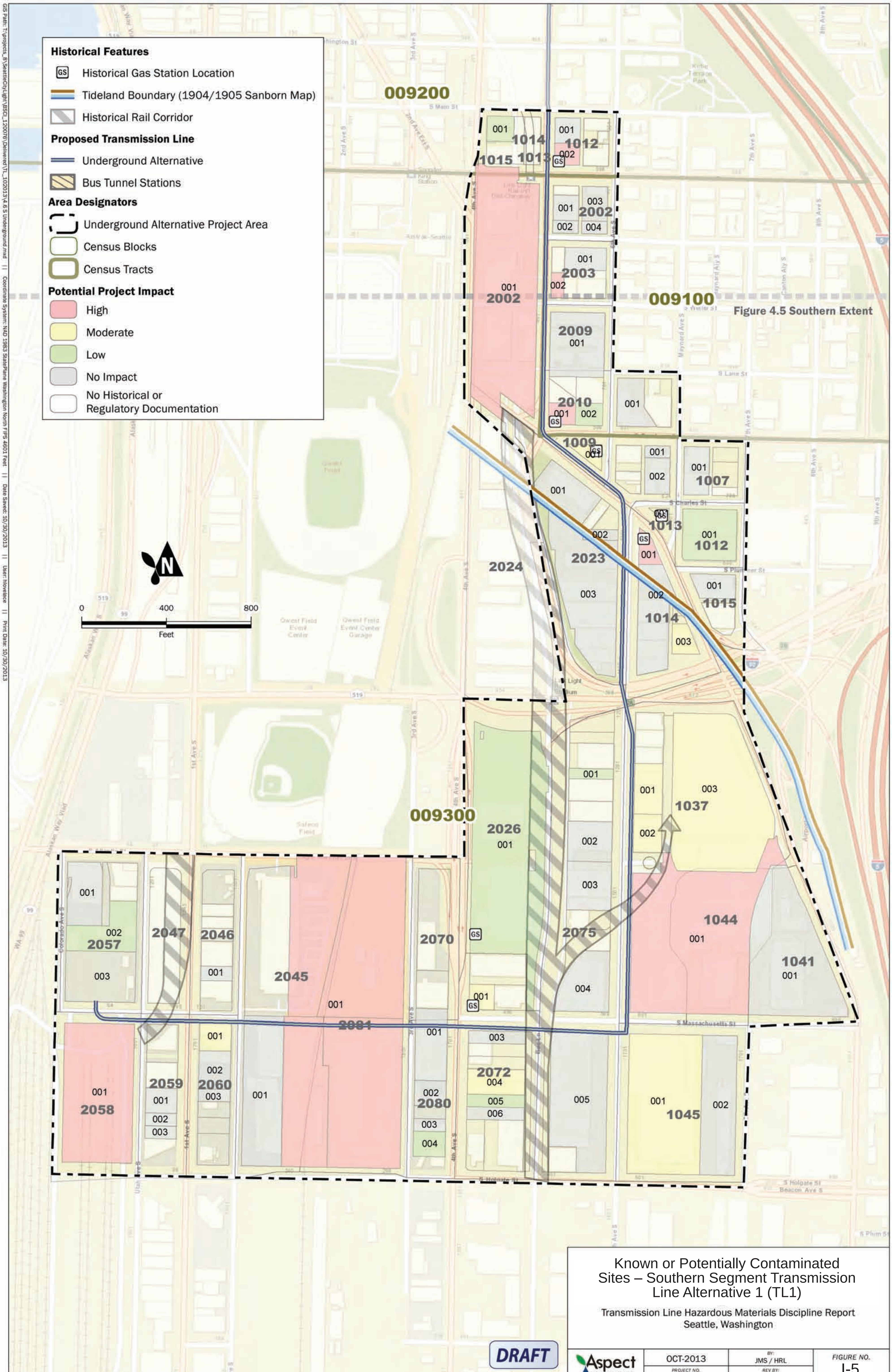
Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Known or Potentially Contaminated Sites – Central Segment Transmission Line Alternative 1 (TL1)

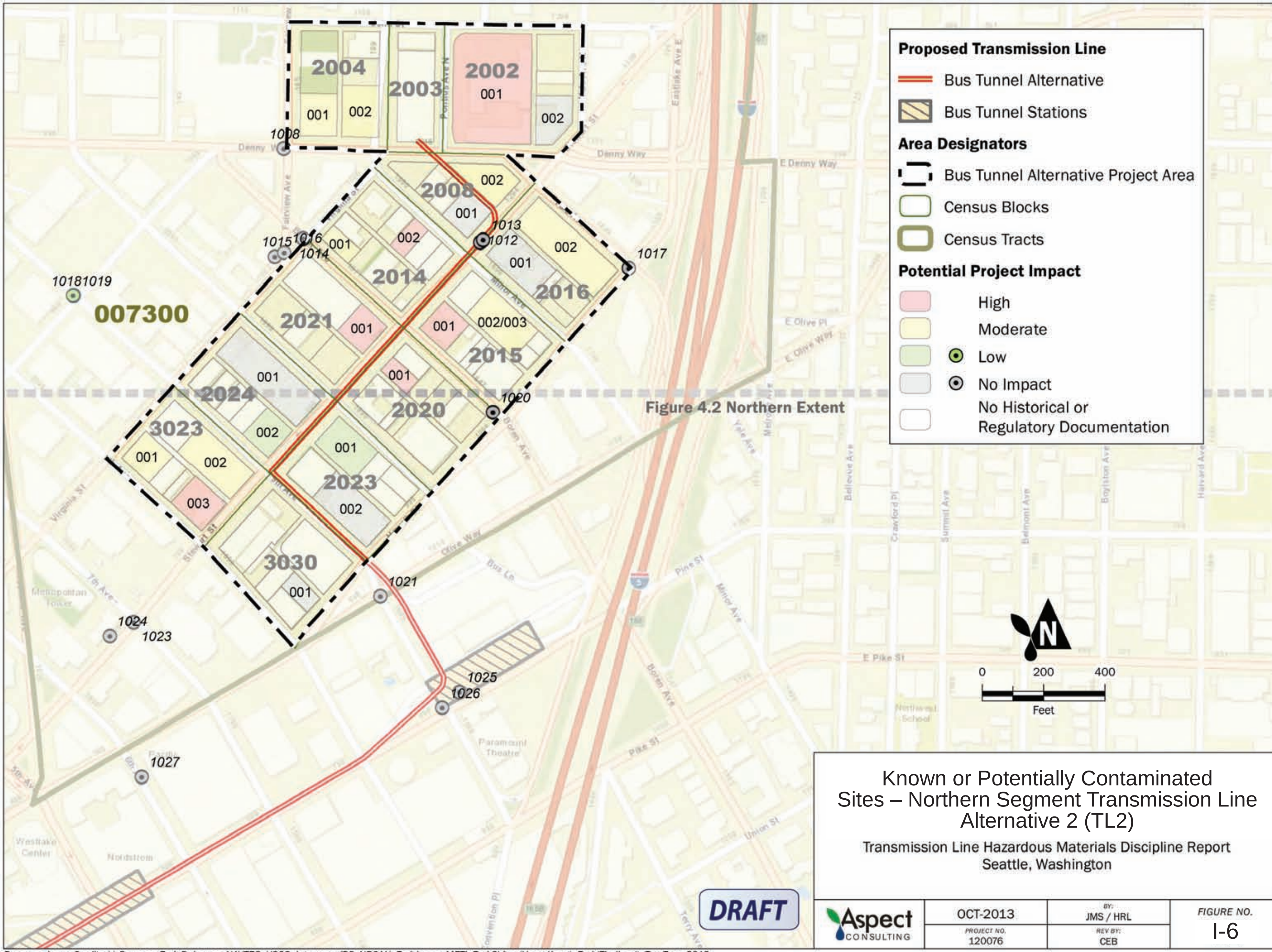
Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect CONSULTING	OCT-2013 PROJECT NO. 120076	BY: JMS / HRL REV BY: CEB	FIGURE NO. I-4

Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

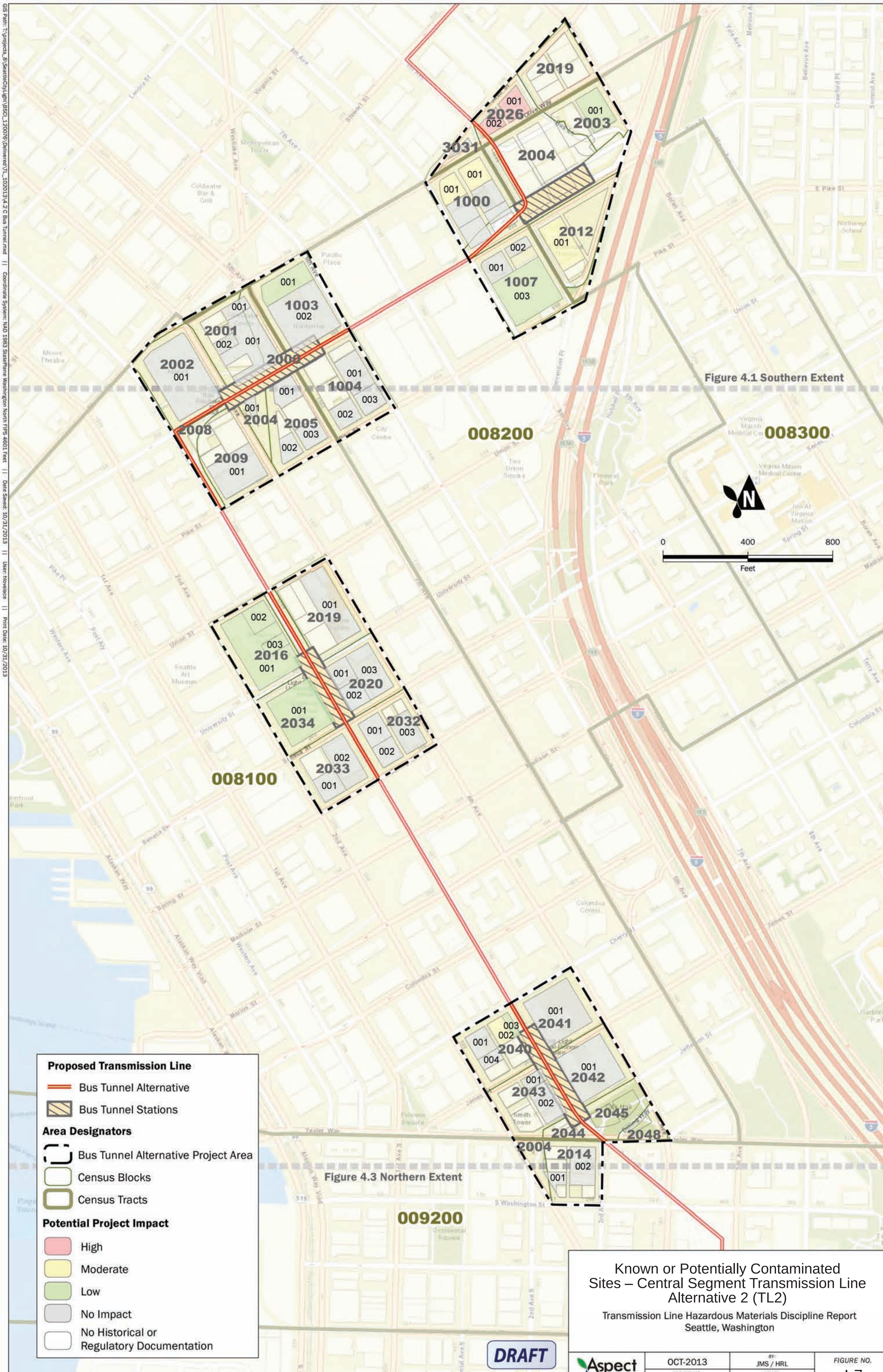


Known or Potentially Contaminated Sites – Northern Segment Transmission Line Alternative 2 (TL2)

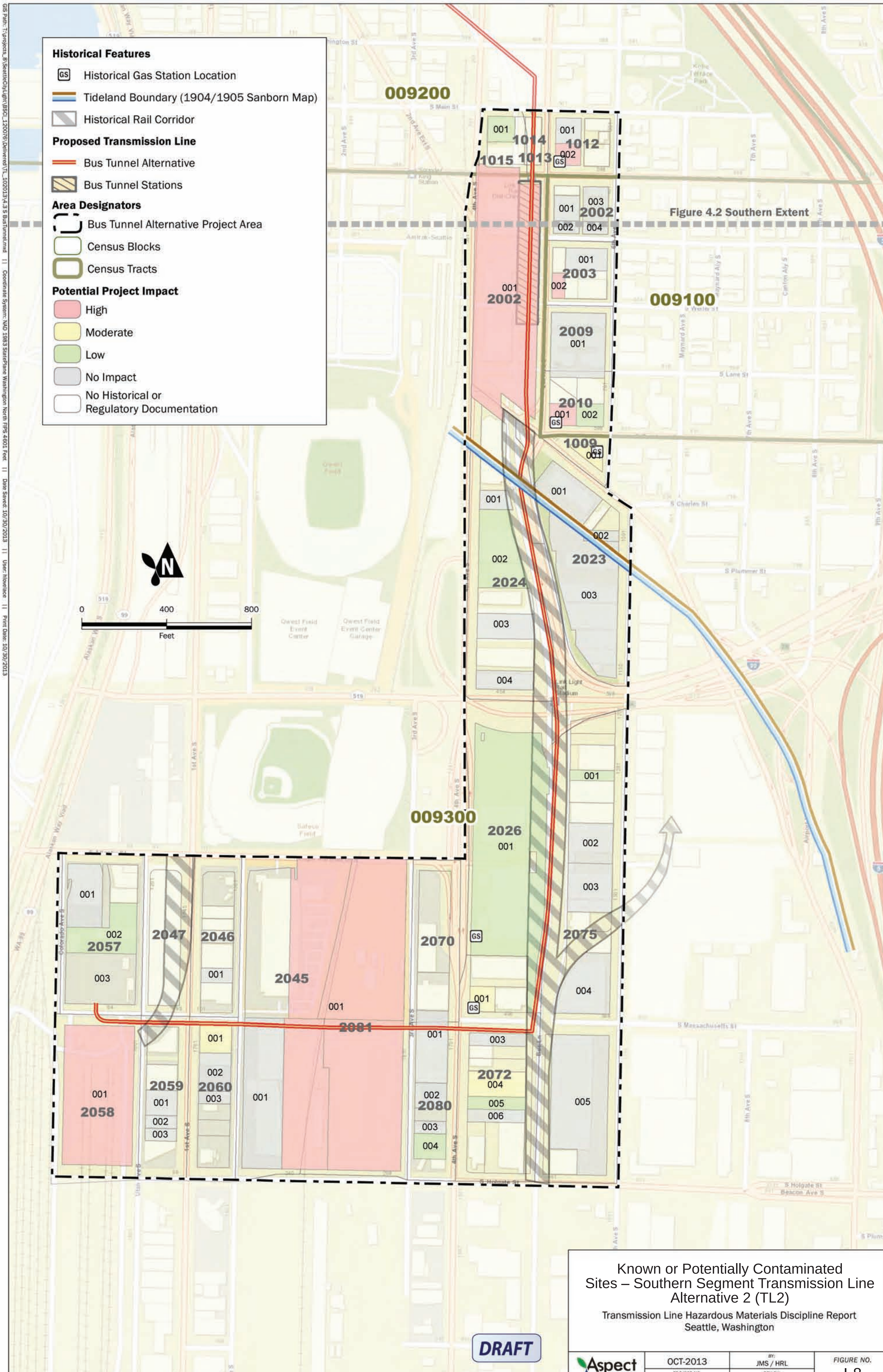
Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect CONSULTING	OCT-2013	BY: JMS / HRL	FIGURE NO.
	PROJECT NO. 120076	REV BY: CEB	I-6

Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

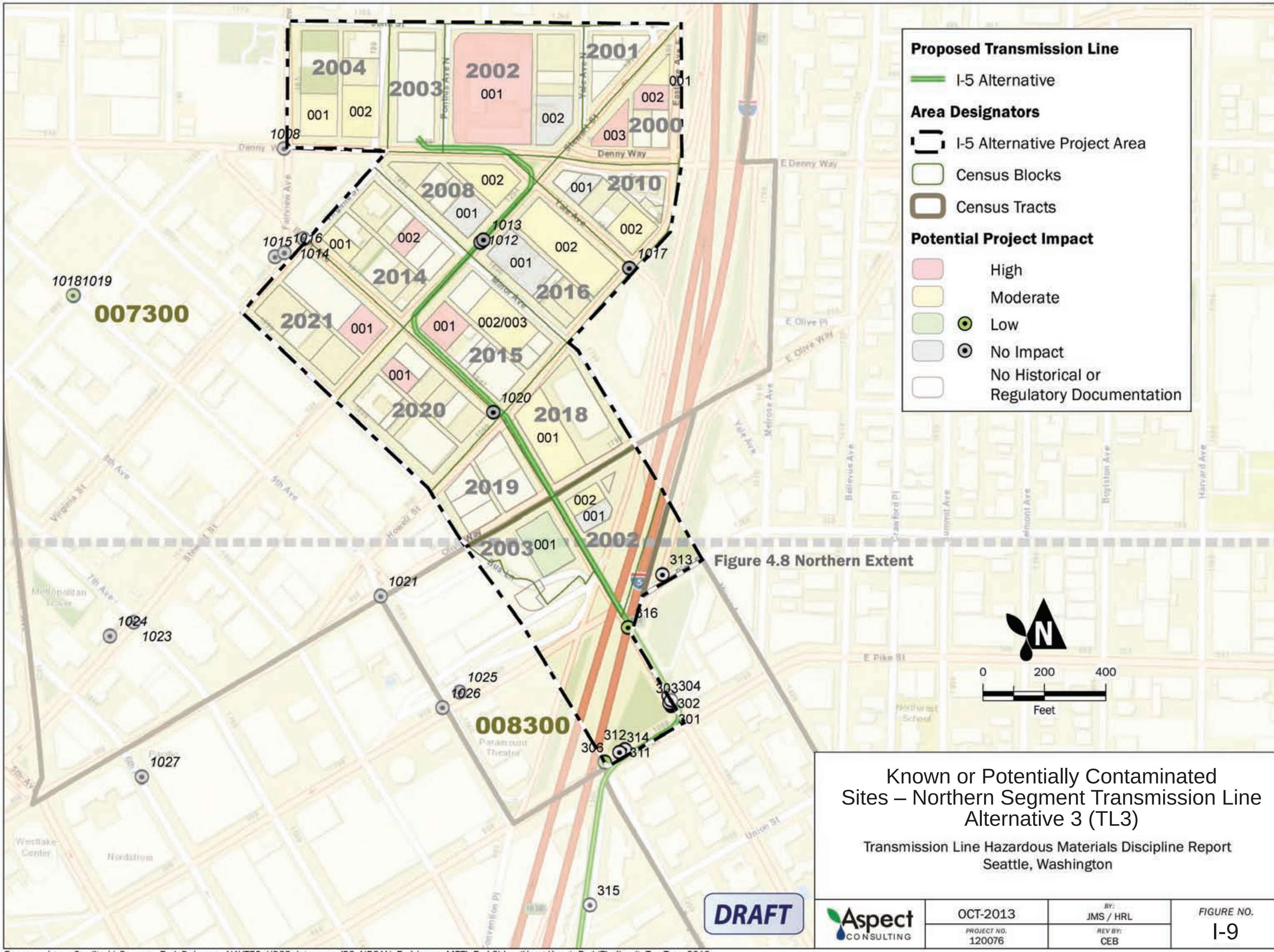


Known or Potentially Contaminated Sites – Southern Segment Transmission Line Alternative 2 (TL2)

Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect Consulting	OCT-2013	BY: JMS / HRL	FIGURE NO.
	PROJECT NO. 120076	REV BY: CEB	I-8

Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



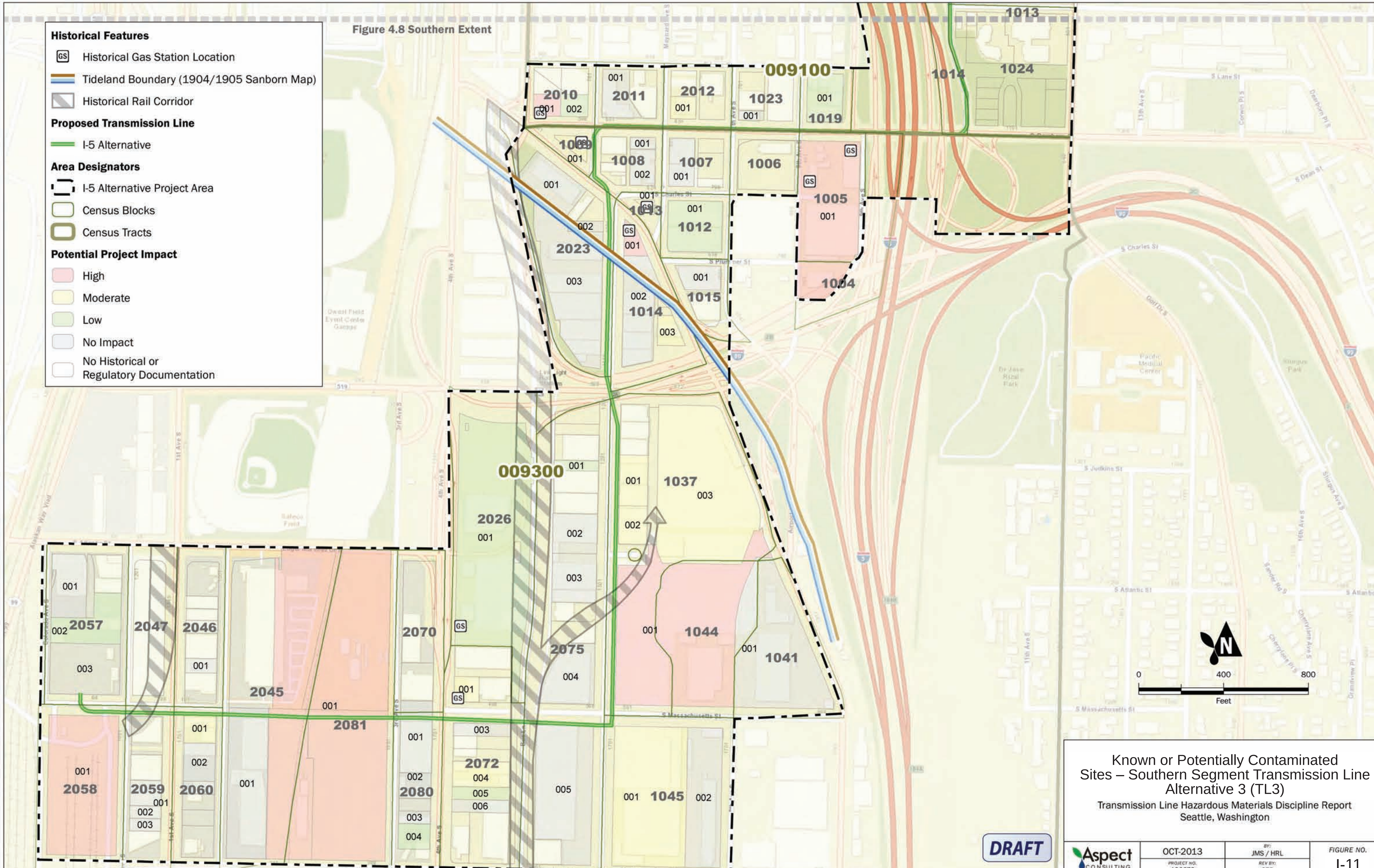
Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Known or Potentially Contaminated Sites – Central Segment Transmission Line Alternative 3 (TL3)

Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Aspect Consulting	OCT-2013	BY: JMS / HRL	FIGURE NO.
	PROJECT NO. 120076	REV BY: CEB	I-10

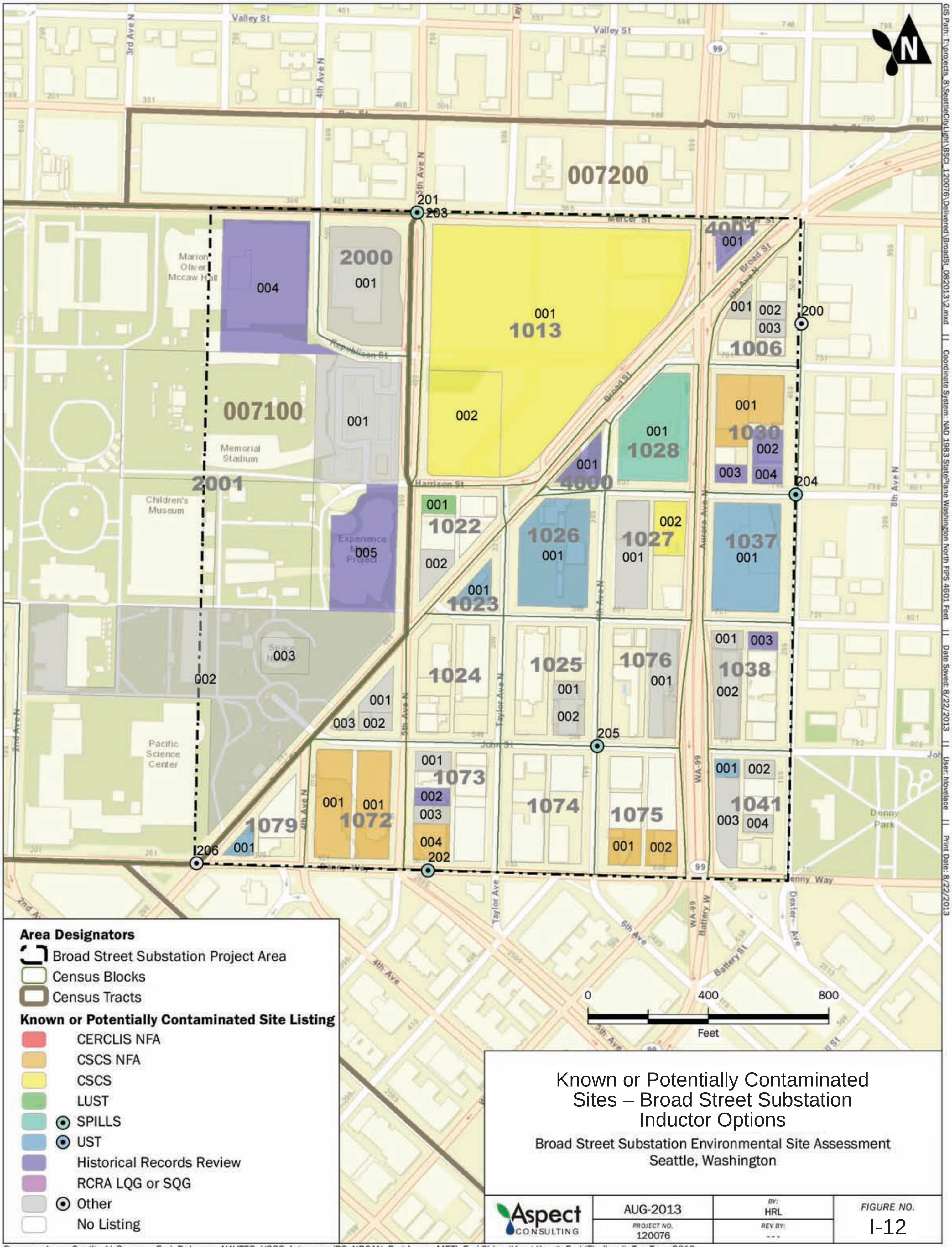
Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



Known or Potentially Contaminated Sites – Southern Segment Transmission Line Alternative 3 (TL3)

Transmission Line Hazardous Materials Discipline Report
Seattle, Washington

Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Basemap Layer Credits || Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

APPENDIX J

Summary of Substation Alternatives Consistency with Long-range Planning Documents

The table below summarizes the goals, policies and objectives from the 2005 City of Seattle Comprehensive Plan, 2007 South Lake Union Urban Center Neighborhood Plan, City of Seattle Land Use Code (Chapter 23.48), 2010 Center City Public Realm Strategy, 2012 Seattle City Light 2013-2018 Strategic Plan, and provides a brief assessment of the degree of consistency for each of the action alternatives for the substation.

Consistency of Proposed Substation Alternatives with Plans, Policies, and Regulations

Planning Document	Goals and Policies	Consistency Summary		
		Substation Alternative 1 (SA1)	**Substation Alternative 2 (SA2)**	**Substation Alternative 3 (SA3)**
Seattle Comprehensive Plan	Urban Village Goals and Policies: • Maximize the benefit of public investment in infrastructure and services, and deliver those services more equitably by focusing new infrastructure and services, as well as maintenance and improvements to existing infrastructure and services, in areas expecting to see additional growth, and by focusing growth in areas with sufficient infrastructure and services to support that growth (UVG10). • Coordinate public and private activities to address transportation, utilities, open space and other public services to accommodate the new growth associated with subarea rezones (e.g., in transit station areas) that result in significant increases in density (UV7.5). • Seek to provide public open space in conjunction with major public projects such as utility and transportation projects, with the amount of open space based on the size of the project, open space needs of the adjacent areas, and the opportunities provided by the particular project (UV55).	Urban Village: • Consistent with UVG10: The north-central area of downtown Seattle, particularly South Lake Union, Belltown, Denny Triangle, and the north end of the Central Business District, has been experiencing rapid redevelopment over the past 15 years, consistent with the City's vision to create jobs and add retail services and housing in the Center City. SA1 would provide the necessary reliability of service to serve expected and desired redevelopment in South Lake Union and Denny Triangle areas. • Consistent with UV7.5: The zoning in South Lake Union was recently changed to allow for increased building heights and residential densities. SA1 would provide the necessary reliability of service to serve the potential increase in growth as allowed per the rezone. • Least consistent with UV55: SA1 would not include any open space.	Urban Village • Consistent with UVG10 and UV 7.5: Same as SA1. • Consistent with UV55: SA2 would be consistent with UV55 as public open space would be incorporated on-site along John Street and Minor Avenue North. Open space uses along Minor Avenue North could potentially be in the form of a dog park, pea patch, or recreational area.	Urban Village • Consistent with UVG10 and UV 7.5: Same as SA1. • Consistent with UV55: SA3 would be the most consistent with UV55 because public open space would be incorporated on-site along John Street, Minor Avenue North, and the elevated pathway along Denny Way and the alley. Open space uses could include an off-leash area and community gardens.
	Transportation Goals and Policies: • Manage the parking supply to achieve vitality of urban centers and villages, auto trip reduction, and improved air quality (TG17). • Consider establishing parking districts that allow for neighborhood based on- and off-street parking management regulations to help meet urban center mode split goals (T37). • Use low-cost parking management strategies such as curb space management, shared parking, pricing, parking information and marketing and similar tools to encourage more efficient use of existing parking supply before pursuing more expensive off-street parking facility options (T38). • Restrict on-street parking when necessary to address safety, operational or mobility problems. In urban centers and urban villages where such restriction is being considered, the pedestrian environment and transit operations are of primary concern, but decisions should also balance the use of the street by high-occupancy vehicles, bicycles and motor vehicles; access to local businesses; control of parking spillover into residential areas; and truck access and loading (T39). • In commercial districts prioritize curb space in the following order: 1. transit stops and layover, 2. passenger and commercial vehicle loading, 3. short-term parking (time limit signs and paid parking); 4. parking for shared vehicles; and 5. vehicular capacity (T40). • During construction or implementation of new transportation projects, consider replacing short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss (T42).	Transportation: • Consistent with TG17: No change would occur to the parking supply as a result of the project. Parcels 1 and 3 could be surplused for a use different than off-street parking lots. • Consistent with T37: The project would not affect the ability to establish parking districts. • Consistent with T38: The project would not hinder use of low cost parking strategies to encourage more efficient use of parking. Parcels 1 and 3 could be surplused for a use different than off-street parking lots. • Consistent with T39: The project is being developed to address pedestrian and transit needs, and balances other uses of the streets affected. • Consistent with T40: The project is prioritizing curb space surrounding the substation site consistent with this policy. • Consistent with T42: The project is not a transportation project, and there would be no loss of on-street parking as a result of SA1..	Transportation: • Consistent with TG17: On-street and off-street parking eliminated as a result of the project would not be replaced. As a result, this project could contribute to auto trip reduction since it is located in an area served by public transit and improvements will be made for pedestrian movement around the substation site. • Consistent with T37: Same as SA1. • Consistent with T38: The project would reduce parking supply and does not propose to add off-street parking. • Consistent with T39: The project would eliminate on-street parking on Pontius Avenue North. John Street will be narrowed consistent with Green Street standards which will improve conditions for pedestrians and bicyclists. • Consistent with T40: Same as SA1. • Consistent with T42: The project is not a transportation project but would vacate a street. On-street parking would be reduced as a result of the project. Since the project is located in an area served by public transit and improvements will be made for pedestrian movement around the substation site, SA2 is considered to be consistent with on-street parking policies.	Transportation: • Consistent with TG17: Same as SA2 • Consistent with T37: Same as SA1 • Consistent with T38: Same as SA2 • Consistent with T39: Same as SA2 • Consistent with T40: Same as SA1 • Consistent with T42: Same as SA2
	Economic Development Policies • Foster a positive business climate in Seattle by ensuring adequate public services, infrastructure, and high-quality customer service (EDG7). • Seek ways to create a local business environment that promotes the establishment, retention, and expansion of high-technology industries in the city. Where possible, look for opportunities to link these businesses to	Economic Development: • Consistent with EDG7: SA1 would create a reliable source of electricity for the business community. It would serve expected development in South Lake Union and Denny Triangle. • Consistent with ED12: High-technology industries have a higher reliance on continuous electricity service than other industries. A new substation	Economic Development: • Same as SA1.	Economic Development: • Same as SA1.

Consistency of Proposed Substation Alternatives with Plans, Policies, and Regulations

Planning Document	Goals and Policies	Consistency Summary		
		Substation Alternative 1 (SA1)	**Substation Alternative 2 (SA2)**	**Substation Alternative 3 (SA3)**
	existing research institutions, hospitals, educational institutions and other technology businesses (ED12). • Seek to coordinate, where appropriate, City investment in utilities, transportation and other public facilities with business, employment and economic development opportunities (ED41).	and distribution system may help attract such industries to South Lake Union and the Denny Triangle. • Consistent with ED41: Several large customers are anticipated to come on-line during the fourth quarter of 2016 and early 2017. Broad Street Substation is reaching its distribution load capacity limit, and many of the anticipated large loads are too far to serve effectively from Broad Street Substation. The Denny Substation Project would provide reliable service to meet these new electrical load needs.		
	Utility Goals and Policies • Provide reliable service at lowest cost consistent with the City's aims of environmental stewardship, social equity, economic development, and the protection of public health (UG1). • Maintain the service reliability of the City's utility infrastructure (UG2). • Operate City utilities consistent with regional growth plans (UG5). • Maintain the reliability of the City's utility infrastructure as the first priority for utility capital expenditures (U3). • Coordinate City utility capital expenditure planning with capital investment planning by other City departments (U5). • Work with neighborhood and community representatives in siting utility facilities (U18). • Continue to subject all above-grade City utility capital improvement projects to review by the Seattle Design Commission (U19). • Consider opportunities for incorporating accessible open space in the siting and design of City utility facilities (U20).	Utility: • Consistent with UG1, UG2, UG5, and U3: The Denny Substation would provide the most viable, safe, reliable, and cost-effective way to meet emerging electrical load in the north downtown Seattle area. A new substation would provide the needed capacity and flexibility to manage load growth in other nearby urban centers and also alleviate the electrical system congestion between the Broad Street, Canal, University, and East Pine substations. • Consistent with U5: City Light is coordinating required water main relocations with planned upgrades by SPU. • Consistent with U18: City Light considered several sites for locating substation • Consistent with U19: The Denny Substation is undergoing review by the Seattle Design Commission (Design Commission) for consistency with Seattle Land Use Code, the Seattle Comprehensive Plan, the South Lake Union Urban Design Framework, the South Lake Union Neighborhood Plan, and the Denny Way Streetscape Concept Plan. • Least consistent with U20: SA1 will not include open space areas.	Utility: • Same as SA1 except more consistent with U20 since public open space would be provided.	Utility: • Same as SA1 except more consistent with U20 since public open space would be provided.
	Seattle City Light: Anticipated Future Facilities (Utilities Appendix A) • Within the Comprehensive Plan's 20 year timeframe a new principal substation will be necessary downtown, with an underground transmission line connection to the South substation. New substations also may be built in the next five to twenty years at Interbay, in the SODO area and in South Lake Union, depending on load growth projections and emerging real construction.	Seattle City Light: Anticipated Future Facilities • Consistent with identified future facility for downtown.	Seattle City Light: Anticipated Future Facilities: • Same as SA1.	Seattle City Light: Anticipated Future Facilities: • Same as SA1.

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Planning Document	Goals and Policies	Consistency Summary		
		Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)
South Lake Union Urban Center Neighborhood Plan	Neighborhood Character Goals, Policies and Strategies: • Encourage public and private developers to consider existing neighborhood character when designing projects adjacent to parks and historical sites (Policy 3). o Use the South Lake Union Design Guidelines to support development that reflects existing and desired neighborhood character (Strategy 3c). • Encourage designs of public spaces and private buildings that can accommodate the needs of people across a range of ages and abilities, allowing residents to age in place (Policy 5). o Consider accessibility in reviewing public projects (Strategy 5c). • Support the growth of innovative industries in South Lake Union including biotechnology, information technology, environmental sciences and technology, and sustainable building. *Note: There is disagreement about this policy. Some of the residents of Cascade neighborhood object to providing support to and attracting the biotechnology industry to the South Lake Union neighborhood and would prefer that the policy state "Support the growth of innovative industries in South Lake Union" without preference given to particular industries* (Policy 9). o Create reliable power and telecommunications networks to attract innovative industries and businesses (Strategy 9d). Innovative industries sometimes have higher demand for power or telecommunications networks than traditional industries. As the neighborhood develops, utilities should work with the neighborhood to provide networks that will meet the neighborhood's needs. • Seek to incorporate the arts into the design of public projects and the use of public spaces (Policy 13). o Maximize the potential for public art in public capital improvement projects by developing a public art plan (Strategy 13a). o Use a Public Art Advisory Committee process to expedite review of art components of public/private projects (Strategy 13b). o Collaborate with community arts organizations on programming public spaces (Strategy 13c).	Neighborhood Character: • Consistent with Policy 3: The Denny Substation is undergoing review by the Design Commission. • Least consistent with Policy 5: No open space would be provided. • Consistent with Policy 9: Innovative industries and businesses have a higher reliance on continuous electricity service than other industries. A new substation and network system might help attract such industries to South Lake Union and the Denny Triangle. • Consistent with Policy 13: The upper section of the exterior of the proposed substation structure would be composed of a ventilated-screen, translucent glass assembly with an opportunity to incorporate art. A City Light artist would be engaged at the 30 percent design phase to incorporate art work into the project.	Neighborhood Character: • Consistent with Policy 3: Same as SA1. • Consistent with Policy 5: The open space areas could provide a range of activities, from passive-seating areas to more active like off-leash dog areas. The areas would be accessible from Denny Way, Minor Avenue North, and John Street sidewalks. • Consistent with Policy 9: Same as SA1. • Consistent with Policy 13: Same as SA1.	Neighborhood Character: • Consistent with Policy 3: Same as SA1. • More Consistent with Policy 5: Similar to SA2. The ramps would be Americans with Disabilities Act (ADA) accessible, making the overlook walk part of the open space available to a range of ages and abilities • Consistent with Policy 9: Same as SA1. • Consistent with Policy 13: Same as SA1.
	Transportation Goals, Policies and Strategies • Promote a system of safe pedestrian and bicycle connections linking key activity areas and destinations, such as open spaces, schools and arts facilities (Policy 18). o Design streetscapes to increase pedestrian interest, accessibility and safety (Strategy 18a). Wider sidewalks, landscaping, street trees, public art, curb bulbs and pedestrian signals can all help to create a more attractive and safe pedestrian environment. Key pedestrian routes that warrant additional attention include Denny Way. o Strategy 18d: Encourage sidewalk enhancements along designated "green streets." • Explore transportation improvements to link South Lake Union with its surrounding neighborhoods (Policy 22). o Provide safe pedestrian crossings in the Denny Way corridor (Strategy 22c). Pedestrian improvements in the Denny Way corridor that could increase pedestrian safety and accessibility include: intersection improvements, including curb bulbs and pedestrian countdown signals.	Transportation: • Consistent with Policy 18: The project's frontage along Denny Way would be improved from existing conditions consistent with Seattle Department of Transportation's (SDOT) right-of-way manual and include a wider concrete sidewalk, curb, and gutter. Native trees, shrubs, and groundcovers would be provided to the extent feasible between the sidewalk and the substation facility. • Consistent with Policy 18: Street trees would be included on the street frontages of Denny Way and John Street. Street trees along Minor Avenue North would be limited due to conflicts with proposed underground duct banks. Curb bulbs would be incorporated at the Denny Way and Minor Avenue North intersection and the Minor Avenue North and John Street intersections. No pedestrian signals are proposed. Vine plantings along the substation structure wall might also be used to help screen the substation from pedestrians. A narrower street section for John Street would be constructed consistent with Green Streets. • Somewhat consistent with Policy 22: Curb bulbs are proposed at the Denny Way and Minor Avenue North intersection	Transportation: • Consistent with Policy 18: The project's frontage along Denny Way would be improved consistent with SDOT's right-of-way manual and include a wider concrete sidewalk, curb, gutter and street trees. Buffer planting along Denny Way would only be placed west of the facility between the substation structure and Minor Avenue North. The landscaping could include a grove of columnar trees planted in a grid pattern. Curb bulbs would be incorporated at the Denny Way and Minor Avenue North intersection and the Minor Avenue North and John Street intersections. The open space along John Street could consist of seating, bicycle racks, shade trees, accent planting, and special paving. A narrower street section for John Street would be constructed consistent with Green Streets. • Somewhat Consistent with Policy 22: Same as SA1.	Transportation: • Consistent with Policy 18: The project's frontage along Denny Way would be improved from existing conditions consistent with SDOT's right-of-way manual and include a wider concrete sidewalk, curb, gutter and street trees. An elevated pedestrian pathway would be constructed along Denny Way and continue north along the alley. Buffer planting between the sidewalk and the pedestrian ramp would be provided to add visual interest. Curb bulbs would be incorporated at the Denny Way and Minor Avenue North intersection and the Minor Avenue North and John Street intersections. The open space and narrowed street along John Street would be similar to the SA2 proposal. • Somewhat Consistent with Policy 22: Same as SA1

Consistency of Proposed Substation Alternatives with Plans, Policies, and Regulations

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		Substation Alternative 1 (SA1)	Substation Alternative 2 (SA2)	Substation Alternative 3 (SA3)
	Parking Goals, Policies and Strategies • Develop flexible off -street parking requirements that provide parking adequate to a building's occupants, and encourage the use of transit, walking, bicycling and other non-automotive modes (Policy 20). o Reduce or eliminate minimum off -street parking requirements (Strategy 20A). o Allow flexibility for shared use of off -street parking (Strategy 20b). o Support efforts to share parking between businesses, residential buildings and public amenities (Strategy 20c). o Use Transportation Demand Management activities to balance parking demand and supply (Strategy 20D). o Consider maximum parking requirements for high-commuter uses (Strategy 20E). • Encourage the efficient use of on-street parking for neighborhood businesses, residents and attractions through innovative parking management and pricing strategies (Policy 21). o Implement a flexible on-street parking meter program throughout the neighborhood that is able to adapt quickly and efficiently to changes in parking demand resulting from new businesses, offices and residences (Strategy 21a). o Eliminate time limits for most on-street parking spaces and charge hourly market rates (Strategy 21B). o Establish a "pilot" residential parking zone to provide a minimum amount of exclusive parking for residents of existing Cascade buildings that have no onsite parking (Strategy 21d).	Parking: • Consistent with Policy 20: The project is not providing additional off-street parking since only one vehicle would be used to access the substation per day. During the property surplus process, Parcels 1 and 3 could revert back to off-street parking lots. • Consistent with Policy 21: The project would not affect existing on-street parking.	Parking: • Consistent with Policy 20: SA2 would not provide additional off-street parking since only one vehicle would be used to access the substation per day. Although the substation could have a learning center and/or community or retail space, it is expected that the majority of visitors to the site would come from within the local neighborhood and walk to the site. The project would permanently eliminate the existing surface parking lot on Parcel 1. During the property surplus process, Parcel 3 would revert back to an off-street parking lot. The off-street public parking lots located in the site vicinity would likely accommodate some of the parking demand that was using Parcel 1. Since the project is located in an area served by public transit and improvements will be made for pedestrian movement around the substation site, SA2 is considered to be consistent with off-street parking policies. • Consistent with Policy 21: SA2 would permanently remove on-street parking spaces on Pontius Avenue North, but would not hinder innovative parking management and pricing strategies. Since the project is located in an area served by public transit and improvements will be made for pedestrian movement around the substation site, SA2 is considered to be consistent with off-street parking policies.	Parking: • Consistent with Policy 20: Same as SA2 • Consistent with Policy 21: Same as SA2
	Parks and Open Space Goals, Policies and Strategies • Consider a variety of tools, including regulatory measures and joint projects with public agencies and private organizations, to provide for new open spaces to support the growth of the neighborhood (Policy 29). o Explore park and recreational opportunities associated with potential substation improvements (Strategy 29b). Seattle City Light is planning to develop a substation site to accommodate projected growth in the planning area. Once City Light has selected a site, the two departments should evaluate the feasibility of co-locating recreational facilities with the substation. If recreation space is not feasible, consider other public facilities as potential co-locators with the substation. o Partner with public agencies and private organizations to develop open spaces (Strategy 29d). o Consider open space and other community facilities identified by this plan as the only public benefits when granting right-of-way vacations (Strategy 29e). Streets and alleys play a number of roles, including that of providing spaces between buildings. If the City vacates streets or alleys, mitigate the impacts of the vacation by requiring the creation of open space, or, if open space isn't appropriate for the site, by providing a community facility that is called for by this plan. • Use visual and physical connections between open spaces, adjacent streets and surrounding activities to stimulate positive social interactions (Policy 31).	Parks and Open Space: • Least Consistent with Policy 29: Open space is not proposed. SA1 would not include any street vacations. • Policy 31 is not applicable: Open space is not proposed. • Somewhat Consistent with Policy 32: There is opportunity to integrate art features as part of the exterior of the facility. Space for performances would not be feasible under SA1.	Parks and Open Space: • Consistent with Policy 29: Open space is proposed along John Street and Minor Avenue North to mitigate the impacts of vacating Pontius Avenue North. • More consistent with Policy 31: Same as SA1 except that open space would be provided along John Street, and along Minor Avenue North, which would receive sunlight at noon during the winter and summer and in the mornings during the summer. Landscaping in public areas on-site and along adjacent street frontages would be consistent with Crime Prevention through Environmental Design (CPTED) principles to maximize the safety and security of the facility, as well as the general public around the edges of the facility or within open space areas. • Somewhat Consistent with Policy 32: Same as SA1.	Parks and Open Space: • More Consistent with Policy 29: Open space is proposed along John Street and Minor Avenue North to mitigate the impacts of vacating Pontius Avenue North. The elevated pathway would be accessible to the public. • More consistent with Policy 31: Same as SA2 except that in addition to the open space along Minor Avenue North, the elevated pathway would receive sunlight year-round except during winter mornings. • Somewhat Consistent with Policy 32: Same as SA1.

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	o Try to site and design open spaces to receive as much direct, year round sunlight as possible (Strategy 31a). o Promote Crime Prevention Through Environmental Design (CPTED) principles in the design of facilities (Strategy 31b). o Design facilities to be physically and visually accessible from the adjacent street (Strategy 31c). o Plan for parks and open spaces to be adjacent to active uses such as shops, restaurants and community organizations (Strategy 31d). • Identify opportunities for alternatives to traditional open space, including green streets and recognition and use of Lake Union as recreation and open space (Policy 32). o Explore integrating art features and spaces for performances into existing and future open spaces (Strategy 32d). <u>Sustainable Development Goals, Policies and Strategies</u> • Provide for a stable and reliable supply of electrical power to South Lake Union as a growing urban center (Policy 43). *Note: Some members of the community feel that this policy and its strategies should be a basic responsibility of the electrical utility and are not appropriate to the neighborhood plan. Others felt that issues with the current quality of service in the neighborhood or that the significant growth planned for the community resulted in special electrical service needs that warranted the inclusion of these issues in the neighborhood plan*. o Develop a utility infrastructure plan to address projected growth in load that: ▪ identifies essential infrastructure, including a substation; and ▪ evaluates a plan and financing for an underground network system that provide stability to the system (Strategy 43b).	<u>Sustainable Development:</u> • Consistent with Policy 43: The substation would be part of a project to convert the existing overhead radial distribution system to an underground network distribution system to provide more reliable electrical service.	<u>Sustainable Development:</u> • Consistent with Policy 43: Same as SA1.	<u>Sustainable Development:</u> • Consistent with Policy 43: Same as SA1.
Seattle City Light 6-year Strategic Plan	<u>Objective 1 – Improve the Customer Experience and Rate Predictability:</u> • Building a new north downtown substation will create a stronger and better-integrated distribution system throughout the city and provide highly reliable power to serve the city's growing biotechnology research and information technology sectors.	Consistent.	Consistent.	Consistent.