

4 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

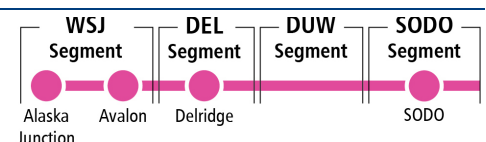
This chapter discusses the applicable laws and regulations, affected environment, and environmental consequences of the West Seattle Link Extension Build Alternatives. The following resources are discussed for the West Seattle Link Extension:

- Acquisitions, Displacements, and Relocations
- Land Use
- Economics
- Social Resources, Community Facilities, and Neighborhoods
- Visual and Aesthetic Resources
- Air Quality
- Noise and Vibration
- Water Resources
- Ecosystems
- Energy Impacts
- Geology and Soils
- Hazardous Materials
- Electromagnetic Fields
- Public Services, Safety, and Security
- Utilities
- Historic and Archaeological Resources
- Parks and Recreational Resources
- Section 4(f) Resources

Each resource section describes the following:

- Introduction to the resource and regulatory requirements applicable to the resource.
- The affected environment, including the study area for the resource.
- The operational, construction, and indirect impacts of each alternative considered in this Final Environmental Impact Statement (EIS).
- Potential mitigation measures for unavoidable impacts.

National Environmental Policy Act and State Environmental Policy Act regulations require that an EIS disclose direct and indirect impacts (i.e., effects) of a proposed action on the environment. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts (sometimes called “secondary impacts”) are caused by the action but are later in time or farther removed in distance. Examples include changes in land use patterns and related effects on air quality. Impacts can be either temporary (short-term), such as construction impacts, or operational (long-term), such as property displacements or impacts due to light rail operations. Cumulative impacts, which could result from the project’s incremental impact when added to those of other past, present, and reasonably foreseeable future actions, are discussed in Chapter 5, Cumulative Impacts.



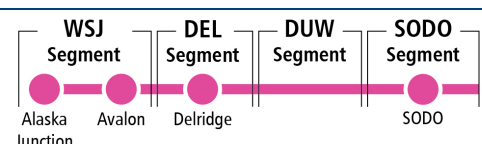
The Sound Transit Board of Directors' (Board) July 2022 Board Action identified which alternatives were preferred for the Final EIS (Motion M2022-57). A Preferred Alternative is not a decision on the project to build. It is a statement of preference for alternatives at the time of the Board Action based on currently available information from the Alternatives Development process, the Draft EIS, and comments from Tribes, agencies, and the public.

Section 2.1, Build Alternatives, describes all of the Build Alternatives evaluated in this chapter, and Section 2.2, No Build Alternative, describes the No Build Alternative. The No Build Alternative is used as the baseline to evaluate the impacts from the build alternatives. The operational impact analysis considers the fully built West Seattle Link Extension and a shorter, minimum operable segment as defined in Section 2.4, Minimum Operable Segment, where the impacts would be different than the fully built alternatives. Impacts from the minimum operable segment would have additional potential impacts when compared with the fully built alternatives for the following resources:

- Acquisitions, Displacements, and Relocations
- Land Use
- Economics
- Social Resources, Community Facilities, and Neighborhoods
- Air Quality
- Energy Impacts

This chapter describes the resources evaluated and the applicable federal, state, and local laws and regulations. Sound Transit's Environmental Policy states that the agency will satisfy all applicable laws and regulations and mitigate environmental impacts consistent with Sound Transit's policies. The West Seattle Link Extension Project, as a regional transit authority facility, is an essential public facility as defined by Revised Code of Washington 36.70A.200.

That means that once Sound Transit's routing decisions have been finalized, local jurisdictions have a duty to accommodate the proposed project in their land use plans and development regulations. Sound Transit and the City of Seattle have worked closely during the environmental process to consider City code requirements and their application to the project. This work will continue through final design as more project detail is developed. Sound Transit and the City of Seattle have identified code requirements where further coordination is needed. For example, some elements of the City code do not specifically address light rail, including Seattle Municipal Code land use code chapters 23.45, 23.47A, 23.48, 23.49, and 23.50, and Chapter 25.11. The City and Sound Transit are developing a permitting plan, which includes potential code amendments to accommodate light rail to reduce permitting timelines while fulfilling the City's responsibility to review and approve projects.



4.1 Acquisitions, Displacements, and Relocations

4.1.1 Introduction to Resource and Regulatory Requirements

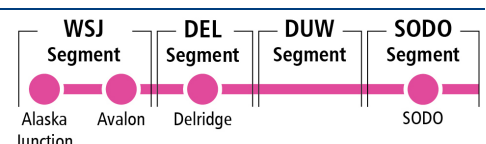
This section summarizes expected property acquisitions based on current conceptual designs and describes major differences between alternatives. Building and operating the West Seattle Link Extension Project (the project) requires acquiring public and private property for right-of-way and other facilities, and displacing and relocating some residential, commercial, and public uses. Sound Transit overlaid the proposed footprint for all the light rail alternatives over the parcel data from King County and conducted field surveys to identify which parcels would be affected, and to estimate the potential acquisitions and displacements for each alternative. The number of parcels affected, which includes both full and partial acquisitions, is presented for each alternative. Many partial acquisitions would not affect buildings on the property. Where a partial acquisition would occur on a property with multiple buildings, some buildings could be removed while others could remain if they continue to be usable.

The summary of parcels affected is an estimate based on conceptual design to provide for comparison of alternatives and will be updated as the project design is refined. In addition, properties that are currently vacant or underdeveloped may be developed during completion of this Final Environmental Impact Statement (EIS), or later before project construction begins. Displacements reported herein are determined upon property use and conditions observed at the time of analysis. Therefore, the number and type of displacements may vary between what is included in the EIS and what is ultimately required. Final determinations of the property needs for the project, including acquisitions and displacements, will be based on the project's final design after Sound Transit completes the EIS process, selects the alternative to be built, and develops final engineering and design plans.

In addition to the potential property acquisitions described in this section, the project would require easements, such as subsurface easements, aerial easements, and temporary construction easements. These easements would not require displacement of surface uses, and the easement area is not included in the data presented here. Land or public rights-of-way owned by Washington State Department of Transportation (WSDOT), City of Seattle, King County, and/or Port of Seattle and state-owned aquatic lands managed by Washington State Department of Natural Resources through the Aquatic Resources Program may also be needed. Specific details and areas of these easements will be established during final design.

Other impacts associated with acquisitions and displacements are discussed in Section 4.2, Land Use; Section 4.3, Economics; Section 4.4, Social Resources, Community Facilities, and Neighborhoods; Section 4.14, Public Services, Safety, and Security; Section 4.16, Historic and Archaeological Resources; Section 4.17, Parks and Recreational Resources; and Section 4.18, Section 4(f) Summary.

The project would comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act), Code of Federal Regulations Title 49, Part 24, as amended. The Uniform Act is a federal requirement that established minimum requirements and provides guidance on how federal agencies, or agencies receiving federal financial assistance for a project, will compensate property owners or tenants who need to relocate if they are displaced by a project. The Federal Transit Administration must ensure all private property owners are treated fairly, consistently, and equitably throughout the real property acquisition process. Sound Transit has also adopted the *Real Property Acquisition and Relocation Policy, Procedures, and Guidelines* (Sound Transit 2017) to guide its compliance with Revised Code of Washington Chapter 8.26 and Washington Administrative Code Chapter 468-100. Property acquisition will meet these laws and policies so that property owners are treated uniformly and equitably.



4.1.2 Affected Environment

The study area for acquisitions, displacements, and relocations includes parcels within the project limits. The project limits include areas that would potentially be acquired for track alignments, stations, and related facilities and to support construction activities for each alternative. All parcels are within the City of Seattle.

The study area includes residential, commercial, and industrial development, and some vacant and public properties. Properties within the SODO and Duwamish segments are primarily industrial with some commercial development, while properties within the Delridge and West Seattle Junction segments are mostly residential with some mixed-use and commercial development. Section 4.2 describes current and projected future land uses along each alternative.

4.1.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would not acquire any properties. No displacements or relocations would occur.

4.1.4 Environmental Impacts of the Build Alternatives during Operation

All segments and alternatives would acquire property and would displace and relocate some uses for operation of the light rail. During construction, additional property would be needed for staging areas and construction access. Tables 4.1-1 to 4.1-4 summarize the numbers of parcels affected and displacements by alternative, and include parcels needed both for operation and construction. Acquisitions and displacements for alternatives within a segment often vary, depending on which alternatives the alternative would connect to in adjacent segments. This variation is represented by the range of acquisitions and displacements shown in the tables. The following discussion highlights the key differences between alternatives and includes information on the minimum operable segment (M.O.S.). Section 2.4, Minimum Operable Segment, provides more information on the M.O.S.

The City of Seattle adopted Mandatory Housing Affordability (M.H.A.) in the City Code in 2019. M.H.A. is an affordable housing incentive program for new development, including in the project corridor. There are currently no M.H.A. properties that would be displaced by the project. If any are developed on properties to be acquired, these would be mitigated as required by the City. There would be affected parcels that currently have income-restricted housing under the Multifamily Tax Exemption Program or that are managed by Seattle Housing Authority.

Properties that would be difficult to relocate based on their size or use are also noted in Section 4.1.9, Relocation Opportunities. Appendix L4.1, Acquisitions, Displacements, and Relocations, provides tables and maps to identify the potentially affected parcels by parcel number and address for each alternative.

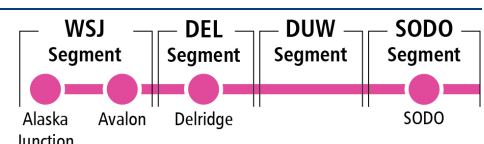


Table 4.1-1. Number of Potential Parcels Permanently Affected and Displaced during Operation, by Alternative – SODO Segment

Alternative	Parcels Affected							Displacements	
	Single-Family	Multi-Family	Commercial and Industrial	Mixed-Use	Public and Institutional	Vacant	Total	Business	Residential
Preferred At-Grade Lander Access Station Option (SODO-1c)	0	0	20	0	0	1	21	33	0
At-Grade Alternative (SODO-1a)	0	0	21	0	0	1	22	34	0
At-Grade South Station Option (SODO-1b)	0	0	20	0	1	1	22	35	0
Mixed Profile Alternative (SODO-2)	0	0	14	0	1	1	16	31	0

Table 4.1-2. Number of Potential Parcels Permanently Affected and Displaced during Operation, by Alternative – Duwamish Segment

Alternative	Parcels Affected							Displacements	
	Single-Family	Multi-Family	Commercial and Industrial	Mixed-Use	Public and Institutional	Vacant	Total	Business	Residential ^a
Preferred South Crossing Alternative (DUW-1a)	8	9 to 16	40 to 42 ^b	0	6 to 9	4 to 7	70 to 78	36 to 37	20 to 28
South Crossing South Edge Crossing Alignment Option (DUW-1b)	9	11 to 12	42	0	7 to 8	4 to 8	80	29 to 30	22 to 25
North Crossing Alternative (DUW-2)	0	0	51 ^b	0	10	3	65	36	0

Note: Ranges reflect differences from connecting to different alternatives in adjacent segments. The total impacts are based on individual alternatives and connection options and not the high and low numbers of each impact type shown in the table.

^a Number of residential displacements is based on the number of dwelling units, not the number of buildings.

^b One parcel (Nucor Steel) is partially within the Duwamish Segment for Preferred Alternative DUW-1a and Alternative DUW-2 but is counted within impacts for the Delridge Segment for Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 in Table 4.1-3.

4.1 Acquisitions, Displacements, and Relocations

Table 4.1-3. Number of Potential Parcels Permanently Affected and Displaced during Operation, by Alternative – Delridge Segment

Alternative	Parcels Affected							Displacements	
	Single-Family	Multi-Family	Commercial and Industrial	Mixed-Use	Public and Institutional	Vacant	Total	Business	Residential ^a
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	18	1	9	0	0	2	30	19	34
Dakota Street Station Alternative (DEL-1a)	47	62	6 to 9	0	4 to 6	3	123 to 127	14 to 17	171 to 172
Dakota Street Station North Alignment Option (DEL-1b)	48	61	5 to 9	0	4	3	121 to 125	13 to 17	191
Dakota Street Station Lower Height Alternative (DEL-2a)	45	45	6 to 10	0	3	3	102 to 106	14 to 18	93
Dakota Street Station Lower Height, North Alignment Option (DEL-2b)	49	62	6 to 10	0	4	4	125 to 129	14 to 18	197
Delridge Way Station Alternative (DEL-3)	22 ^b	53	6 to 10	0	4	7	92 to 96	14 to 18	151 ^b
Delridge Way Station Lower Height Alternative (DEL-4)	20 ^b	35	6 to 10	0	4	6	71 to 75	14 to 18	70 ^b
Andover Street Station Alternative (DEL-5)	5	37	8	0	0	4	54	17	114
Andover Street Station Lower Height Alternative (DEL-6a)	17	2	8	0	0	1	28	16	48
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	14	0	9	0	0	2	25	19	14

Note: Ranges reflect differences from connecting to different alternatives in adjacent segments. The total impacts are based on individual alternatives and connection options and not the high and low numbers of each impact type shown in the table.

^a Number of residential displacements is based on the number of dwelling units, not the number of buildings.

^b With the M.O.S., there would be four additional single-family parcels affected, with four additional residential displacements.

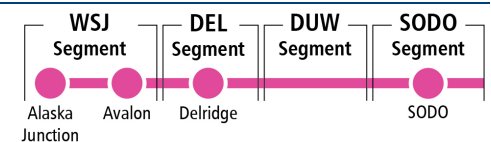


Table 4.1-4. Number of Potential Parcels Permanently Affected and Displaced during Operation, by Alternative – West Seattle Junction Segment

Alternative	Parcels Affected							Displacements	
	Single-Family	Multi-Family	Commercial and Industrial	Mixed-Use	Public and Institutional	Vacant	Total	Business	Residential ^a
Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	21	8	9	1	0	3	41	44	110
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	30 to 33	20 to 22	19	2	1	4	76 to 80	57	351 to 370
Elevated Fauntleroy Way Station Alternative (WSJ-2)	24 to 28	7 to 8	14 to 17	4	1	3	53 to 60	15 to 18	474 to 493
Tunnel 41st Avenue Station Alternative (WSJ-3a)	17 to 22	8 to 12	12 to 15	2	0	3	46 to 50	15 to 18	162 to 269
Tunnel 42nd Avenue Station Option (WSJ-3b)	16 to 22	8 to 9	10 to 13	1	1	2	39 to 46	42 to 45	126 to 230
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	54	16	14	3	0	4	91	17	253
Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	24	9	12	2	0	3	50	15	153
No Avalon Station Tunnel Alternative (WSJ-6)	11	4	5	1	0	1	22	6	109

Note: Ranges reflect differences from connecting to different alternatives in adjacent segments. The total impacts are based on individual alternatives and connection options and not the high and low numbers of each impact type shown in the table.

^a Number of residential displacements is based on the number of dwelling units, not the number of buildings.

4.1.4.1 SODO Segment

Affected properties in the SODO Segment are primarily commercial or industrial, and none of the alternatives would displace residences. Affected parcels in the SODO Segment are shown on Figures L4.1-1a through L4.1-4c. As shown in Table 4.1-1, Option SODO-1b would have the most business displacements and Alternative SODO-2 would have the least. Both Option SODO-1b and Alternative SODO-2 would displace the United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office at 4th Avenue South and South Lander Street. Relocation of the facility could be challenging due to its size, functions, and the service area that it would need to be within. Impacts of relocating the United States Postal Service facility are yet undefined, and if an alternative that triggers relocation of the facility moves forward, additional environmental review will be conducted to evaluate and disclose impacts of relocating the facility. Preferred Option SODO-1c and Alternative SODO-1a would avoid direct impacts to the United States Postal Service facility and would not require relocation of the United States Postal Service facility.

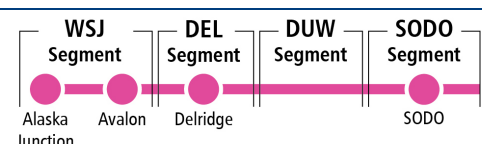
4.1.4.2 Duwamish Segment

Affected properties in the Duwamish Segment are primarily commercial or industrial, with some institutional, public, and residential. Affected parcels in the Duwamish Segment are shown on Figures L4.1-5a through L4.1-7j. As shown in Table 4.1-2, Preferred Alternative DUW-1a and Option DUW-1b would displace the most residences. The displacements would vary slightly between these alternatives depending on which alternative they would connect to in the Delridge Segment. Because of its location along the north side of the West Seattle Bridge, Alternative DUW-2 would not have any residential displacements but would have the most business displacements.

Preferred Alternative DUW-1a and Option DUW-1b would both displace some businesses at Terminal 102, although Option DUW-1b would displace fewer businesses. These alternatives would also acquire part of the West Duwamish Greenbelt and part of the Seattle City Light South Service Center. Preferred Alternative DUW-1a and Alternative DUW-2 would acquire part of the Nucor Steel property but would not affect any buildings or the use of the property. Water-dependent uses are those businesses that are operationally reliant on a waterfront location with water access. Because of their locations around the Duwamish Waterway, all of the alternatives in this segment would displace some businesses that are water-dependent or that support water-dependent businesses. Alternative DUW-2 would displace the most water-dependent businesses.

When connecting to the Delridge Way Station alternatives (Alternative DEL-3 or Alternative DEL-4) in the Delridge Segment, part of the Fire Station 36 property would be acquired with Preferred Alternative DUW-1a and Option DUW-1b. If access or egress is restricted, the station may need to be relocated. Preferred Alternative DUW-1a and Alternative DUW-2 would acquire part of the Fire Station 14 property but are not expected to require relocation of the station. Alternative DUW-2 would displace a Washington State Department of Social and Health Services Facility. All of the alternatives in this segment would displace Alaskan Copper and Brass for the connection to the existing Operations and Maintenance Facility Central.

All of the alternatives in this segment would affect Port of Seattle-owned properties. Preferred Alternative DUW-1a would affect the fewest Port-owned properties but would have the most business displacements on Port-owned properties. Alternative DUW-2 would affect the most Port-owned properties but would have the fewest business displacements on Port-owned properties. The impacts associated with Port-owned properties are discussed in Section 4.3.



Alternative DUW-1a and Option DUW-1b would acquire a portion of the northern end of the West Duwamish Greenbelt. Impacts to parks are discussed further in Section 4.17.

4.1.4.3 Delridge Segment

Affected properties in the Delridge Segment are primarily residential or commercial. Affected parcels in the Delridge Segment are shown on Figures L4.1-8a through L4.1-17c. As shown in Table 4.1-4, Option DEL-2b would have the most residential displacements. Alternative DEL-7 would have the least residential displacements of the Delridge Segment alternatives. Preferred Option DEL-6b and Alternative DEL-6a would also have fewer residential displacements compared to other alternatives. Alternative DEL-6a would displace a behavioral health facility with supportive housing and assisted living that also provides services to nonresidents who live in the area. Alternative DEL-1a, Option DEL-1b, Option DEL-2b, and Alternative DEL-3 would acquire buildings within the Edge Apartments, displacing residential units in those buildings.

Preferred Option DEL-6b and Alternative DEL-7 would have slightly more business displacements than other alternatives. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would all acquire part of the Nucor Steel property but would not affect any buildings or the use of the property.

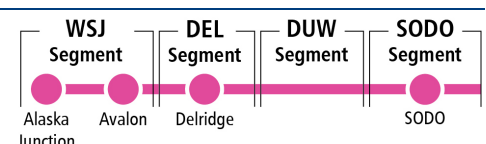
Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would also fully acquire a commercial center and displace all 11 businesses in that commercial center; other alternatives, including Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would also impact the commercial center and displace five businesses, in addition to four Washington state Department of Child, Youth, and Families offices.

Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would not affect any institutional or public parcels. Option DEL-1b and Option DEL-2b would acquire a portion of the Longfellow Creek Legacy Trail and Natural Area, but the use of the acquired area would not affect the function of the natural area or trail. Alternative DEL-3 would acquire part of the Delridge Community Center property but would not displace or affect use of the community center. Alternative DEL-2a, and Alternative DEL-4 would acquire part of the West Seattle Golf Course property and would require reconfiguration of holes. Impacts to parks are discussed further in Section 4.17.

As shown in Table 4.1-3 and Appendix L4.1, for the West Seattle Link Extension M.O.S., Alternative DEL-3 and Alternative DEL-4 would need to acquire additional residential parcels for the bus facilities along Delridge Way Southwest and Southwest Dakota Street.

4.1.4.4 West Seattle Junction Segment

Most of the affected properties within the West Seattle Junction Segment are single- or multi-family residences with some commercial and mixed-use development along main arterials. The alternatives in this segment would affect more mixed-use properties than in other segments. The majority of residential displacements in this segment are multi-family residences near Fauntleroy Way Southwest and Southwest Alaska Street. Affected parcels in the West Seattle Junction Segment are shown on Figures L4.1-18a through L4.1-25d.



As shown in Table 4.1-4, Preferred Option WSJ-5b and Alternative WSJ-6 would have the least residential displacements. Alternative WSJ-1 and Alternative WSJ-2 would have the most residential displacements. Alternative WSJ-1 would displace residential units from four apartment or condominium complexes, including about 200 units at Spruce Apartments. Alternative WSJ-2 would displace residential units from five apartment or condominium complexes, including about 250 units at Maris Luxury Apartments. Alternative WSJ-3a, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6 would each displace 90 residential units at the City Watch Apartments.

Alternative WSJ-1 would have the most business displacements. This alternative, including Preferred Option WSJ-5b and Option WSJ-3b, would displace Jefferson Square complex, which accounts for most business displacements at 33 businesses, in addition to 78 residential units. Alternative WSJ-6 would have the least business displacements. Alternative WSJ-2, Alternative WSJ-3a, Alternative WSJ-4, and Alternative WSJ-5a would displace a similar number of businesses.

Alternative WSJ-1 and Alternative WSJ-2 would acquire Fauntleroy Place park, while Option WSJ-3b would acquire Junction Plaza Park. Impacts to parks are discussed further in Section 4.17.

4.1.5 Environmental Impacts of the Build Alternatives during Construction

During construction, property would be needed for staging areas and construction access. Most of the area needed for construction would be accommodated within areas required for permanent right-of-way, although some additional properties would need to be acquired for construction and are accounted for in estimated acquisitions and in the construction limits depicted in Appendix J, Conceptual Design Drawings.

Temporary construction easements provide for temporary use of a property during construction. These easements might be needed along the project corridor. Once construction is complete, the property would be restored to its previous condition, and the easement would be terminated. These parcels are not included in Appendix L4.1 because the exact locations where these easements might be needed are not known at the current level of design, they would not permanently displace existing uses, and they are not anticipated to substantially disrupt existing uses.

Option DUW-1b would temporarily displace moorage at the Harbor Island Marina, which allows live-aboard boats, and could potentially affect people living there. See Section 3.11.3.6, Navigation, for more information on impacts to moorage during construction.

4.1.6 Indirect Impacts of the Build Alternatives

Consistent with Sound Transit policy and local land use regulations, some parcels initially acquired for a project use, such as construction staging, could be redeveloped to accommodate transit-oriented development (TOD). The potential indirect impacts associated with TOD are discussed in Section 4.2. The potential indirect impacts associated with displacement of industrial and maritime uses are discussed in Section 4.3.

4.1.7 Mitigation Measures

Sound Transit's policies and procedures comply with the federal Uniform Act and the Washington state relocation and property acquisition requirements. In some cases, Sound Transit provides advisory services to property owners above the minimum requirements of federal and state law.

Sound Transit would compensate affected property owners in accordance with the Uniform Act and according to the provisions specified in Sound Transit's adopted *Real Property Acquisition and Relocation Policy, Procedures, and Guidelines* (2017; Sound Transit Real Property Acquisition and Relocation Policy, Procedures, and Guidelines Summary). Benefits would depend on the level of impact, available relocation options, and other factors.

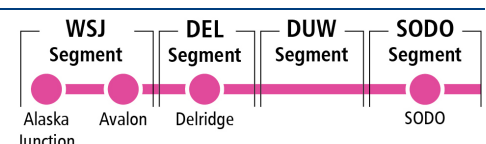
For Option SODO-1b and Alternative SODO-2, Sound Transit would identify a replacement property for the Carrier Annex and Distribution Center/Terminal Post Office at 4th Avenue South and South Lander Street. Sound Transit would be responsible for future environmental review, design, and construction of a replacement facility. The replacement facility would meet siting criteria and requirements identified by the United States Postal Service. For Option SODO-1b and Alternative SODO-2, postal operations would be relocated prior to the project impacting the existing facility. Preferred Option SODO-1c and Alternative SODO-1a would avoid permanent impacts. With regard to property acquisition at the Nucor Steel property (under Preferred Alternative DUW-1a, Alternative DUW-2, Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7), Sound Transit would coordinate with the property owner to maintain operations.

Relocation would occur in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 and the Sound Transit *Real Property Acquisition and Relocation Policy, Procedures and Guidelines* (Sound Transit 2017).

4.1.8 Sound Transit Real Property Acquisition and Relocation Policy, Procedures, and Guidelines Summary

Sound Transit has notified property owners whose property may be directly affected by any of the alternatives. Property acquisition generally would not begin until the environmental process is complete and the Sound Transit Board selects the alternative to build after publication of the Final EIS. The tables and maps in Appendix L4.1 identify each potentially affected parcel. Property acquisition activities would begin during final design. Sound Transit would continue to communicate with property owners during the Sound Transit Board decision process on the project to build and during final design. As described in Chapter 2, Alternatives Considered, the project may be constructed in phases.

Relocation assistance applies to all residences (regardless of ownership status), businesses, and organizations displaced by the project. Sound Transit relocation staff would be available to answer questions and provide additional information about relocation assistance services, payments, reimbursement eligibility, and the timing of the process. Relocation agents from Sound Transit would determine the needs and preferences of each household, business, and organization to be displaced. They would work closely and proactively with residents and businesses to help them plan for relocation and would help find new homes or sites and solve problems that might occur. While the ultimate choice of relocation site is up to the affected resident or business, the agency would help identify possible locations, including nearby properties. Sound Transit would use interpreters to help those with limited English proficiency understand their choices and options.



Boat owners whose moorage would be displaced may also be eligible for relocation assistance. In addition to advisory services, relocation assistance could include moving expenses to transport the vessel to another location. If the boat and/or slip is used as a primary residence, the boat owner may be eligible for a replacement housing payment for condominiumized or rented boat slips. However, it is expected that most affected boats would be classified as personal property (not primary residences), and that the slips would generally be rented, not mortgaged; in these cases, the owners would be eligible for advisory services plus moving expenses.

A public agency must pay just compensation to property owners for land and improvements acquired for public purposes. Just compensation must not be less than the fair market value of the property acquired. This value includes any measurable loss in value to the remaining property as a result of a partial acquisition. For instance, Sound Transit would mitigate for the permanent loss of parking spaces resulting from partial property acquisition by compensating the property owner or by providing replacement parking. Sound Transit would pay for normal expenses of sale, including escrow fees, title insurance, prepayment penalties, mortgage release fees, recording fees, and typical costs incurred as part of conveying title.

Owners would not have to relocate until they were either paid the agreed purchase price or an amount equal to Sound Transit's estimate of just compensation has been deposited with the court. Residents, businesses, and tenants would receive at least 90 days' written notice prior to having to relocate. Property owners would be offered just compensation for their land and improvements as described here.

Relocation benefits depend on individual circumstances. Factors that can affect relocation benefits include time of occupancy at the displaced property and the condition of the replacement property. Depending on the type of displacement, Sound Transit might pay for expenses associated with moving, replacement housing payments, business reestablishment expenses, and/or other eligible expenses. Depending on the individual factors for each business, business reestablishment expenses could include exterior signage, modifications to make the relocation site suitable to conduct business, advertisement of replacement location, and the difference (or a portion of the difference) between the present and future cost of operations during the first 2 years.

Owners may be eligible for price differential payment and mortgage interest differential payment if the cost of comparable decent, safe, and sanitary housing is greater than the value of their existing property. Likewise, tenants may be eligible for replacement housing payments if comparable decent, safe, and sanitary replacement housing rents are more than their current rental cost. In these cases, Sound Transit would pay the difference, or a portion of the difference, between the tenant's current and new rental rates for a 42-month period.

4.1.9 Relocation Opportunities

Sound Transit researched market conditions for available residential and commercial real estate in the City of Seattle. Property availability will change over time, but research indicates that there are adequate opportunities for most residents and businesses to successfully relocate within the project vicinity. Some affected properties with unique characteristics or uses, such as water-dependent uses, assistive living and supportive housing, and public facilities (including the United States Postal Service facility discussed in Section 4.1.4.1) could be difficult to relocate and may require construction of new facilities. Some water-dependent facilities may not be able to be relocated. There is currently adequate retail, office, and industrial space available in the Seattle area to accommodate the spaces that could be displaced by the project. In some instances, zoning restrictions may make it difficult for some businesses to relocate in the same

area, particularly industrial and maritime businesses. Relocations across the project corridor would occur over a multi-year period; therefore, replacement properties for these relocations would not need to be identified and made available at the same time (thereby alleviating concerns related to high numbers of relocation properties needing to be available at one single point in time).

Currently available residential units in Seattle also exceed the number of units potentially displaced, and there is a sufficient supply of relocation housing similar in size and quality for renters in the study area; however, depending on market conditions and individual circumstances, the replacement property may cost more. Section 4.1.7, Mitigation Measures, describes how Sound Transit would accommodate this difference. Additional information on relocation opportunities is provided in Appendix L4.1.

Sound Transit would offer relocation assistance that includes compensation and supporting services that consider the needs of those being relocated, to help reduce inconveniences or hardships. Sound Transit would also satisfy federal and state requirements for residential relocation, which define a “comparable replacement dwelling” as follows (42 United States Code 4601(10)):

- Decent, safe, and sanitary;
- Adequate in size to accommodate the occupants;
- Within the financial means of the displaced person;
- Functionally equivalent;
- In an area not subject to unreasonable adverse environmental conditions; and
- In a location generally not less desirable than the location of the displaced person’s dwelling with respect to public utilities, facilities, services, and the displaced person’s place of employment.

To meet these requirements, Sound Transit may identify relocation properties that are in better condition and of higher value than the properties being acquired. If so, tenants may be eligible for a rent supplement.

4.2 Land Use

4.2.1 Introduction to Resource and Regulatory Requirements

This section describes existing and potential future land uses and summarizes overarching land use policies as they relate to the West Seattle Link Extension (the project). Appendix L4.2, Land Use, provides a detailed analysis of the consistency of the project with applicable adopted plans. Sound Transit reviewed applicable regulations, Sound Transit policies, adopted plans, and planning studies related to land use. High-capacity transit such as light rail is addressed in local comprehensive plans and other planning documents. Planning studies were reviewed, but a consistency analysis was not conducted of these studies because they have not been adopted by the corresponding jurisdiction. However, their findings have been incorporated into adopted plans. The City of Seattle planning studies reviewed were the *North Delridge Action Plan* (2018) and the *West Seattle Triangle Urban Design Framework* (2011).

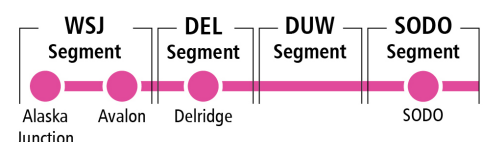
Some proposed stations exceed current height limits for the underlying zoning as described in Section 4.2.2. The code provisions of Seattle Municipal Code 23.80, Essential Public Facilities, authorize the Seattle Department of Construction and Inspection's Director to waive or modify applicable development standards (including height limits) based on certain conditions. Sound Transit and the City are continuing to evaluate design for the light rail facilities.

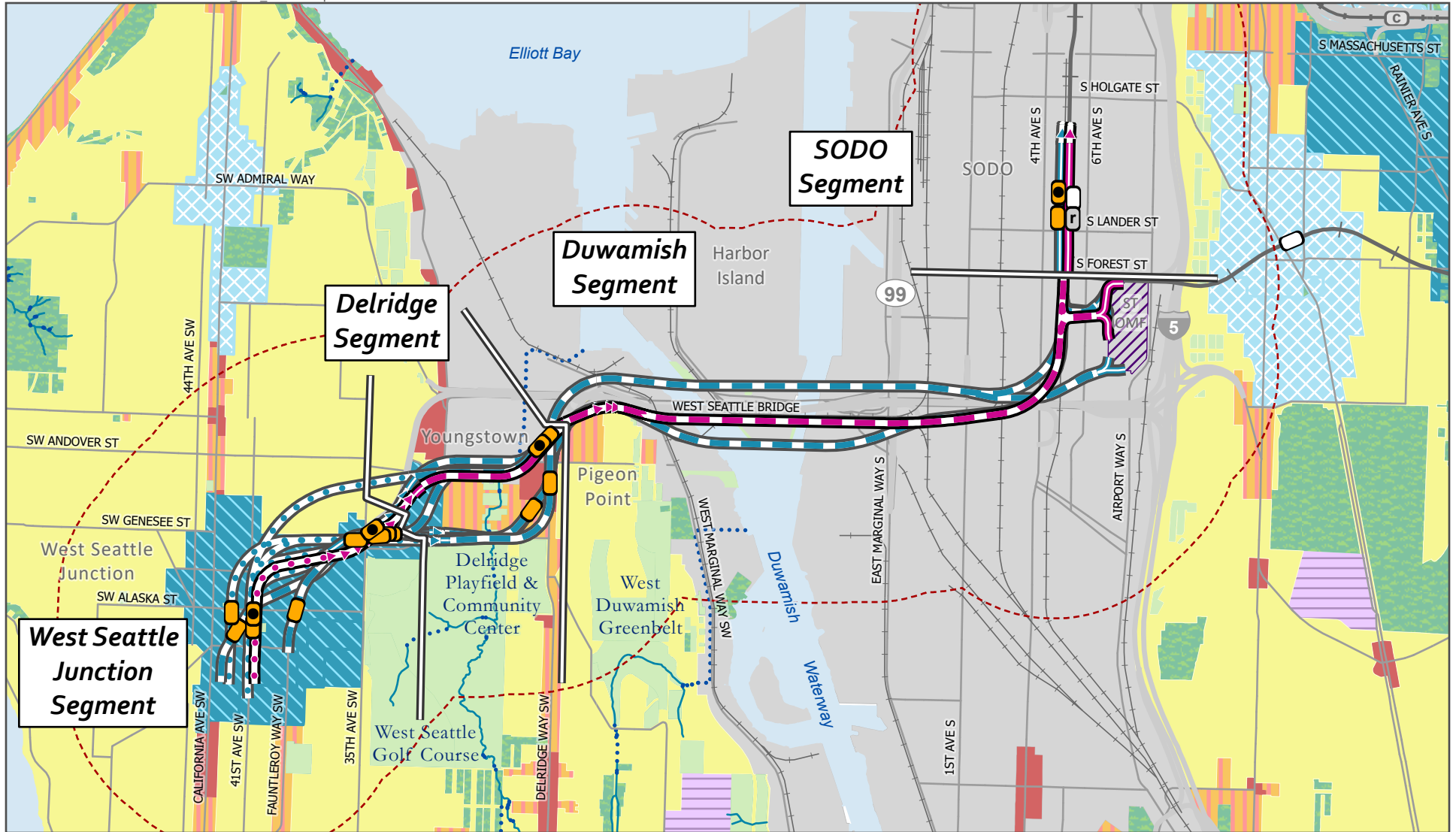
Local and regional plans identify the need to connect urban centers with high-capacity transit to allow for more efficient use of land as an alternative to increasing traffic congestion. In addition to summarizing the plan and policy consistency analysis, Appendix L4.2 also describes transit-oriented development (TOD) potential.

4.2.2 Affected Environment

This section describes existing and potential future land uses in each segment and summarizes overarching land use policies as they relate to the project. The land use study area for the project is the area within 0.5 mile of the project limits, which include permanent project improvements and areas needed for project construction. Land uses in the areas within 0.5 mile of the potential stations have the greatest potential to be affected, both directly and indirectly. The study area is within the city of Seattle. Neighborhoods and communities identified in this section are mapped and described in more detail in Section 4.4, Social Resources, Community Facilities, and Neighborhoods.

Existing land uses are generalized into dominant land use categories (i.e., single-family residential, multi-family residential, commercial, institutional/public, mixed use, downtown office, downtown harbor front, parks and open space, industrial, vacant land, and other). Existing land uses are based on current King County assessor data (King County 2022) and are shown in Appendix L4.2, Land Use. The future land uses shown on Figure 4.2-1 are based on current municipal data (City of Seattle 2022). Mandatory Housing Affordability zoning is in the study area and applies to a variety of zoning designations. Mandatory Housing Affordability requires developers to provide affordable housing within their project or pay into a fund that supports affordable housing (City of Seattle 2019). The study area east of Interstate 5 is not described because Interstate 5 acts as a barrier between the project and land uses east of the interstate. Direct and indirect land use effects are not anticipated to occur in this area.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut
- Other Alternatives**
- Elevated
- At-Grade
- Tunnel
- Retained Cut
- Station** (● Indicates Preferred Alternative)
- New
- Relocated
- Existing

- Segment Line
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park

- Study Area
- Future Land Use**
- Hub Urban Village
- Residential Urban Village
- Manufacturing Industrial Center
- Neighborhood Residential Areas
- Multi-Family Residential Areas
- Commercial / Mixed Use Areas
- Major Institutions
- Parks/Open Space

FIGURE 4.2-1
Future Land Use

West Seattle Link Extension



Much of the study area falls within areas designated in the City of Seattle Comprehensive Plan (2020) as urban centers or urban villages. The City has the goal of concentrating most of the expected future growth in these areas.

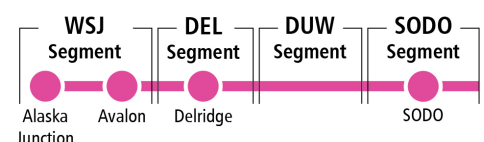
4.2.2.1 SODO Segment

The primary neighborhood in the SODO Segment is the Industrial District, which is an area designated by both the Puget Sound Regional Council and the City of Seattle as the Duwamish Manufacturing/Industrial Center. Land uses are predominantly industrial with limited commercial development.

The Seattle Public Schools' central office, the John Stanford Center for Educational Excellence, United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office, and Starbucks headquarters are in this segment. Port terminals and port-related uses are along the eastern edge of the East Waterway. Transportation maintenance and storage facilities (owned by King County Metro Transit [Metro], Sound Transit, and BNSF Railway) are also in this segment. The City has identified the industrial nature of SODO in the Duwamish Manufacturing/Industrial Center designation and has plans and policies in place to protect existing industrial land uses given their crucial role in the city and regional economies. As a result, potential future land uses are similar to existing land uses in this segment. The Greater Duwamish Manufacturing/Industrial Center Plan in the Neighborhood Plans chapter of the City of Seattle Comprehensive Plan promotes continued growth and retention of employment and industrial use in the Duwamish Manufacturing/Industrial Center. This includes retaining and promoting port, trade, and maritime industrial uses, and seeking to prioritize use of land for private industrial uses rather than public facilities. One of the City's goals for this area is to provide a transportation network that minimizes conflicts between different travel modes while emphasizing mobility of freight and goods (City of Seattle 2020). The City of Seattle recently approved land use and zoning updates to industrial and maritime land uses that were proposed in the City's *Industrial and Maritime Strategy Director's Report and Recommendation*, which was approved in 2023 (City of Seattle 2023). The *Industrial and Maritime Strategy* includes strategies to prioritize industrial and maritime investment in Seattle.

4.2.2.2 Duwamish Segment

Similar to the SODO Segment, the primary Duwamish Segment neighborhood is the Industrial District (designated as the Duwamish Manufacturing/Industrial Center). Harbor Island is a key marine freight terminal for the Port of Seattle, and much of the surrounding uses support this function. Two fire stations (Fire Stations 14 and 36) make up the institutional land uses in this area. Single-family housing, public/institutional uses (Pathfinder K-8 School), and open space (the West Duwamish Greenbelt) are in the area of the Pigeon Point community. Potential future land uses are generally similar to existing land uses. The Greater Duwamish Manufacturing/Industrial Center Plan in the Neighborhood Plans chapter of the *Seattle 2035 Comprehensive Plan* promotes employment and industrial use in the Duwamish Manufacturing/Industrial Center. The City's plan for this area includes maintaining economic vitality, providing adequate public infrastructure, and maintaining land for industrial uses (City of Seattle 2020).



4.2.2.3 Delridge Segment

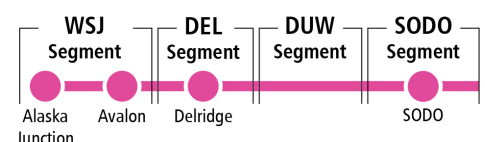
The Delridge Segment includes the Delridge neighborhood, which includes the Youngstown community. A small portion of this segment is within the Industrial District (designated as the Duwamish Manufacturing/Industrial Center), and includes Nucor Steel Seattle, a steel manufacturing plant. The Delridge Segment has single and multi-family land uses with parks and open spaces. There is limited commercial development along arterials with multi-family residential uses concentrated along Southwest Avalon Way. Potential future land uses allow for commercial and multi-family development in the Youngstown community, where future development is subject to Mandatory Housing Affordability requirements. The Delridge Plan in the Neighborhood Plans chapter of the City of Seattle Comprehensive Plan calls for preservation of open spaces in Delridge and for clustering mixed-use activity nodes to provide services to residents. Delridge neighborhood planning policies in the Comprehensive Plan also advocate for providing educational, recreational, cultural, and social opportunities, and potentially increased housing to the neighborhood near Southwest Delridge Way and Southwest Genesee Street, as a vibrant center. The policies also advocate for more commercial services and pedestrian improvements in the neighborhood anchor vicinity near Southwest Delridge Way and Southwest Andover Street to serve the neighborhood's needs and provide safe pedestrian conditions. The City's goals for this area include providing a transportation system that allows for convenient access to local travel and access to employment, shopping, and entertainment (City of Seattle 2020).

4.2.2.4 West Seattle Junction Segment

The West Seattle Junction Segment includes the West Seattle neighborhood and a small portion of the Delridge neighborhood. There are multi-family and commercial uses along Southwest Avalon Way. The West Seattle neighborhood includes the West Seattle Junction hub urban village, where there is an active mixed-use district serving the surrounding single- and multi-family residential areas. Commercial and mixed-use development is mostly clustered along Fauntleroy Way Southwest, Southwest Alaska Street, and California Avenue Southwest. There are parks and open space areas on the eastern edge of this segment. There are also a number of religious institutions concentrated in the northern portion of the study area. Potential future land uses include additional mixed-use areas where zoning allows for denser development in the West Seattle Junction hub urban village. Near the Alaska Junction (the intersection of Southwest Alaska Street and California Avenue Southwest) and along Fauntleroy Way Southwest, future development is subject to Mandatory Housing Affordability requirements (City of Seattle 2019). The West Seattle Junction Plan in the Neighborhood Plans chapter of the City of Seattle Comprehensive Plan emphasizes maintaining a compact mixed-use commercial core with a "small town character." It also reinforces pedestrian orientation and balances parking, traffic circulation, and pedestrian safety purposes. The plan promotes housing, services, and amenities to support populations of "diverse incomes, ages, and other social characteristics." One of the City's goals for this area includes facilitating movements of people and goods using a full range of transportation choices.

4.2.3 Environmental Impacts of the No Build Alternative

The No Build Alternative includes the existing transportation system and future employment and population growth assumed in adopted plans, but without the project (see Section 2.2, No Build Alternative). Proposed and planned development would continue to move through permitting procedures consistent with adopted land use plans and would be constructed.



This alternative is inconsistent with many regional land use and transportation policies because it would not develop and expand upon the high-capacity-transit system and would not connect the region's highest growth centers. It is also not consistent with many local plans and policies that call for increased density and TOD. The *Seattle 2035 Comprehensive Plan* estimates that between 2015 and 2035, the population in the city of Seattle will grow by 120,000 people, adding 115,000 jobs and 70,000 households (City of Seattle 2020). With the No Build Alternative, population growth in the study area would not be supported by TOD near high-capacity transportation options. Under the No Build Alternative, a major transportation investment that is called for in local and regional plans to accommodate transportation demand from existing land uses and anticipated growth would not be in place. As such, the No Build Alternative would limit transportation options, increasing traffic congestion and slowing the rate of denser development in Seattle.

4.2.4 Environmental Impacts of the Build Alternatives during Operation

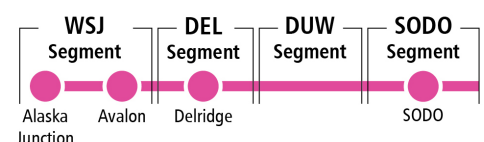
This section discusses the consistency of the Build Alternatives with regional, state, and local land use policies and the direct and indirect operational impacts on planned future land uses. Sound Transit's property acquisitions are detailed in Section 4.1, Acquisitions, Displacements, and Relocations. The land use analysis also considers findings from other environmental elements including Chapter 3, Transportation Environment and Consequences; Section 4.3, Economics; Section 4.5, Visual and Aesthetic Resources; Section 4.6, Air Quality; Section 4.7, Noise and Vibration; and Section 4.17, Parks and Recreational Resources.

Long-term direct impacts would occur in locations where the light rail alternatives would require private or public property acquisitions for the new project facilities. These acquisitions would convert property to a transportation-related use. Direct impacts also include proximity impacts (e.g., visual, noise, and traffic impacts) that could cause changes in adjacent land uses. The following discussion highlights the key differences between alternatives and includes information on the West Seattle Link Extension Minimum Operable Segment (M.O.S.).

4.2.4.1 Impacts Common to All Alternatives

4.2.4.1.1 Consistency with Land Use Plans and Policies

Regional and state planning documents establish the framework for local land use and transportation programs and plans. Local land use and transportation plans are the basis of zoning laws that establish development regulations. Improving transit accessibility and encouraging transit use are goals shared by regional, state, and local land use plans in the study area. The project would connect residential and commercial areas to Seattle's major economic centers and create uninterrupted access among several neighborhoods within the corridor. All alternatives would enhance a regional transit system serving a growing transportation need in planned high-density areas. The project would support the 2020 Puget Sound Regional Council VISION 2050 strategies of focusing growth within regional growth centers and high-capacity-transit station areas, reducing greenhouse gas emissions through mobility options, building the region's planned high-capacity-transit system to support growth in designated growth centers, and building more diverse and affordable housing near transit. VISION 2050 discourages residential development in manufacturing/industrial centers to maintain and support industrial uses. The project would also support Puget Sound Regional Council's *Regional Transportation Plan* (2022) and Sound Transit's *Regional Transit Long-Range Plan* (2014a) by developing safe and efficient high-capacity transit to improve mobility



within and among the region's major cities and urban areas. In addition, the *Sound Transit Transit-Oriented Development (TOD) Strategic Plan Update* (2014b), *Equitable Transit Oriented Development Policy* (Board Resolution No. R2018-10) (2018), and *Real Property Excess, Surplus, and Disposition Policy* (2013) would be followed as land acquisitions and disposition occurs. The project was reviewed for consistency with the City of Seattle's *Industrial and Maritime Strategy* (2023) and would be consistent with the goals of that document. Also relevant are the City of Seattle Comprehensive Plan goals and policies seeking integrated land use and transportation planning strategies. A detailed analysis of the project's consistency with adopted applicable plans is provided in Appendix L4.2, Land Use.

The project is a "regional transit authority facility" and is, therefore, explicitly recognized as an essential public facility in the Growth Management Act (Revised Code of Washington 36.70A.200). Once an alternative is selected to be built, jurisdictions have a duty to accommodate the project in their land use plans and development regulations.

4.2.4.1.2 Conversion of Land Uses to Transportation Uses

Direct land use impacts occur where Sound Transit would acquire property for the project. Most of this property would be permanently converted to a transportation use for the light rail tracks, stations, or ancillary facilities. Property that is already public right-of-way for transportation uses is not included in this analysis because it would remain a transportation use. The alternatives generally follow existing transportation corridors, limiting the amount of land that would be converted to a transportation use. Property acquisitions are discussed in Section 4.1, Acquisitions, Displacements, and Relocations, and listed in Appendix L4.1, Acquisitions, Displacements, and Relocations.

Land acquired for operation of the project would account for less than 0.1 percent of the total land in Seattle and up to 0.8 percent of the total land in the study area. Tables 4.2-1 through 4.2-4 summarize the approximate amount of land that would be permanently converted to a transportation use within each segment. In areas where the project would acquire property for construction staging, the land could be restored to its previous land use or redeveloped with an allowed use under current zoning. Redevelopment would be consistent with the City's zoning and Sound Transit's Equitable Transit Oriented Development Policy. Sound Transit's TOD policy includes goals for prioritizing affordable housing when redeveloping suitable agency-owned properties. These properties may also be used for joint development of transit facilities with other compact residential or commercial development done in partnership with others.

Tables 4.2-1 to 4.2-4 summarize impacts by alternative. Development and redevelopment potential in station areas is discussed in Section 4.2.6, Indirect Impacts of the Build Alternatives.

4.2.4.2 SODO Segment

The alternatives in the SODO Segment would convert manufacturing/industrial center land to a transportation use. Each of the alternatives would convert a similar amount of land to a transportation use. Alternative SODO-2 would convert the most manufacturing/industrial center land in the Duwamish Manufacturing/Industrial Center to a transportation use and Preferred Option SODO-1c would convert the least. All alternatives would include a station north of South Lander Street within Industrial General Zone 1 (IG1 U-85), which has no height limit for noncommercial projects.

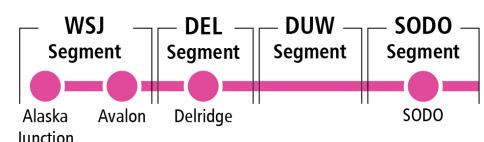


Table 4.2-1. Potential Permanent Conversion of Land Use to a Transportation-Related Land Use – SODO Segment

Alternative	City-owned Open Space (acres)	Commercial/ Mixed-Use Areas (acres)	Hub Urban Village (acres)	Manufacturing/ Industrial Center (acres)	Multi-family Residential (acres)	Single-family Residential (acres)	Urban Center (acres)	Total Acres Affected ^a
Preferred At-Grade Lander Access Station Option (SODO-1c)	0	0	0	2.9	0	0	0	2.9
At-Grade Alternative (SODO-1a)	0	0	0	3.2	0	0	0	3.2
At-Grade South Station Option (SODO-1b)	0	0	0	4.2	0	0	0	4.2
Mixed Profile Alternative (SODO-2)	0	0	0	4.5	0	0	0	4.5

Note: Future land use types were developed using City of Seattle Future Land Use 2035 dataset (2022).

^a Total Acres Affected cell values may be different than the total of individual cell values due to rounding.

Table 4.2-2. Potential Permanent Conversion of Land Use to a Transportation-Related Land Use – Duwamish Segment

Alternative	City-owned Open Space (acres)	Commercial/ Mixed-Use Areas (acres)	Hub Urban Village (acres)	Manufacturing/ Industrial Center (acres) ^a	Multi-family Residential (acres) ^a	Single-family Residential (acres) ^a	Urban Center (acres)	Total Acres Affected ^{a,b,c}
Preferred South Crossing Alternative (DUW-1a)	1.2	0	0	10.0 to 10.1	0.4 to 0.5	0.7 to 0.9	0	12.3 to 12.5
South Crossing South Edge Crossing Alignment Option (DUW-1b)	1.3	0	0	9.4	0.4	0.7	0	11.8
North Crossing Alternative (DUW-2)	0	0	0	13.3	0	0	0	13.3

Note: Future land use types were developed using City of Seattle Future Land Use 2035 dataset (2022).

^a Shown as a range if the number of acres changes depending on connections in adjacent segments or options.

^b Totals reflect the high and low values in component ranges.

^c Total Acres Affected cell values may be different than the total of individual cell values due to rounding.

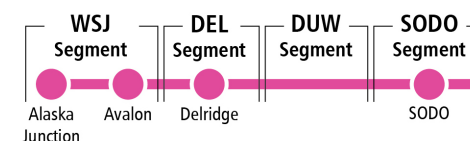


Table 4.2-3. Potential Permanent Conversion of Land Use to a Transportation-Related Land Use – Delridge Segment

Alternative	City-owned Open Space (acres)	Commercial/ Mixed-Use Areas (acres) ^a	Hub Urban Village (acres)	Manufacturing/ Industrial Center (acres) ^a	Multi-family Residential (acres)	Single-family Residential (acres)	Urban Center (acres)	Total Acres Affected ^{a,b,c}
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	0	1.3	1.5	5.3	0	0	0	8.1
Dakota Street Station Alternative (DEL-1a) ^a	0.5	1.3 to 1.4	<0.1	0 to 0.7	3.6	<0.1	0	5.6 to 6.1
Dakota Street Station North Alignment Option (DEL-1b)	0.1	1.4	0.3	<0.1	4.1	0	0	6.0
Dakota Street Station Lower Height Alternative (DEL-2a)	1.4	1.8	0	<0.1	3.3	0	0	6.5
Dakota Street Station Lower Height, North Alignment Option (DEL-2b)	<0.1	1.8	0.7	<0.1	4.0	0	0	6.5
Delridge Way Station Alternative (DEL-3)	0.6	1.7	<0.1	<0.1	1.0 ^d	0.3	0	3.7
Delridge Way Station Lower Height Alternative (DEL-4)	1.3	1.7	0	<0.1	1.0 ^d	0.3	0	4.3
Andover Street Station Alternative (DEL-5)	0	0.7	0.6	5.1	0.2	0	0	6.6
Andover Street Station Lower Height Alternative (DEL-6a)	0	0.9	0.5	4.6	0	0.1	0	6.2
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	0	1.3	0.4	5.3	0	0	0	7.0

Note: Future land use types were developed using City of Seattle Future Land Use 2035 dataset (2022).

^a Shown as a range if the number of acres changes depending on connections in adjacent segments or options.

^b Totals reflect the high and low values in component ranges.

^c Total Acres Affected cell values may be different than the total of individual cell values due to rounding.

^d With the West Seattle Link Extension M.O.S., there would be 0.3 additional acre of multi-family residential land converted to a transportation use.

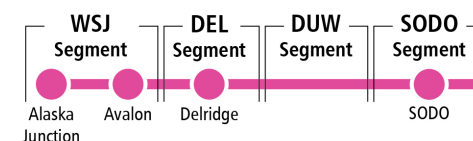


Table 4.2-4. Potential Permanent Conversion of Land Use to a Transportation-Related Land Use – West Seattle Junction Segment

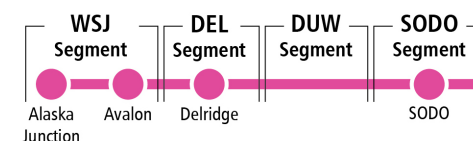
Alternative	City-owned Open Space (acres)	Commercial /Mixed-Use Areas (acres)	Hub Urban Village (acres) ^a	Manufacturing/ Industrial Center (acres)	Multi-family Residential (acres)	Single-family Residential (acres)	Urban Center (acres)	Total Acres Affected ^{a,b,c}
Preferred Medium Tunnel Avenue Station West Entrance Station Option (WSJ-5b)	0	0	4.0	0	0	0	0	4.0
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	0.1	0	6.6	0	0	0	0	6.7
Elevated Fauntleroy Way Station Alternative (WSJ-2)	<0.1	0	6.9 to 7.0	0	0	0	0	6.9 to 7.0
Tunnel 41st Avenue Station Alternative (WSJ-3a)	0	0	4.1 to 4.3	0	0	0	0	4.1 to 4.3
Tunnel 42nd Avenue Station Option (WSJ-3b)	0.2	0	4.0	0	0	0	0	4.2
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	0	0	6.5	0	0	0	0	6.5
Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	0	0	5.3	0	0	0	0	5.3
No Avalon Station Tunnel Alternative (WSJ-6)	0	0	0.8	0	0	0	0	0.8

Note: Future land use types were developed using City of Seattle Future Land Use 2035 dataset (2022).

^a Shown as a range if the number of acres changes depending on connections in adjacent segments or options.

^b Totals reflect the high and low values in component ranges.

^c Total Acres Affected cell values may be different than the total of individual cell values due to rounding.



4.2.4.3 Duwamish Segment

Alternatives in the Duwamish Segment would mostly convert manufacturing/industrial center uses to a transportation use. Option DUW-1b would convert the least land to a transportation use, and Alternative DUW-2 would convert the most land to a transportation use, including Port of Seattle-owned properties. Preferred Alternative DUW-1a would convert slightly more land to a transportation use than Option DUW-1b. Most of this land is designated as Duwamish Manufacturing/Industrial Center, although some residential and City-owned open space land would also be converted. Alternative DUW-2 would not convert any single- or multi-family residential land or City-owned open space to a transportation use, but would convert more manufacturing/industrial center land in the Duwamish Manufacturing/Industrial Center than other alternatives in this segment.

4.2.4.4 Delridge Segment

Preferred Option DEL-6b would convert the most land to a transportation use. Alternative DEL-3 would convert the least amount of land to a transportation use.

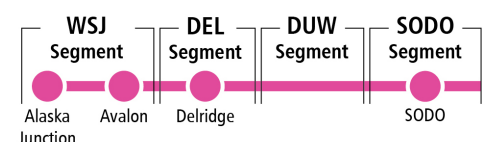
Alternative DEL-2a would convert the most City-owned open space land to a transportation use, and Alternative DEL-4 would convert a similar but slightly less amount. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would not convert open space land.

All alternatives except Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7 would convert multi-family residential land to a transportation use. Option DEL-1b and Option DEL-2b would convert the most multi-family residential land. Alternative DEL-3 and Alternative DEL-4 would convert the most single-family residential land.

Preferred Option DEL-6b and Alternative DEL-7 would convert the most manufacturing/industrial center land in the Duwamish Manufacturing/Industrial Center. Alternative DEL-1a would only convert manufacturing/industrial land to a transportation use when connecting to Alternative DUW-2. Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would convert less than 0.1 acre of manufacturing/industrial land in the Duwamish Manufacturing/Industrial Center.

Preferred Option DEL-6b Delridge Station would be approximately 70 feet high in a primarily industrial and commercial area. The station would be located in the City's General Industrial 2 zone and lower than the 85-foot structure height limit. Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b would include a Delridge Station in a multi-family residential area near Southwest Dakota Street. The addition of a light rail station in a predominantly residential area is a notable change in land use. The top of the station structure would be approximately 110 feet high for Alternative DEL-1a and Option DEL-1b and approximately 60 feet high for Alternative DEL-2a and Option DEL-2b; however, this station would be within the City's Low-Rise Multifamily LR1(M) zone and higher than the 35-foot structure height limit. Alternative DEL-3 and Alternative DEL-4 would have a station height of approximately 90 feet, which is higher than the 55-foot to 75-foot height limit allowed by zoning. However, Alternative DEL-3 and Alternative DEL-4 would include a station building in the street right-of-way and so may not need adjustments to applicable development standards. Similar to Preferred Option DEL-6b, the Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have a Delridge Station height of approximately 70 feet, which is lower than the 85-foot structure height limit in the General Industrial 2 zone.

As shown in Table 4.2-3, under the West Seattle Link Extension M.O.S., Alternative DEL-3 and Alternative DEL-4 would require converting additional multi-family residential land to a transportation use for the bus stops and bus layover spaces along Delridge Way Southwest and Southwest Dakota Street.



4.2.4.5 West Seattle Junction Segment

The alternatives in the West Seattle Junction Segment would convert hub urban village land and City-owned open space to a transportation use. Alternatives WSJ-1 and WSJ-2 would convert the most land to a transportation use. Alternative WSJ-4 would convert slightly less. Alternative WSJ-6 would convert the least amount of land to a transportation use since it would be entirely within a tunnel.

The Avalon Station associated with Preferred Option WSJ-5b and Alternative WSJ-5a would be in a retained cut south of Southwest Genesee Street, beneath 35th Avenue Southwest in a primarily residential area. The station would be located in the City's Residential Small Lot (M) zone, which has a height limit of 30 feet. The top of the station structure would be approximately 30 feet above the existing ground surface, which is consistent with City zoning. The Alaska Junction Station would be in a tunnel, and station entrances would be designed to be consistent with City zoning requirements.

Alternatives with an elevated guideway in the West Seattle Junction Segment (Alternative WSJ-1, Alternative WSJ-2, and Alternative WSJ-4) could be close enough to adjacent properties to limit future development. Due to fire life safety access requirements, these properties may not be able to be developed to the full extent allowed under current zoning. This would affect potential density in several buildings in the junction area, including potential future affordable housing units under Mandatory Housing Affordability zoning requirements or payment into a fund to support affordable housing.

Alternative WSJ-1, Alternative WSJ-2, and Alternative WSJ-4 would include an elevated Avalon Station in a residential area near Southwest Genesee Street. The top of the station would be between 60 feet and 80 feet high, which would be above the 30-foot limit allowed by zoning. Alternative WSJ-1 and Alternative WSJ-2 would include an Alaska Junction Station in a commercial neighborhood near Southwest Alaska Street. The top of the station would be approximately 60 feet to 80 feet high, which is below the 95-foot height limit allowed by zoning.

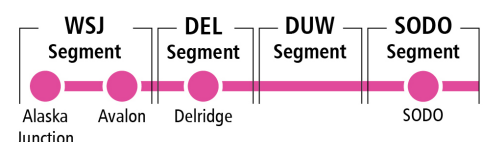
Alternative WSJ-6 would include a guideway and an Alaska Junction Station entirely within a tunnel. Station entrances would be designed to be consistent with City zoning requirements.

4.2.5 Environmental Impacts of the Build Alternatives during Construction

Potential impacts to existing land uses include temporary impacts from construction staging areas; easements; noise, air emissions, and visual changes; and traffic congestion. These impacts would not affect the land use types unless the property became vacant, and, are not anticipated to be severe enough to cause vacancies after mitigation, as described in Section 4.2.7, Mitigation Measures. Proximity and construction impacts were determined based on the findings of other environmental elements. For more information, see Section 4.3, Economics, and Section 4.7, Noise and Vibration.

4.2.6 Indirect Impacts of the Build Alternatives

Indirect impacts could occur from changes to surrounding land uses either from aerial easements or TOD. Some existing uses may choose to relocate away from the project due changes from the guideway and station development. Potential impacts to properties adjacent to the project are discussed in Section 4.3, Economics, and Section 4.5, Visual and Aesthetic Resources.



4.2.6.1 Aerial Easements Common to All Alternatives

Relocation of an overhead 230-kilovolt transmission line in the Duwamish and SODO segments for all Build Alternatives and options could require aerial easements on adjacent properties to safely accommodate the power line away from future buildings. Effects to future land uses are anticipated to be minimal because this area is within the Duwamish Manufacturing/Industrial Center and redevelopment into denser land uses is not anticipated in the City of Seattle Comprehensive Plan. Impacts would be offset by removing the overhead power line from its existing location and removing any associated aerial easements.

4.2.6.2 Transit-oriented Development Potential Common to All Alternatives

Improvements in transportation systems can influence changes to nearby land uses. Although the project would directly affect land use through property acquisitions, the project would not directly change surrounding land use designations. Cities and counties control land use regulations, including zoning, and property owners make decisions about developing or redeveloping their property. The project could indirectly affect land use by acting as a catalyst for others to develop or redevelop land near project facilities consistent with City land use and zoning requirements. This type of development could increase availability and density of housing options, including affordable housing units. Alternatively, this could result in the indirect effect of increased housing prices and business rent around desirable station areas.

TOD is a pattern of land use and development that includes a mix of uses at higher density or intensity in the vicinity of transit stations. TOD generally occurs when stations are in prime regional or community centers, areas attractive to typical market forces, areas with active regional and local real estate markets with willing investors, and jurisdictions where public policies and regulations such as zoning encourage intensive development in station areas. There is also the potential for joint development of transit facilities like station entrances and concourses, as well as redevelopment of surplus properties no longer needed after construction.

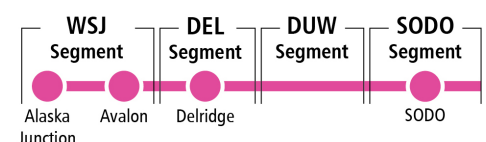
The Sound Transit Board adopted the Equitable Transit Oriented Development Policy in 2018 (Board Resolution No. R2018-10). The policy addresses how the agency should consider potential for TOD near transit facilities being planned and studied, and provides guidance on implementing and integrating Equitable TOD throughout transit projects, with a particular focus on development of affordable housing.

Transit-oriented Development

TOD is a pattern of development that includes a mix of residential, commercial, and civic uses near a high-capacity transit station. TOD helps to harmonize the relationship between land use and transit, with more residences and jobs accessible from transit, and vice versa. TOD is influenced through real estate markets, infrastructure investment, and zoning, and is implemented through individual decisions by property owners and developers.

Agency TOD

“Agency TOD” refers to TOD that Sound Transit facilitates on property it owns. Agency TOD could occur on property purchased for construction staging that Sound Transit does not need in the long-term, or through joint development. Agency TOD is implemented through partnerships with public, non-profit, or private developers. Sound Transit's Equitable Transit Oriented Development Policy prioritizes partnerships with developers of affordable housing.



The policy supports land use changes and economic development that would maximize ridership while supporting achievement of comprehensive and regional plans and improving quality of life. During alternatives development and design, this policy guides Sound Transit to incorporate TOD criteria as a decision-making factor that considers local and regional comprehensive plans. Sound Transit's TOD policy promotes TOD within station areas and on Sound Transit property that is no longer needed for transit, and seeks proposals from developers that support various income levels and family sizes. It also provides guidance to engage communities equitably in planning for TOD, particularly for low-income communities and communities of color, and contains goals to support and encourage equitable economic development and opportunities for existing residences and businesses.

Notably, the policy also supports exploration of development potential of transit project decisions, and pursuit of joint or co-development of transit facilities where and when appropriate. There is specific priority placed on partnerships that deliver affordable housing, responding to a state statute that requires Sound Transit to first offer at least 80 percent of surplus property suitable for housing to qualified developers of affordable housing, who are then obligated to ensure 80 percent of housing units constructed are affordable to those earning 80 percent or less of the area median income for the county.

Sound Transit prepared a study, *Station Area Development Opportunities Evaluation* (2021), to identify and assess specific potential TOD opportunities associated with the West Seattle Link Extension's stations to identify areas where TOD could occur, as discussed in Section 4.2.6.3, Transit-oriented Development Potential by Alternative.

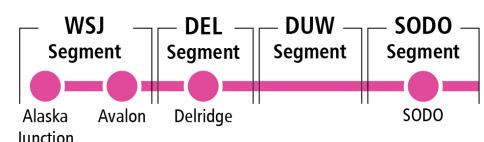
The City of Seattle has been developing an Equitable Transit-oriented Development Strategy & Implementation Plan with the support of an FTA grant. This comprehensive approach to advancing racial equity and community participation in planning for development around light rail stations includes station access and public investments, establishing a citywide community advisory group, supporting place-based groups in the Delridge neighborhood, and comprehensive planning for underutilized land adjacent to future light rail alignments.

Joint Development

Joint development refers to a type of Agency TOD that has a direct, integral physical interface with a transit project, and is often designed and constructed along with the transit project. FTA defines joint development (FTA 2020) as "a public transportation project that integrally relates to, and often co-locates with commercial, residential, mixed-use, or other non-transit development. Joint development may include partnerships for public or private development associated with any mode of transit system that is being improved through new construction, renovation, or extension. Joint development may also include intermodal facilities, intercity bus and rail facilities, transit malls, or historic transportation facilities." Sound Transit would design stations with potential for joint development to support overbuild of other uses where appropriate.

4.2.6.3 Transit-oriented Development Potential by Alternative

For the SODO Segment, all SODO station alternatives have potential for Agency TOD on surplus properties. All station alternatives within the Delridge Segment have some Agency TOD potential based on current zoning and project footprints, except the two Delridge Way station alternatives (Alternative DEL-3 and Alternative DEL-4), which would primarily be constructed within the right-of-way. The stations north of Southwest Andover Street (Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7) have some potential for Agency TOD due to the mix of industrial and commercial zoning, which allows for increased building heights and more diverse uses.



The Dakota Street station alternatives (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b) would result in surplus parcels that could be redeveloped but have lower potential for Agency TOD, based on current low-rise residential zoning. This zoning allows for multi-family residential construction, but limits building heights to 30 feet and does not allow for non-residential uses, which limits the mixed-use purpose of TOD. The Agency TOD potential of the Andover Street station alternatives (Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7) and Dakota Street station alternatives (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b) would be increased with adjustments to zoning.

In the West Seattle Junction Segment, all station alternatives have some potential for future Agency TOD, based on current zoning and the possibility of redeveloping surplus property after construction. Tunnel alternatives at the Alaska Junction stations (Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-5a, and Alternative WSJ-6) and Avalon stations (Alternative WSJ-3a and Option WSJ-3b) would have higher potential for Agency TOD due to the ability to use air rights above tunnels and stations for joint development, along with fewer permanent impacts to development capacity due to the guideway. In addition, future Agency TOD could create new business opportunities around each station area.

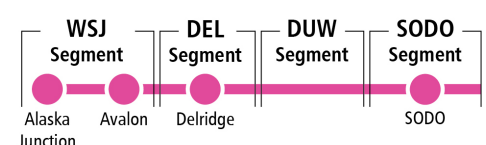
Equitable Transit-oriented Development

Equitable TOD explicitly advances a mission of social, racial, and/or economic equity in its use, programming, or ownership structure. Equitable TOD can include affordable housing, cooperative or affordable commercial space and uses, childcare and human development, and community-based management or stewardship of property. Sound Transit supports Equitable TOD objectives through its 2018 Equitable Transit Oriented Development Policy.

4.2.7 Mitigation Measures

No mitigation would be required for land use impacts during operation or construction of the project. The project would convert less than 0.1 percent of City land to transportation uses, which would not be a substantial impact on the overall land use within the city. In addition, the project is included in adopted land use plans (see Appendix L4.2 for consistency analysis) and is part of larger land use planning efforts in the Puget Sound region. Therefore, in general, the project would not result in inconsistencies with adopted land use plans. Where minor inconsistencies with zoning height requirements occur, Sound Transit will continue to coordinate with the City of Seattle, Port of Seattle, and other stakeholders to minimize inconsistencies to the greatest extent feasible.

During construction, Sound Transit would minimize disturbances to surrounding land uses as described in Section 2.7, Construction Approach, Section 4.5, Visual and Aesthetic Resources, Section 4.6, Air Quality, and Section 4.7, Noise and Vibration. Therefore, impacts are not expected to cause substantial changes to land use during construction.



4.3 Economics

4.3.1 Introduction to Resource and Regulatory Requirements

This section identifies potential adverse and beneficial effects on local and regional economies associated with the West Seattle Link Extension Project (the project) alternatives. Large transit projects that acquire private property or require conversions in land use to a transportation use along the new transit corridor might be disruptive to businesses and communities but might also present new opportunities for economic activity. The economic analysis addresses the ways in which land acquisition, construction, and operations of light rail facilities would impact local economic conditions along the project corridor and in the broader economic area. Federal and state regulations, policies, and related resources that guide a major transit project EIS were used to conduct this assessment and are identified in Appendix L4.3, Economics.

4.3.2 Affected Environment

Demographic and economic trends in the study area were assessed using Forecast Analysis Zone estimates (a map of the zones is shown in Figure L4.3-1 in Appendix L4.3, Economics). Forecast Analysis Zones are geographic units used to delineate future socio-economic conditions to support transportation planning. Table L4.3-2 in Appendix L4.3 shows the population, household, and employment forecast trends for the Forecast Analysis Zones associated with each segment area in the West Seattle Link Extension from 2018 to 2050. Tables L4.3-3, L4.3-4, and L4.3-5 in Appendix L4.3 provide a closer look at historic total employment since 2000 and employment forecast trends from 2018 to 2050 by sector.

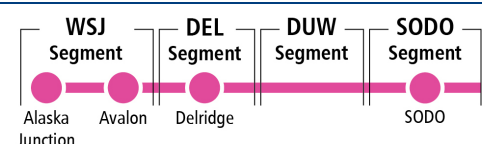
This analysis includes an assessment of potential adverse and beneficial economic effects of the proposed project alternatives across three different study area scales:

- **Segment:** Site-specific business and employment impacts were evaluated for potential displacement of business activity. Impacts to Tribal treaty-protected fishing were evaluated for applicable segments.
- **City:** Potential impacts to tax revenues were evaluated within the city of Seattle.
- **Regional:** Broader potential impacts to regional economic activity, including the effects on jobs, labor income, and gross regional product, were assessed for project construction. Broader economic considerations were assessed for King, Kitsap, Pierce, and Snohomish counties (referred to as the Puget Sound region study area) stemming from project operation. The Puget Sound region study area encompasses the four-county area to account for shifts in the population's demand for goods and services within and outside the project corridor study area.

4.3.2.1 Regional Demographic and Economic Trends

Between 2000 and 2020, total employment increased from 1.9 million to 2.4 million jobs in the Puget Sound region study area. Along with employment, the median household income increased regionally over this time (Puget Sound Regional Council 2020). This trend of economic growth is forecasted to continue for the next few decades.

Population, household, and employment forecasts for the Puget Sound region and associated counties in the region are provided in Appendix L4.3, Table L4.3-1. The forecast population data for the Puget Sound region shows regional growth from 2018 to 2050 (the forecast period) of

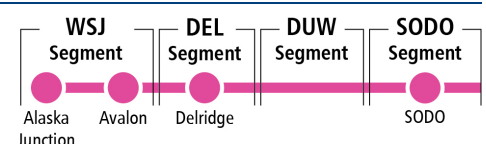


roughly 1.8 million people, which would result in a population of approximately 5.9 million people in the region by 2050. This represents an average increase in population of 1.1 percent per year (Puget Sound Regional Council 2023). Puget Sound Regional Council data from 2023 shows that King County's population will grow at a slower average pace of 1.0 percent per year over the same period (Puget Sound Regional Council 2023). The number of households in the Puget Sound region is predicted to grow by approximately 814,000 households over the 2018 to 2050 period—or by an average of 1.3 percent per year—which is greater than the average growth rate of the regional population (1.1 percent), thus reflecting a decrease in average household size over time. Research shows that transportation demand increases overall where there are a greater number of households for the same population size (U.S. Department of Transportation 2021); consequently, the forecasted household growth in the Puget Sound region suggests a potential increase in demand for highway and transit service.

Median household incomes in the Puget Sound region study area are higher than Washington state overall. Median household income for the state is currently \$84,200 (U.S. Census Bureau American Community Survey 2021). King County had the highest median household income within the region at approximately \$110,600 (U.S. Census Bureau American Community Survey 2021). From 2015 to 2021, median household income in King County grew by about 35 percent, while statewide median household income increased by about 31 percent. Employment in the region is expected to grow at an approximate compound annual growth rate of 1.3 percent through 2050, resulting in about 1.1 million new jobs over the forecast period from 2018 to 2050 (Puget Sound Regional Council 2023). King County is predicted to expand employment by 1.2 percent on average per year through 2050, with much of that growth centered in urban Seattle. Approximately 213,900 jobs are expected to be added by 2050 in the city of Seattle (Puget Sound Regional Council 2023). These trends in income and employment growth support forecasts for increasing travel demand in the region and the project corridor.

4.3.2.2 Segment Demographic and Economic Trends

Jobs are concentrated in the SODO and Duwamish segments because of their greater concentration of land uses and zones associated with manufacturing and industrial activities (City of Seattle 2018). These Forecast Analysis Zones have the highest forecasted job growth, with projected compound annual job growth of 1.3 percent in the SODO Segment and 1.7 percent in the Duwamish and Delridge segments (Forecast Analysis Zone 5826). These growth rates are markedly higher than the 0.5 percent projected for the West Seattle Junction Segment between 2018 and 2050. The West Seattle Junction Segment area is more residential in nature. It has far more households and more single-family residential uses in comparison to the SODO, Delridge, and Duwamish segments, where there are a greater mix of industrial and commercial uses (City of Seattle 2018). The compound annual household growth rate is projected to be at 1.9 percent between 2018 and 2050 for the Forecast Analysis Zone that covers the SODO Segment and at 0.6 percent for that of the West Seattle Junction Segment. The compound annual growth rates for the two Forecast Analysis Zones in the Delridge and Duwamish segments are 0.7 percent and 0.9 percent, respectively (Forecast Analysis Zone geographies are larger than the areas encompassing the project segments). For more information on Forecast Analysis Zones, see Table L4.3-2 in Appendix L4.3, Economics.



4.3.2.3 Tax Revenue Sources

The project would be within the city of Seattle, where property, sales, utility, and business and occupation taxes represent the largest contribution to the general fund's taxes.

Table 4.3-1 shows the breakdown of different tax revenues and their share in the City's general fund in 2021. These taxes, combined with other sources of funding, such as license fees, grants, and fines, help fund a range of general City services, including police and fire, human, general government, and transportation services (City of Seattle 2023a). The City has a range of district-based (or dedicated) funding sources for certain uses, such as the Metropolitan Park District property tax levy to fund park and recreation services and the Transportation Benefit District sales tax to fund transportation services, which are included under the respective property and sales taxes in Table 4.3-1.

Table 4.3-1. Percent of Total General Fund Revenues for the City of Seattle, 2021

Tax	General Fund Total (\$ millions)	General Fund Percent
Property Tax	\$363.7	20.8
Sales Tax	\$299.4	17.1
Utility Tax	\$212.7	12.1
Business and Occupation Tax	\$315.4	18.0
Other	\$561.2	32.0
Total	\$1,752.4	100.0

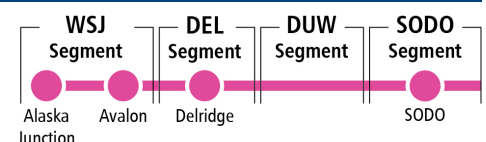
Source: City of Seattle 2023a (Actuals).

Note: "Other" represents revenue garnered through licenses, federal and state grants, state entitlements and impact programs, external service charges, court fines, and other miscellaneous investments, earnings, and charges.

4.3.2.4 Seattle Comprehensive Plan

The *Seattle 2035 Comprehensive Plan: Managing Growth to Become an Equitable and Sustainable City 2015-2035* (Seattle Comprehensive Plan) outlines goals to concentrate anticipated job and housing growth in urban centers and urban villages (City of Seattle 2018). The Urban Village Strategy within the plan promotes housing and employment development in specific locations by supporting compact, pedestrian-oriented development and reliable transit access accommodations. The strategy identifies four different types of growth areas: urban centers, hub urban villages, residential urban villages, and manufacturing and industrial centers. The study area includes the Duwamish Manufacturing/Industrial Center, one of two Puget Sound Regional Council and City-designated manufacturing and industrial centers in the city (see Figure 4.2-1 in Section 4.2, Land Use). These centers are designated as locations for more intensive industrial activity as part of the regional growth strategy set forth by the Puget Sound Regional Council and the City of Seattle. The West Seattle Junction Hub Urban Village is a City-designated area focused on balancing employment and housing opportunities with a mix of goods and services.

The City of Seattle is in the process of updating industrial and maritime land-use policies in its Comprehensive Plan to implement the Industrial and Maritime Strategy legislation approved by the City Council on July 18, 2023. The legislation updates the City's industrial lands policy and zoning that will create an estimated 35,000 new jobs over the next 20 years (City of Seattle 2023b). The proposal creates pathways to careers in industrial and maritime businesses, strengthens land-use protections for existing industries, prepares for growth near light rail services, and supports improved environmental quality for area residents.



4.3.2.5 Regional Transportation of Goods and Services

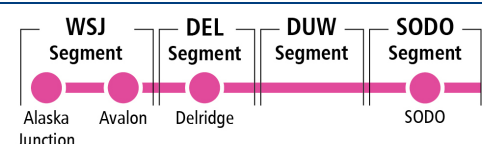
As one of the most trade-dependent states in the nation (City of Seattle 2016), the economy of Washington and the need for effective freight mobility are closely intertwined. Both consumers and businesses in the region depend on the efficient and safe movement of goods by truck, rail, and boat. The primary truck freight corridors in the state for regional and interstate commerce consist of Interstate 5 and Interstate 90. Substantial freight traffic also uses State Route 99. All three routes can be heavily congested during peak travel times. This congestion leads to longer travel times, increased operating costs, and decreased pick-up and delivery reliability. As a result, some businesses have shifted their delivery to non-peak hours and others have chosen to use alternate routes.

4.3.2.6 Industrial Centers

The Duwamish and SODO segments are within the Duwamish Manufacturing/Industrial Center (referred to as the center) along the Duwamish Waterway (also known as Duwamish River); see Figure 4.2-1 in Section 4.2, Land Use. As one of the largest industrial centers in the Pacific Northwest, it has an estimated employment of close to 70,000 jobs across key sectors such as manufacturing, construction, resource extraction, and wholesale/transportation/utilities (City of Seattle et al. 2020). The center is a critical trade and transportation hub, serving as the Port of Seattle's primary marine shipping area equipped with deep-water berths, wharfs, piers, shipyards, drydocks, container cranes, on-dock rail, container yards, cargo distribution and warehousing, and major railroad yards (Puget Sound Regional Council 2013). The center also includes Harbor Island, a key freight terminal for the Port of Seattle and the Northwest Seaport Alliance. Overall, the center supports 104,800 jobs and \$24.3 billion in business revenue throughout the King County economy directly and through indirect (the business supply chain) and induced (household income expenditures) effects. For every job supported by businesses in the center, 1.6 full-time equivalent jobs are supported throughout the King County economy. The regional economic impact of these businesses is measured at 5.9 full-time equivalent jobs per million dollars in business revenues and \$1.40 of output for every dollar of business revenues (City of Seattle et al. 2020).

The Port of Seattle and Northwest Seaport Alliance container terminals serve as an international gateway for imported and exported cargo goods. In 2017, use of the Northwest Seaport terminals generated a total direct revenue of over \$2 billion and supported over 7,000 direct jobs (Port of Seattle 2021). Terminal 18, a 196-acre container terminal that is the largest in the Pacific Northwest, is on Harbor Island at the mouth of the Duwamish Waterway. The Duwamish Waterway serves as an important hub for exporting regional agricultural goods and other commodities and importing commodities and final goods from around the globe. The recently renovated Terminal 5 is expected to support 1,700 jobs in 2024, with a total economic impact of \$1.2 billion, and indirectly supports 5,200 jobs throughout the region (City of Seattle et al. 2020).

Railroads are also an important and cost-effective component of moving goods and services to markets. BNSF Railway and Union Pacific Class 1 Rail run through the Duwamish Manufacturing/Industrial Center, and these rail lines often provide direct service for local businesses. Some of the container docks at the port have rail to increase the efficiency of intermodal transfers.



4.3.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would have fewer transportation options and longer travel times for transit riders, potentially resulting in increased road congestion and less transit usage. Chapter 3, Transportation Environment and Consequences, provides additional information on transportation considerations. This may deter or slow some investment in the study area, and the development that occurs could be more dispersed and of lower density than with the project.

The No Build Alternative would likely result in a different pattern of economic development and property development than with the project. Business and employee displacements could occur as part of the natural process of changing business dynamics and land development.

4.3.4 Environmental Impacts of the Build Alternatives during Operation

The project has the potential to advance local and regional plans by expanding transportation infrastructure and modal options available, thus increasing the efficiency of transportation and strengthening the local and regional economy. There would also be a small increase in long-term transit employment (train operators and maintenance staff) once new West Seattle Link Extension light rail service begins in 2032.

Changes to the local business environment and surrounding neighborhoods might occur as a result of the project. Direct economic impacts include business and employee displacements, as well as associated potential tax impacts from changes in land use, regional freight mobility, or maritime operations resulting from land acquisition for the project.

All Build Alternatives could result in some change in economic activity at or near the project corridor. Some alternatives could result in changes in economic activity for the broader region if the economic activity could not be relocated within the region. These changes might include business displacements when property is acquired for the project, along with corresponding effects on employees and property taxes that could shift the tax burden to other businesses and residents. If businesses are displaced outside of the region, business and occupation taxes and retail sales taxes could also be affected.

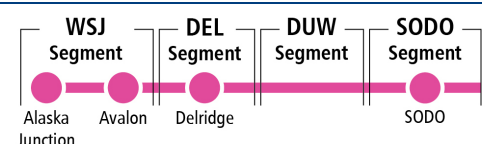
Potential maritime industry impacts that would have broader supply-chain impacts in the region and potential impacts on Tribal fishing where the project would cross the Duwamish Waterway are discussed in Section 4.3.4.3, Duwamish Segment.

4.3.4.1 Impacts Common to All Alternatives

This section describes impacts common to all alternatives, including business and employee displacements, industrial properties acquired, and the impact of acquisitions and displacements on the tax base of the city, and includes information on the minimum operable segment (M.O.S.). Additional detail on displacements is also provided by segment, along with impacts to the regional transportation of goods and services and freight mobility and access.

4.3.4.1.1 Business and Employee Displacements

The project would require acquisition of commercial, industrial, and institutional properties that might result in the disruption or displacement of businesses along the project corridor. Substantial displacement of local businesses can affect residents and businesses by altering the scale and mix of land uses and economic activity.



Often the direct impacts for displaced businesses are financial, but this does not capture the broader dynamics associated with displacement. Businesses are affected differently based on their characteristics, such as firm size, community importance, employment impact, and ability to relocate. For example, businesses that rely on a localized customer base might have more difficulty finding a suitable new location to serve the same population. Businesses that use machinery or hazardous substances might require large parcels or have perceived negative costs to the public (such as waste and pollution) that make relocation difficult. Moving to a new location could also restrict their labor pool.

Potentially displaced businesses generate local tax revenues, provide employment opportunities, and contribute to the local economy. Table 4.3-2 indicates the number of business and employee displacements that would be required by each Build Alternative within each project segment. Those alternatives with the least amount of such displacements and acquisitions would generally be expected to have a smaller negative effect on the local economy. The analysis considers impacts to specific industries that are dependent on critical waterways or infrastructure for operations by assessing if those businesses would be directly acquired.

The highest share of estimated employee displacements for the Duwamish and Delridge segments (see Table 4.3-3) are within businesses located in office-related use types. Office uses are typically associated with service-related industries, including professional, scientific and technical services, information, management of companies and enterprises, finance and insurance, and real estate. Major occupational types supported by these service-related industries include computer- and mathematical-related occupations, business and financial operations occupations, office and administrative support occupations, and management occupations. These types of occupations support median wages ranging between \$50,000 and \$142,000 in the Seattle Metropolitan Statistical Area and typically require a bachelor's degree or higher for entry (U.S. Bureau of Labor Statistics 2021 and 2022).

Depending on the segment, up to 38 percent of estimated employee displacements are within businesses located in warehouse use types. The warehousing and storage industry most commonly supports sales and related occupations, transportation and material moving occupations, and office and administrative support occupations. Median wages among these occupations range between \$46,500 and \$50,000 in the Seattle Metropolitan Statistical Area and typically require a high school diploma for entry (U.S. Bureau of Labor Statistics 2021 and 2022).

Up to 53 percent of estimated employee displacements, depending on the segment, are employed by businesses in industrial uses. Industrial uses support a wide range of industries, including construction, manufacturing, and utilities. These industries employ a wide range of occupations, including most commonly construction and extraction occupations and production occupations. These occupation types see median wages in the Seattle Metropolitan Statistical Area ranging from \$50,000 to \$73,000 and most commonly require a high school diploma for entry (U.S. Bureau of Labor Statistics 2021 and 2022).

Between 0 and 30 percent of estimated employee displacements within each segment are within businesses at retail uses. Retail uses support a broad range of occupations, with the most concentrated within the industry being sales and related occupations. Other common occupations within retail industries include computer and mathematical occupations and business and financial occupations. These occupations see median wages within the Seattle Metropolitan Statistical Area ranging between \$48,000 and \$135,000. Sales and related occupations most commonly require no formal education, while computer and mathematical occupations and business and financial occupations most commonly require a bachelor's degree for entry (U.S. Bureau of Labor Statistics 2021 and 2022).

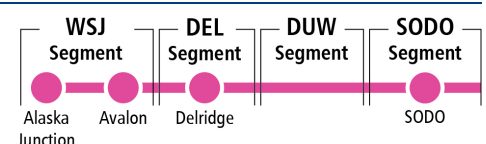


Table 4.3-2. Estimated Property Acquisition Impacts on Businesses and Employees from the West Seattle Link Extension

Segment	Alternative or Design Option	Business Displacements ^a	Employee Displacements ^a
SODO	Preferred At-Grade Lander Access Station Option (SODO-1c)	33	240
	At-Grade Alternative (SODO-1a)	34	240
	At-Grade South Station Option (SODO-1b)	35	260
	Mixed Profile Alternative (SODO-2)	31	280
Duwamish	Preferred South Crossing Alternative (DUW-1a)	36 to 37	620
	South Crossing South Edge Crossing Alignment Option (DUW-1b)	29 to 30	380 to 390
	North Crossing Alternative (DUW-2)	36	380
Delridge	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	19	130
	Dakota Street Station Alternative (DEL-1a)	14 to 17	150 to 160
	Dakota Street Station North Alignment Option (DEL-1b)	13 to 17	140 to 150
	Dakota Street Station Lower Height Alternative (DEL-2a)	14 to 18	150
	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	14 to 18	150
	Delridge Way Station Alternative (DEL-3)	14 to 18	150
	Delridge Way Station Lower Height Alternative (DEL-4)	14 to 18	150
	Andover Street Station Alternative (DEL-5)	17	130
	Andover Street Station Lower Height Alternative (DEL-6a)	16	110
	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	19	130
West Seattle Junction	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	44	240
	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	57	290
	Elevated Fauntleroy Way Station Alternative (WSJ-2)	15 to 18	90 to 100
	Tunnel 41st Avenue Station Alternative (WSJ-3a)	15 to 18	100 to 110
	Tunnel 42nd Avenue Station Option (WSJ-3b)	42 to 45	230 to 240
	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	17	110
	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	15	100
	No Avalon Station Tunnel Alternative (WSJ-6)	6	70

Data Sources: King County Assessment Department 2023; United States Department of Energy 2018.

Note: The employee numbers are estimates and rounded to the nearest multiple of 10. These employee numbers were derived using a mean square feet per worker ratio by building activity derived by the United States Department of Energy (2018). The estimate for each alternative is based on translating the size of the business building area into jobs using the job density ratio. The estimate is based off the secondary building use parcel data.

^a Ranges reflect differences from connecting to different alternatives in adjacent segments.

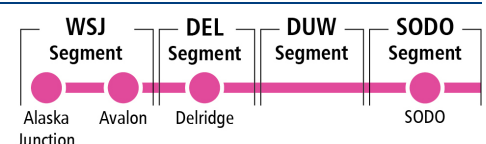


Table 4.3-3. Estimated Share of Property Acquisition Impacts on Employees from the West Seattle Link Extension by Land Use Type

Land Use Type	Minimum or Maximum Share	SODO Segment Impacts	Duwamish Segment Impacts	Delridge Segment Impacts	West Seattle Junction Segment Impacts
Office	Minimum	10%	33%	40%	3%
	Maximum	17%	63%	83%	62%
Industrial	Minimum	31%	8%	4%	0%
	Maximum	53%	30%	23%	0%
Warehouse	Minimum	28%	27%	0%	0%
	Maximum	32%	38%	6%	2%
Retail	Minimum	2%	0%	1%	0%
	Maximum	9%	1%	3%	30%
Medical Office	Minimum	0%	0%	0%	0%
	Maximum	0%	0%	10%	70%
All Other Uses	Minimum	2%	1%	0%	2%
	Maximum	17%	7%	32%	31%

Data Sources: King County Assessment Department 2023; United States Department of Energy 2018; U.S. Bureau of Labor Statistics 2022; Washington State Employment Security Department 2022.

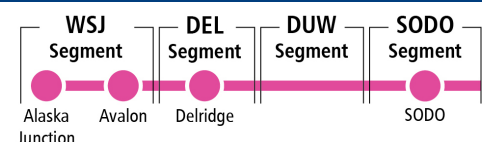
Note: The percentage of total employment is based on estimates of employee numbers presented in Table 4.3-2 by segment and alternative. Use types are aggregations of detailed use types based on data from secondary building use parcel data. Ranges reflect differences from different alternatives per segment.

The West Seattle Junction Segment has a different profile compared to the other three segments. Up to 70 percent of estimated employee displacements are within businesses located in medical office use types, depending on the alternative. For comparison, potential displacements within this use type among the other three segments range between 0 and 10 percent. Medical office uses typically employ healthcare support occupations and healthcare practitioners and technical occupations. Median wages in these occupation types range between \$40,000 and \$100,000. Healthcare support occupations typically require either a high school education or some higher education, but less than a bachelor's degree. Healthcare practitioners and technical occupations typically require a bachelor's degree or higher for entry (U.S. Bureau of Labor Statistics 2021 and 2022).

Some businesses might relocate to other areas or permanently close when their property is purchased, thereby causing a loss of associated jobs. However, it is anticipated that most displaced businesses and jobs would not be lost permanently because Sound Transit would provide relocation assistance to displaced businesses. Potential business displacements that are location-specific to neighborhoods are evaluated in Section 4.4, Social Resources, Community Facilities, and Neighborhoods. See Section 4.1, Acquisitions, Displacements, and Relocations, for information about displacements and relocation assistance.

4.3.4.1.2 Industrial Properties Acquired

Industrial and manufacturing land that would be converted to transportation use is described in Section 4.1, Acquisitions, Displacements, and Relocations, and Section 4.2, Land Use. Section L4.1.2.1 also cites an industrial vacancy rate of 7.2 percent, which indicates some land availability for relocations. However, industrial business replacements can be challenging when unique land features, such as access to rail or water, are required for business operation.



4.3.4.1.3 Impact of Acquisitions and Displacements on Tax Base of City

All of the project Build Alternatives would require acquisition of parcels that have existing commercial or industrial activity and businesses that pay a sales and/or business and occupation tax. Acquisition of these parcels would result in the initial reduction of sales and business and occupation taxes from the displacement of existing businesses. Determining the potential reduction for such taxes is not possible because it is not known if businesses would relocate within the city. If displaced businesses were to relocate within the city, they would resume paying sales and business and occupation taxes and there would likely be a minimal effect on the city tax base. There may be a reduction in sales tax and/or business and occupation taxes if most of the displaced businesses relocate outside the city, or if these businesses cease operations altogether.

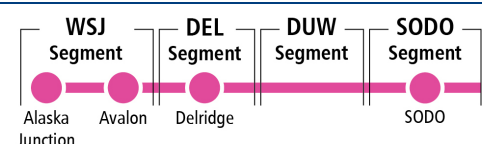
Like sales and business and occupation taxes, specific property tax impacts are not possible to calculate because of the structure of property taxes in Washington. Potential acquisitions would not initially reduce property taxes in Seattle due to the budget-based system that limits the growth of property tax revenues (Initiative 747 and subsequent legislative action to cap increases in City property tax revenues at 1 percent per year, plus some add-on value from new construction). This means the overall amount of tax collected is determined by statute and not directly determined by changes in assessed valuation. The amount of tax is then distributed across taxable property on the basis of assessed valuation. If the amount of taxable property is reduced via acquisition and made exempt, the same tax amount is redistributed to the remaining taxable properties within the jurisdiction. However, the conversion of property from taxable to tax-exempt would shift the property tax burden to other non-exempt property taxpayers. The impact is expected to be minimal given the reduction in taxable assessed valuation of acquired properties in relation to the City's overall tax base. For example, the total taxable assessed valuation of real property for project acquisitions is equal to 0.4 percent of the City of Seattle's overall assessed valuation in 2019.

Some of the initial tax revenue displacement would be offset by future construction elsewhere in Seattle. Not all the land required for the project would be needed permanently, and the unused land could be redeveloped after project completion. The long-term implications of the project's fiscal impacts depend on business relocation decisions. Some displaced businesses might choose to relocate to another site in the local area. Retaining those displaced businesses could reduce the effect on local sales taxes, property tax, and business and occupation taxes. In addition, if the project were to promote future development and investment in the local vicinity of the project corridor, property tax assessments of properties in the neighborhood could increase. However, the project could also result in shifting demand across the region, so that while assessments near the stations increase, property tax assessments in other areas of the city might be reduced. Overall, long-term property tax impacts are uncertain, and it is difficult to determine if the result on property tax assessments would be a net positive or negative.

4.3.4.2 SODO Segment

4.3.4.2.1 Business and Employee Displacements

The properties that would be affected in the SODO Segment are primarily commercial or industrial, as well as one public/institutional property (the United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office [Carrier Annex/Terminal Post Office]). Option SODO-1b would have the most business displacements. Alternative SODO-2 would displace the fewest businesses but the most employees. Preferred Option SODO-1c and Alternative SODO-1a would displace the fewest employees.



Preferred Option SODO-1c or Alternative SODO-1a would avoid displacing the United States Postal Service facility at 4th Avenue South and South Lander Street. Both Option SODO-1b and Alternative SODO-2 would displace this facility. Relocation of the facility could be challenging due to its size, functions, and the service area that it would need to be within. Impacts of relocating the United States Postal Service facility are yet undefined, and if an alternative that triggers relocation of the facility moves forward, additional environmental review would be conducted to evaluate and disclose impacts of relocating the facility.

Alternative SODO-1a and Option SODO-1b would acquire property owned by Pacific Iron and Metal, a metal recycler. This property has a custom stormwater system designed to meet their operational and regulatory permit needs. These alternatives could affect the stormwater system and therefore also affect the ability of this business to operate. Pacific Iron and Metal would be fully displaced by Alternative SODO-2. Stormwater system requirements would make Pacific Iron and Metal difficult to relocate.

4.3.4.2.2 Impacts to Regional Transportation of Goods and Services and Freight Mobility and Access

For all SODO Segment alternatives, spur tracks along the SODO Busway north of South Forest Street would be removed, which would affect rail access to businesses. Option SODO-1b and Alternative SODO-2 would displace the Carrier Annex/Terminal Post Office at South Lander Street and 4th Avenue South. Impacts of relocating the United States Postal Service facility are yet undefined and should an alternative that triggers relocation of the facility move forward, additional environmental review will be conducted to evaluate and disclose impacts of relocating the facility.

Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would build new vehicle overpasses over the existing and future light rail tracks on South Lander Street, which is a major truck street, and would improve truck mobility by eliminating conflict and delay with the existing light rail crossings. These mobility improvements could support industrial businesses by making the local freight system more efficient by reducing delays. With Preferred Option SODO-1c and Alternative SODO-1a, where the Carrier Annex/Terminal Post Office would not be displaced, access to and from the facility would remain or be reconfigured to ensure that operations would not be affected (see Section 4.14, Public Services, Safety, and Security, for more information).

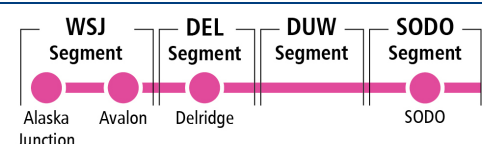
4.3.4.3 Duwamish Segment

4.3.4.3.1 Business and Employee Displacements

The properties that would be affected in the Duwamish Segment are primarily commercial or industrial, with a few institutional parcels. Option DUW-1b would displace the fewest number of businesses and employees in the segment. Preferred Alternative DUW-1a would result in the most employee displacements and the same business displacement as Alternative DUW-2. The Duwamish Segment Build Alternatives would displace businesses that might be water-dependent or supportive of water-dependent businesses (see Section 4.3.4.3.3, Impacts to Maritime Industry).

4.3.4.3.2 Impacts to Regional Transportation of Goods and Services and Freight Mobility and Access

Preferred Alternative DUW-1a and Option DUW-1b would displace United Motor Freight, because it would be unable to maintain operations during project construction and operation.



United Motor Freight transports cargo off ships to container freight stations. It is one of the few heavy and long-haul equipment companies in the Puget Sound region for importing and exporting cargo, and their operations could be difficult to relocate. Option DUW-1b would also displace General Construction, which uses gravel from barges and requires waterside docks. The company provides construction services for bridges, piers, marinas, breakwaters, jetties, dam upgrades, ferry terminals, submarine cables, and outfalls. It is highly dependent on its existing property due to the existing onsite infrastructure and co-location with CalPortland. This facility is the company's equipment yard. The facility would likely be challenging to relocate within the area.

Alternative DUW-2 would displace Centerline Logistics, Olympic Tug & Barge (part of Centerline Logistics), Island Tug & Barge, Sea-Pac Transport Services, and Maxum Petroleum. These businesses are involved in supporting the movement of marine transportation in Puget Sound, and their operations could be difficult to relocate. Island Tug and Barge is highly dependent on the existing property due to its access to the waterway, moorage, railroad lines, and freight access/circulation. Island Tug & Barge rents moorage space from the Port of Seattle and primarily hauls crushed aggregate for CalPortland, and occasionally scrap metal. Their business is highly dependent on their current location due to the proximity to CalPortland.

Sea-Pac Transport Services' property has unique features such as direct railroad, intermodal loading access from the marine terminal, and deep-water moorage. Maxum Petroleum stores fuels in storage tanks that require a large property. To find adequate space and infrastructure, Maxum Petroleum might need to relocate outside of the immediate area, which would result in temporary impacts to their operations, including their ability to fulfill a biodiesel contract with Washington State Ferries. There would be no long-term impacts to rail access.

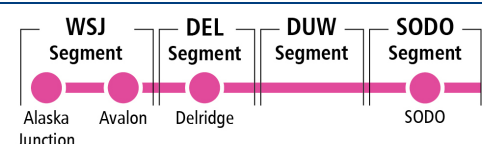
4.3.4.3.3 Impacts to Maritime Industry

Maritime businesses along the Duwamish Waterway would be displaced by the Duwamish Segment Build Alternatives. If the businesses have cargo operations or waterfront dependent functions, they could be difficult to relocate. Where feasible, Sound Transit would work with the maritime businesses to explore ways to maintain their operations.

Preferred Alternative DUW-1a would displace water-dependent businesses,¹ including the following:

- **United Motor Freight** – This business is one of the occupants of the buildings on the Riverside Millworks property at 3800 West Marginal Way Southwest. United Motor Freight provides multi-modal commercial shipping services and is highly dependent on its current location in proximity to Port of Seattle terminals. The business requires multiple modes of transportation, including access to water and rail.
- **Bob's Boat Shop** – This business is also one of the occupants of the buildings on the Riverside Millworks property. Bob's Boat Shop is dependent on the existing property for dock and waterway access and proximity to marinas because of its maritime customer base. It provides marine services, including vessel repairs and boat storage. The business requires a waterfront property.

¹ Water-dependent businesses are those that meet the following definition for water-dependent uses from Revised Code of Washington 70.105.060(24)(a): a use that cannot logically exist in any location but on the water. Examples include, but are not limited to, waterborne commerce; terminal and transfer facilities; ferry terminals; watercraft sales in conjunction with other water-dependent uses; watercraft construction, repair, and maintenance; moorage and launching facilities; aquaculture; log booming; and public fishing piers and parks.



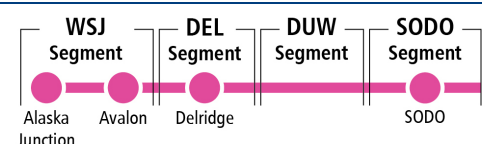
Preferred Alternative DUW-1a would also displace PCC Logistics at Terminal 104. Although not a water-dependent business (Sound Transit 2023), this business is highly dependent on the existing property due to its proximity to Port of Seattle terminals (Terminal 18 and Terminal 104), access to intermodal shipping infrastructure, and space for daily operations. Displacement could affect shipping schedules in the near-term, but Terminal 18 would not be impacted and could likely compensate for reduced capacity during relocation, with only short-term disruptions to operations.

The 2023 Duwamish Crossing Real Estate Assessment study (Sound Transit 2023) assessed the real-estate impacts associated with Preferred Alternative DUW-1a for the two directly impacted properties where the businesses listed above are located:

- The Riverside Millworks property, where United Motor Freight and Bob's Boat Shop are located. The study suggests that if the project requires a full acquisition of the Riverside Millworks property, "replacing the entire property will be challenging given the specialized water-dependent facilities located on the southern portion of the site, consisting of a marine crane and pier, with protected saltwater access" (Sound Transit 2023). The study also mentions that from casual observation, the dock on the Riverside Millworks property is currently used for recreational pleasure craft moorage rather than urban industrial uses. The type of large (60+ foot) pleasure craft docked at Riverside Millworks can be accommodated at a few Seattle area marinas, within a 1- to 4-year wait, depending on the marina. Lastly, the study determines that opportunities in the market for a comparable property to Riverside Millworks with similar improvements are limited but "do occur from time to time."
- Terminal 104 where PCC Logistics leases space from Port of Seattle. The Duwamish Crossing Real Estate Assessment Technical Memorandum concludes that a suitable replacement property can be found for PCC Logistics given the current changes in economic conditions impacting Seattle's industrial market and several new development projects that have increased the amount of available space. The relocation site should, ideally, be sited in an area with rail access, heavy haul street locations, a foreign trade zone, and bonded warehouse areas.

Option DUW-1b would displace the same water-dependent businesses as Preferred Alternative DUW-1a except for PCC Logistics. Option DUW-1b would also displace the following additional water-dependent businesses:

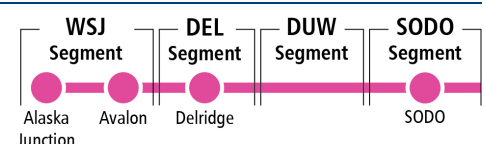
- General Construction Company – General Construction is a Marine Construction company located on Port of Seattle property that rents their equipment yard from the Port of Seattle/Northwest Seaport Alliance. It is a major company of its type in the Pacific Northwest and assisted in building the State Route 520 Floating Bridge. This business services in-water structures such as bridges, piers, marinas, dams, and ferry terminals. The property serves as Kiewit Corporation's equipment yard and private local marine service. Over half of Kiewit's vessels come to the property for service and maintenance. It is highly dependent on its existing location due to the existing infrastructure and proximity to Kiewit's operations.
- Jim Clark Marina – This is a private recreational marina that rents slips to boaters. It is owned, managed, and maintained by an association of recreational boaters so moorage rates are below market rate. It is highly dependent on the existing property and proximity to West Seattle.
- Harbor Island Marina – This facility is owned and operated by the Port of Seattle and includes a marina with a separate administrative office. Liveaboards are allowed at this marina. It is highly dependent on the existing property and proximity to West Seattle.



There are also a few water-related businesses that would be displaced by Preferred Alternative DUW-1a and Option DUW-1b, including businesses within the Harbor Marina Corporate Center at Terminal 102, owned by Port of Seattle. This center supports maritime shipping and ancillary businesses and includes warehouse and light manufacturing tenants. The Duwamish Crossing Real Estate Assessment Technical Memorandum finds that for Preferred Alternative DUW-1a, relocation opportunities for impacted office and flex users at the Harbor Marina Corporate Center are readily available in the foreseeable future due to reduced demand for office space and shifting work patterns driven by the COVID-19 pandemic. The technical memorandum also mentions that Dock E, located on the property, would be impacted by intermittent interruptions during project construction and that locating replacement properties to accommodate the temporary displacements of dock users would require advanced planning.

Alternative DUW-2 would displace the following water-dependent businesses:

- **Maxum Petroleum** – This business is a marine diesel oil and lubricant distributor that operates a fuel pier, tanker trucks, and bunkering vessels at Terminal 18 as well as warehouses where fuels and lubricants are blended and trucked to the fuel docks on Harbor Island. The warehouses would be displaced, which could affect fuel and lubricant delivery to Harbor Island facilities. This business requires intermodal access, including rail access, infrastructure for flammable materials storage and handling, and proximity to their facilities on Harbor Island. Maxum’s bunkering services also support the North Pacific Fishing Fleet home ported at Terminal 91.
- **Puget Sound Packaging and Crating** – This business is highly dependent on the existing property to serve their maritime customer base at nearby Port of Seattle shipping terminals. It requires a large warehouse with barge facilities and moorage.
- **Sea-Pac Transport Services** – This business provides cargo packaging services for rail and container ships and is dependent on their current location due to maritime customers at nearby shipping terminals and their co-location with Island Tug and Barge. It requires moorage and a moderately sized warehouse with intermodal loading access.
- **Pacific Terminals Moorage** – This business provides moorage for commercial shipping vessels and has an existing moorage agreement with Sea-Pac Transport Services, which supports warehouse operations. The auxiliary moorage would be displaced, but the warehouse would not be affected. Displacement and relocation of available berths could affect shipping schedules, and the business would require space to moor vessels along the waterway.
- **Island Tug and Barge** – This business includes moorage and a headquarters building, provides tug and barge services, and requires access to multiple modes of transportation. The company benefits from its co-location with Sea-Pac Transport Services and proximity to nearby maritime customers. They require access to multiple modes of transportation. This business requires proximity to its customers and transportation infrastructure.
- **Tilbury Cement** – This business is a commercial cement production and shipping business that also leases moorage to Western Towboat Barge. It is highly dependent on its current location due to the existing infrastructure and proximity to the Duwamish Waterway. This business requires a comparable location, adequate dock, infrastructure, and acreage for daily operations.
- **Western Towboat Barge** – This tug and barge service business is dependent on their existing moorage agreement with Tilbury Cement, as space along the waterway for large barges is very limited. Western Towboat also moors tugs at Harbor Island Marina, Dock E, which is a Port of Seattle property.



- **Westway Feed Products** – This business, which has operations in 28 North American manufacturing facilities, is located at Terminal 18 and requires access to shipping infrastructure and storage capacity for production and shipping of livestock feed supplements.
- **Centerline Logistics** – This business is a petroleum transport business that operates tugboats, bunker, and terminal barges. It is co-located with Olympic Tug and Barge and requires access to the Duwamish Waterway and moorage for daily operations. Displacement could affect fuel delivery to container ships and other large vessels in Elliott Bay in the near and long term. Centerline Logistics and Maxum provide the majority of fueling services to container, cruise, and fishing vessels in Puget Sound. Their services are critical to the harbor and would need to be relocated in reasonable proximity to Puget Sound.
- **Olympic Tug & Barge** – This business is dependent on its co-location with Centerline Logistics and requires access to the Duwamish Waterway and moorage to bunker in Elliott Bay and transport petroleum using the Centerline Logistics fleet. Displacement of this business could affect fuel delivery to container ships and other large vessels in Elliott Bay.

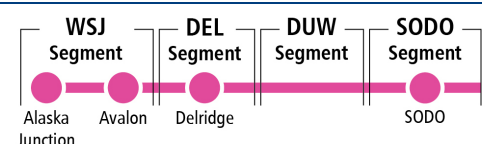
As described above, Alternative DUW-2 would displace the most water-dependent businesses and have the greatest impact on shipping of goods and services. The displacements triggered by Alternative DUW-2 would risk detrimental impacts to the economic activities of the Port of Seattle and Northwest Seaport Alliance, two of the key economic drivers of the Puget Sound region. As stated in Section 4.3.2.6, these organizations support a critical mass of port employment across a variety of industries and are essential for maintaining trade and transportation flows.

Preferred Alternative DUW-1a and Option DUW-1b would not affect the navigation channel for the West or East waterways and are not expected to have a direct economic effect related to navigation. See Section 3.9, Affected Environment and Impacts During Operation – Navigation, in Chapter 3 for further discussion of navigation on the Duwamish Waterway.

Alternative DUW-2 would introduce a new over-water structure north of the existing fixed Spokane Street Bridge, which is an existing restriction of the East Waterway navigation channel. Alternative DUW-2 would affect the vertical and horizontal clearance in this area. Because vessels that use this area typically require less vertical clearance than Alternative DUW-2, the change in vertical clearance is not anticipated to prevent current uses. However, the change in horizontal clearance could reduce the number of barges that are docked in this area, which could have some effect on maritime businesses. Alternative DUW-2 would not impact the navigation channel of the West Duwamish Waterway. It would not impact port parking at Terminal 25, or access to Terminal 5 on the west side of the waterway.

4.3.4.3.4 Impacts to Tribal Treaty-Protected Fishing

The Muckleshoot Indian Tribe has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region, which includes the Duwamish Waterway. The Muckleshoot Indian Tribe is signatory to both the Treaty of Point Elliott and the Treaty of Medicine Creek. The Suquamish Tribe of the Port Madison Reservation (the Suquamish Tribe) is signatory to the Treaty of Point Elliott and has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region, which also includes the Duwamish Waterway. Some bridge types would require placement of guideway columns in water, which could interfere with Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Muckleshoot Indian Tribe. Some bridge types could also interfere with Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Suquamish Tribe. Preferred Alternative DUW-1a would be constructed with either a cable stay or steel truss bridge, which would not



have guideway columns in the Duwamish Waterway. Alternative DUW-2 could be constructed with bridge types that would avoid guideway columns in the water. Option DUW-1b would have guideway columns in the water with all bridge types.

4.3.4.4 Delridge Segment

4.3.4.4.1 Business and Employee Displacements

The businesses that would be affected in the Delridge Segment are primarily commercial. Alternative DEL-1a would have the highest number of employee displacements. Preferred Option DEL-6b and Alternative DEL-7 would have the most business displacements. These alternatives would displace a business park, a health club, and other retail and local service businesses. Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would have a similar number of business and employee displacements. These alternatives as well as Alternative DEL-1a and Option DEL-1b would displace four government offices under the Washington State Department of Child, Youth and Families.

For the West Seattle Link Extension M.O.S., none of the Delridge Segment alternatives would need to acquire additional commercial, industrial, or institutional properties or displace any additional businesses.

4.3.4.4.2 Impacts to Regional Transportation of Goods and Services and Freight Mobility and Access

Preferred Option DEL-6b would create a new signalized intersection at Delridge Way Southwest and Southwest Charlestown Street/23rd Avenue Southwest that would provide truck and passenger vehicle access to Nucor Steel. Alternative DEL-7 would be similar to Preferred Option DEL-6b. None of the other Delridge Segment alternatives would affect truck, rail, or marine networks in this segment. No commercial load zones would be affected.

4.3.4.5 West Seattle Junction Segment

4.3.4.5.1 Business and Employee Displacements

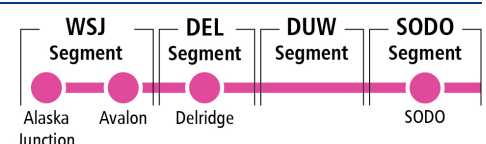
The properties that would be affected in the West Seattle Junction Segment are primarily commercial or mixed-use. Alternative WSJ-1 would have the most business and employee displacements because it would be closest to the main commercial and retail corridor in West Seattle. Alternative WSJ-6 would displace the fewest employees and businesses.

4.3.4.5.2 Impacts to Regional Transportation of Goods and Services and Freight Mobility and Access

None of the West Seattle Junction Segment alternatives would affect truck, rail, or marine networks. Up to three commercial load zones would be affected by any of the alternatives.

4.3.5 Environmental Impacts of the Build Alternatives during Construction

This section describes potential beneficial and adverse economic impacts common to all alternatives, and then describes impacts on businesses and freight during construction by segment. Segment-specific impacts discussed after Section 4.3.4.1, Impacts Common to All Alternatives, are focused on road closures that would result from construction of the West Seattle Link Extension. This type of impact affects retail and service businesses most directly



because they generally rely on easy customer access. For some, the nearby construction activities could make the business less accessible to customers, which could result in reduced business revenues and sales tax and business and occupation tax revenues. The extent and duration of the interference, the location of competitors, and the type of affected business would all influence the degree of economic effects to local businesses from project construction. Potential impacts on Tribal treaty-protected fishing during construction are also discussed for the Duwamish Segment.

4.3.5.1 Impacts Common to All Alternatives

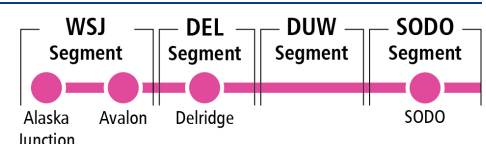
Construction activities often result in changes to the economy of the surrounding area. The benefits of construction mainly come in the form of construction and related spending entering the community via construction jobs, the purchase of local goods and services needed for construction, and construction employees spending money in the community. Negative effects of construction often include blocked visibility and reduction in access to businesses, traffic delays, noise, and rerouting traffic in ways that increase travel time.

4.3.5.1.1 Potential Beneficial Economic Impacts from Construction

The project schedule estimates that construction would begin in 2027 and be completed by 2032. Capital expenditures on light rail projects can help support regional economic activity through the purchase of goods and services, thus providing labor income and generating tax revenues in the study area. The economic contributions arising from construction projects are often temporary in nature and occur as construction spending unfolds. How much construction spending increases employment and business spending depends on the source of project funding and the types of labor used during construction. Table 4.3-4 provides the estimated direct expenditures and the estimated number of direct employees who would be supported under the preferred, highest, and lowest cost combinations of Build Alternatives. The cost estimate for the preferred alternative is composed of Preferred Option SODO-1c, Preferred Alternative DUW-1a, Preferred Option DEL-6b, and Preferred Option WSJ-5b. The high-cost estimate is composed of Alternative SODO-1b, Preferred Alternative DUW-2, Alternative DEL-4, and Option WSJ-3a. The low-cost estimate is composed of Alternative SODO-1a, Alternative DUW-1b, Alternative DEL-5, and Alternative WSJ-2.

The project would support economic activity in the region by increasing demand for services and materials in the business supply chain for the construction industry. The wages paid to workers in construction or supporting industries would support household spending in the region. The direct estimates represent business spending and jobs directly supported by the project Build Alternatives. The direct spending generates additional economic output and employment from secondary (supply-chain and household spending) effects associated with each Build Alternative. These secondary effects are represented using economic multipliers, which reflect the incremental economic activity across industries in the region generated from each dollar of capital spending.

Based on the multipliers in the 2012 Washington Office of Financial Management Input-Output model (Washington Office of Financial Management 2012, updated February 2021), every \$1 million spent on construction activity supports an additional \$1,120,000 in economic output. Numbers may be different than other Sound Transit reporting of project jobs supported by dollars spent on capital projects that is based on planning level budgets. Both estimates use the Washington State Input-Output model but may have different budget assumptions, depending on what cost estimates are available at the time of analysis. Construction projects can result in increased economic capacity, but only a short-term increase in output and jobs can be



specifically attributable to the project. Construction effects generally decrease as project spending declines over the life of the project.

Table 4.3-4. Estimated Direct Expenditures and Direct Employment from West Seattle Link Extension Construction

Cost Estimates and Employment	Project Construction ^a
Preferred Alternatives estimate total direct expenditure (\$ millions)	\$3,283.77
Preferred Alternatives estimate total direct employment (job-years)	8,300
High-cost estimate total direct expenditure (\$ millions)	\$3,940.03
High-cost estimate total direct employment (job-years)	9,900
Low-cost estimate total direct expenditure (\$ millions)	\$2,631.12
Low-cost estimate total direct employment (job-years)	6,600

Note: These estimates reflect updated cost estimates issued in December 2023 and are expressed in 2024 dollars.

^a Does not include right-of-way, professional, and contingency costs. A job year is defined as full-time employment for one person over the course of a year (assuming 2,080 hours of employment per year).

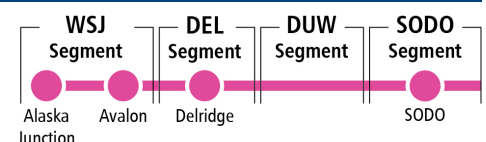
4.3.5.1.2 Potential Adverse Economic Impacts from Construction

Businesses in the study area near construction of the West Seattle Link Extension could be negatively affected by construction activities. Negative impacts might include reduced sales resulting from changes in traffic, access, parking, visibility, dust, and noise because patrons might choose to avoid construction areas or have greater difficulty accessing businesses near construction activity. Reduced sales could affect downstream tax revenues, such as sales and Business & Occupation tax. This type of impact affects retail and service businesses most directly because they generally rely on easy customer access. The extent and duration of the interference, the location of competitors, and the type of affected business would all influence the degree of economic effects to local businesses from construction.

For all project segment alternatives, construction employment could increase localized demand for parking. Increased parking occupancy may reduce business patronage for those who travel by personal vehicle if they are not able to find parking or alternative ways to access the business. Sound Transit would prohibit construction worker parking on city streets outside of the staging areas and require the contractor to develop a parking plan to describe where construction worker parking would be allowed. See Section 3.6, Affected Environment and Impacts during Operation – Parking, for more information on parking.

4.3.5.2 SODO Segment

Businesses in the SODO Segment that could be affected by construction activities are a mix of mostly industrial and commercial. General freight movement could be affected by closure of South Lander Street in this segment during construction as described in Section 3.10, Affected Environment and Impacts during Operation – Freight Mobility and Access.



4.3.5.3 Duwamish Segment

4.3.5.3.1 Potential Impacts on Businesses and Freight

Businesses in the Duwamish Segment that could be affected by construction activities are primarily industrial, with a concentration of freight-related industries and the Port of Seattle on Harbor Island and along the Duwamish Waterway. The regional movement of freight and goods would be impacted by construction activities that cause short-term lane closures on key streets in the truck network (Spokane Street, State Route 99, East Marginal Way, and West Marginal Way) on nights and weekends when the guideway is built over those streets. All Duwamish Segment alternatives would require short-term closures of the navigation channel and could impact vessel movement outside the channel during construction. Lane closures and impacts to vessel movements could impact the movement of freight, thereby affecting the Port of Seattle and other freight-related businesses during construction. More detail about the existing freight use and potential impacts along the Interstate 5 corridor, waterways, and rail corridors is included in Section 3.9, Affected Environment and Impacts during Operation – Navigation, and Section 3.10, Affected Environment and Impacts during Operation – Freight Mobility and Access, in Chapter 3.

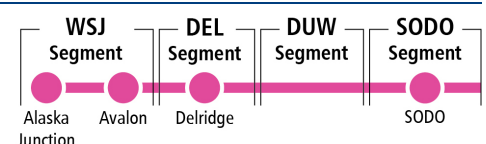
Construction of Preferred Alternative DUW-1a would temporarily close the northern gangway from Harbor Island to the Harbor Island Marina commercial dock (Dock E), and Option DUW-1b would temporarily close the southern gangway. However, mariners could use the alternate access point for each of these alternatives. The northern 125 feet of the dock would also be closed during construction of Preferred Alternative DUW-1a, while the southern 300 feet of the dock would be restricted during overhead construction of Option DUW-1b. These closures and restrictions would temporarily displace commercial vessels. Finding replacement commercial moorage on the Duwamish Waterway would be difficult. Sound Transit would coordinate with the Port of Seattle to minimize disruptions to land and water access.

Netting and scaffolding used during construction of all Duwamish Segment alternatives for all bridge types would temporarily reduce the vertical clearance of the East and West Duwamish waterways, as described under construction impacts in Section 3.11.3, Duwamish Segment. In the East Waterway, the remaining clearance would be high enough for commercial vessels that typically use this area; however, businesses with commercial vessels that use the West Waterway, such as Alaska Marine Lines and Delta Marine, have vessels that are typically taller and could be affected.

Preferred Alternative DUW-1a and Option DUW-1b would result in temporary closures to tracks east of East Marginal Way South. None of the alternatives would affect access to Terminal 18.

Alternative DUW-2 would span the lead rail track serving Harbor Island but is not expected to disrupt rail operations during construction. There would be a guideway column in the Terminal 18 employee parking lot just west of the Terminal 18 truck gate queue area, but it would not affect truck operations at the terminal. Access for construction vehicles to staging areas and construction of the guideway itself could encroach into the gate area but is not expected to affect queue capacity or circulation within the terminal operations.

For all alternatives, access to construction of the guideway and columns could also temporarily affect the local business rail spurs on each side of the SODO Busway in the Duwamish Segment. Night and weekend closures of West Marginal Way with all alternatives could affect access to Terminal 5, but these impacts are expected to be minimal due to the short duration and limited hours.



Preferred Alternative DUW-1a and Option DUW-1b would fully close Delridge Way Southwest and its northbound on-ramp to the West Seattle Bridge on nights and weekends during construction of the elevated guideway over these roadways. This would affect access to Nucor Steel and businesses on Delridge Way Southwest during these times. Closures would be coordinated with Nucor Steel, which operates 24 hours a day, 7 days a week, to minimize impacts to their operations. Alternative DUW-2 would require partial closures of the West Seattle Bridge on nights and weekends during construction of the elevated guideway over the roadway. This would not directly affect access to businesses in West Seattle and alternate routes would be available for accessing businesses.

More detail about the existing freight use and potential impacts along the Interstate 5 corridor, waterways, and rail corridors is included in Chapter 3.

4.3.5.3.2 Impacts to Tribal Treaty-Protected Fishing

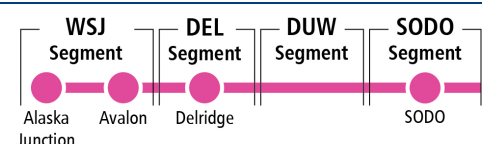
If construction were to occur during fishing seasons, Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Muckleshoot Indian Tribe may be affected by construction activities for bridges over the Duwamish Waterway for all alternatives, such as placement of temporary cofferdams, work trestles, and work barges. Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Suquamish Tribe may also be affected. Construction activities may also change vessel traffic patterns, which could interfere with upstream and downstream Tribal treaty-protected fishing rights and access. More detail about the impact of construction activities on navigation is included in Section 3.11.3, Duwamish Segment.

4.3.5.4 Delridge Segment

Businesses in the Delridge Segment that could be affected, primarily along Delridge Way Southwest, are a mix of service businesses and offices that serve the surrounding community as well as some that serve the larger West Seattle community. These businesses are more likely to be affected by construction nearby than other types of businesses that are not dependent on easy customer access. Potential impacts could occur to remaining service businesses along the west side of Delridge Way Southwest. Nucor Steel is adjacent to two alternatives (Alternative DEL-5 and Alternative DEL-6a) that would require full closure of Southwest Andover Street between 26th Avenue Southwest and 28th Avenue Southwest during construction of the tall bridge footings and structure, but access to Nucor by vehicle and rail would be maintained. Alternative DEL-5 would require the full closure of Southwest Avalon Way for up to 2 years. Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7 would have the same closure but only on nights and weekends when the elevated guideway would be constructed over the roadway. Alternative DEL-3 and Alternative DEL-4 would require a multiple-year partial closure of Delridge Way Southwest from the West Seattle Bridge to south of Southwest Dakota Street, which could also impact access for Nucor Steel. Although construction of these alternatives would temporarily disrupt local traffic, access to Nucor Steel would be maintained in both instances.

Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would affect one general load zone on Southwest Yancy Street; the other Build Alternatives would not have additional load zone impacts during construction beyond those described as long-term impacts.

Delridge Segment alternatives connecting to Alternative DUW-2 in the Duwamish Segment would displace some employee parking, but Sound Transit would work with Nucor Steel to provide alternate parking if needed.



Alternative DEL-1a, Option DEL-1b, and Alternative DEL-3 would fully close Southwest Genesee Street between 26th Avenue Southwest and Southwest Avalon Way during construction.

Alternative DEL-2a, Option DEL-2b, and Alternative DEL-4 would require partial closures or night-time and weekend closures of this arterial that carries people between Delridge and other parts of West Seattle, and therefore these closures could affect businesses in Delridge.

4.3.5.5 West Seattle Junction Segment

Businesses in the West Seattle Junction Segment that could be affected are primarily retail and service businesses that serve the surrounding community as well as the larger West Seattle community. These types of businesses would be more likely to be affected by construction nearby than other types of businesses that are not dependent on easy customer access.

Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, and Alternative WSJ-5a would have greater potential impacts to businesses along Fauntleroy Way Southwest than other alternatives in this segment because of the duration of roadway closures. The other West Seattle Junction Segment alternatives would have stations closer to the Alaska Junction retail district and therefore would have greater potential impacts during construction to businesses there, but less potential impacts to businesses on Fauntleroy Way Southwest.

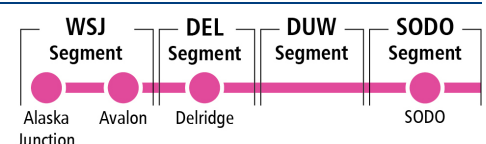
4.3.6 Indirect Impacts of the Build Alternatives

The project could have indirect economic impacts to the surrounding area. These indirect impacts can be positive or negative. Increasing economic activity in and around the industrial areas may place redevelopment pressure on maritime users as they experience more traffic congestion and competition for scarce industrial sites located close to water access.

Development of the project would likely bring more dense and mixed-use land uses to station areas consistent with adopted land-use plans, which could result in increased economic activity, increased development and redevelopment potential of surrounding properties, and increased property value of parcels near the station. As described in Section 4.2, Land Use, this increase in mixed land uses would support Seattle's Urban Village Strategy (City of Seattle 2018) by promoting compact, pedestrian-oriented development and reliable transit access accommodations. The project would also bring high-capacity transit opportunities and connections to new transportation corridors and increase access to locations around the region, especially for those with mobility challenges.

As the project expands light rail access to the area, the convenience, visibility, and desirability of the surrounding residential and commercial properties near stations would be expected to increase. In addition, heavier pedestrian activity near stations and important nodes of economic activity would increase the number of potential customers to retail businesses in the area, thus taking advantage of the clustering of businesses near each other to complete shopping trips more efficiently. Convenient light rail access might also encourage more employees to use public transportation to complete their commute, instead of driving.

Many case studies have found that residential and commercial properties within the vicinity of light rail stations typically experience an increase in property values and are ultimately valued higher than similar properties not near light rail stations (Transportation Research Board 2004, Nelson 2017), especially if pedestrian infrastructure is added (Bartholomew and Ewing 2011). In addition, higher-than-typical densities of residential housing, consumer retail and services, and pedestrian amenities characterize transit-oriented development (TOD). Gains in property value and real-estate market performance often result from the synergy of proximity to transit, building density, mixed-use properties, and pedestrian-friendliness (Transportation Research



Board 2004, Cervero 2004). Also, incremental new construction of property developments around station areas enabled by light rail access would be expected to bolster property tax assessments in future years.

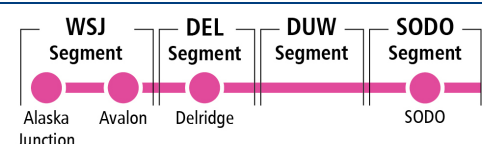
Benefits from the operation of the West Seattle Link Extension would not be presumed to be inevitable; the occurrence of these benefits would require a strong demand for real estate, location within a neighborhood with the appropriate zoning, increased infrastructure investment, and public policies that support TOD and transit system expansion. Moreover, property values might also be affected by external forces other than TOD, such as fluctuations in the business cycle, macroeconomic variables, consumer confidence, and local development pressures. Changes in property values would be expected to take time to manifest as the stages for TOD would occur over time. As described in Section 4.2, Land Use, TOD benefits may not be uniformly realized at all station areas. The project may also have broader impacts on the industrial businesses, especially the maritime businesses. Water-dependent commerce is highly specialized and dependent on being close to suppliers and distributors. Direct displacement of these uses can have indirect economic effects as demand for supply-chain services could shift to other areas within or outside the region when these specialized businesses are relocated. Therefore, some direct business displacements can indirectly affect multiple other businesses if their goods or services are no longer needed in the area due to their primary customers being displaced. Generally, those maritime businesses prefer to be close to their end markets.

Displacement of water-dependent uses could affect the regional economic capacity to support the movement of goods because these businesses might be difficult to relocate close enough to provide the same services. Therefore, the displacement of these businesses along the Duwamish Waterway might impair the operations of waterway transportation and shipment of goods and services, which could have negative effects on businesses that rely on the shipping terminals and support businesses that provide inputs for the maritime industry. As a result, it could have a broader effect on regional jobs and business revenues than the jobs and businesses displaced directly by the project. When these firms are near each other, this helps support additional economic activity by reducing transaction costs and delivery times, which boosts producer surplus and reduces the product costs for end markets.

Businesses that support water-dependent activities can be found in a broad range of industries, including wholesale, retail, real-estate services, engineering services, and petroleum products manufacturing. Water-dependent economic activities tend to purchase their business inputs from within the county, which suggests that impacts from supplier disruptions would be magnified to industry operations.

During construction, the lower vertical clearance in the West Waterway could delay commercial vessels that use the waterway, which could then result in an indirect effect to businesses. Some of these business served by these vessels are located in Alaska and Hawaii and have limited shipping options.

The acquisition of the parcels used to support the elevated guideway bridge might be disruptive to several businesses and the broader maritime industry along the Duwamish Waterway. Many of the maritime businesses along the Duwamish Waterway purchase goods and services from local suppliers (including other local maritime businesses) who would also lose revenue if displacement occurred. Most maritime businesses have close supply-chain relationships in industries that support warehousing, the broader transportation sector (including boatbuilding), and sign manufacturing. Alternative DUW-2 would likely be most disruptive to the existing maritime cluster, based on the extent of business and employee displacements and their relationship to maritime and freight movement industries in the region.



The project could also result in negative effects to surrounding properties along the West Seattle Link Extension. Negative operations effects could include impaired road access and traffic flow changes or restrictions, decreased parking, noise increases, and impaired visibility that could reduce business patronage. Indirect displacement of existing businesses might occur as a result of new development patterns that may increase rents or saturate the local market area with similar businesses, drawing away sales from existing businesses. Chapter 3 and Section 4.5, Visual and Aesthetic Resources, and Section 4.7, Noise and Vibration, address traffic, noise, and visual effects and describe these issues in more detail. Noise and reduced visibility would have to be noticeably greater than what currently exists for decreases in business patronage and property values to be expected.

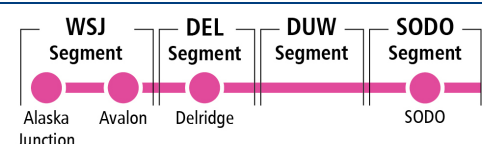
4.3.7 Mitigation Measures

In most cases, with relocation assistance for business displacements discussed in Section 4.1, Acquisitions, Displacements, and Relocations, long-term operation of the West Seattle Link Extension is not anticipated to result in adverse effects that would require mitigation. Where feasible, Sound Transit would explore ways to maintain water-dependent business operations. For Preferred Alternative DUW-1a, Sound Transit would work with affected businesses on the Riverside Millworks property to determine if they could continue to operate on the southern portion of the property or to find a suitable relocation site.

Construction might cause adverse impacts on businesses due to reduced access or general construction activity. Mitigation measures presented in Section 3.11, Construction Impacts; Section 4.1, Acquisitions, Displacements, and Relocations; Section 4.5, Visual and Aesthetic Resources; and Section 4.7, Noise and Vibration, would minimize these impacts. Construction management plans would be developed to address the needs of businesses and could include, but are not limited to, the following measures:

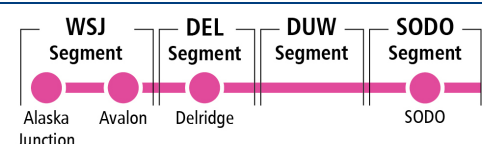
- Provide a 24-hour construction telephone hotline for community members to report issues to Sound Transit community engagement staff, who work with the construction team to resolve issues and respond to the community member.
- Provide business cleaning services on a case-by-case basis.
- Provide detour, open for business, and other signage as appropriate.
- Establish effective communications with the public through measures such as meetings, construction updates, alerts, and schedules.
- Implement promotion and marketing measures to help affected business districts maintain their customer base, consistent with Sound Transit policies, during construction.
- Maintain access as much as possible to each business and coordinate with businesses during times of limited access.
- Provide a community ombudsman consistent with Sound Transit policy. In the event that complaints arise about construction impacts that could not be resolved by community outreach staff or the relevant department director, the ombudsman policy provides a process for addressing those complaints in an impartial, fair, and timely manner that ensures effective stewardship of public resources and minimizes construction impacts.

Because the project design could affect Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Muckleshoot Indian Tribe, Sound Transit and the Federal Transit Administration would continue working with the Muckleshoot Indian Tribe to avoid and mitigate impacts to treaty-protected fishing rights and access to the Usual and Accustomed



Areas from construction of the Duwamish Waterway crossing through ongoing government-to-government consultation. Sound Transit will not authorize construction of the Duwamish Waterway crossing prior to reaching agreement with the Tribe on these measures.

Because project design could affect Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Suquamish Tribe, Sound Transit and the Federal Transit Administration would continue working with the Suquamish Tribe to avoid and mitigate impacts to treaty-protected fishing rights and access to the Usual and Accustomed Areas from construction of the Duwamish Waterway crossing through ongoing government-to-government consultation. Sound Transit will not authorize construction of the Duwamish Waterway crossing before reaching agreement with the Tribe on these measures.



4.4 Social Resources, Community Facilities, and Neighborhoods

4.4.1 Introduction to Resource and Regulatory Requirements

This section describes the existing social resources, community facilities, and neighborhoods that could be affected by the West Seattle Link Extension Project (the project) alternatives, and it identifies potential impacts on them. The National Environmental Policy Act and State Environmental Policy Act require evaluation of potential impacts to the human environment, which includes how a project may alter, for better or worse, access to social resources and community facilities or how the project may impact neighborhoods. Social resources include social service providers, emergency housing (shelters), and food banks. Community facilities include social service providers; grocery stores; park and recreation facilities; community, youth and senior centers; sports venues; cultural institutions such as libraries, museums, and theaters; religious institutions; cemeteries; daycare facilities; and government offices. A major public art installation in the SODO Segment was also considered for this analysis.

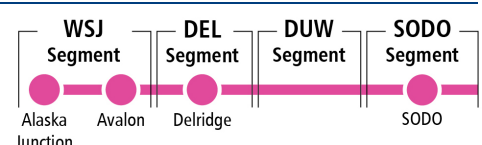
Consistent with published guidance from the Federal Transit Administration (FTA), four key neighborhood and community issues are considered when addressing the affected environment and potential impacts of a transportation project: changes in quality of life, barriers to social interaction, impacts on community resources, and effects on safety and security. The analysis in this section also considers the demographics of potentially affected areas, the potential social effects of economic changes, and the potential for displacement of cultural institutions as a result of the project. Public services, including fire and emergency services, police, government offices and facilities, schools, solid waste and recycling, post offices, and libraries are shown and discussed in Section 4.14, Public Services, Safety, and Security. Section 4.17, Parks and Recreational Resources, provides additional information about the parks and recreational facilities within the study area.

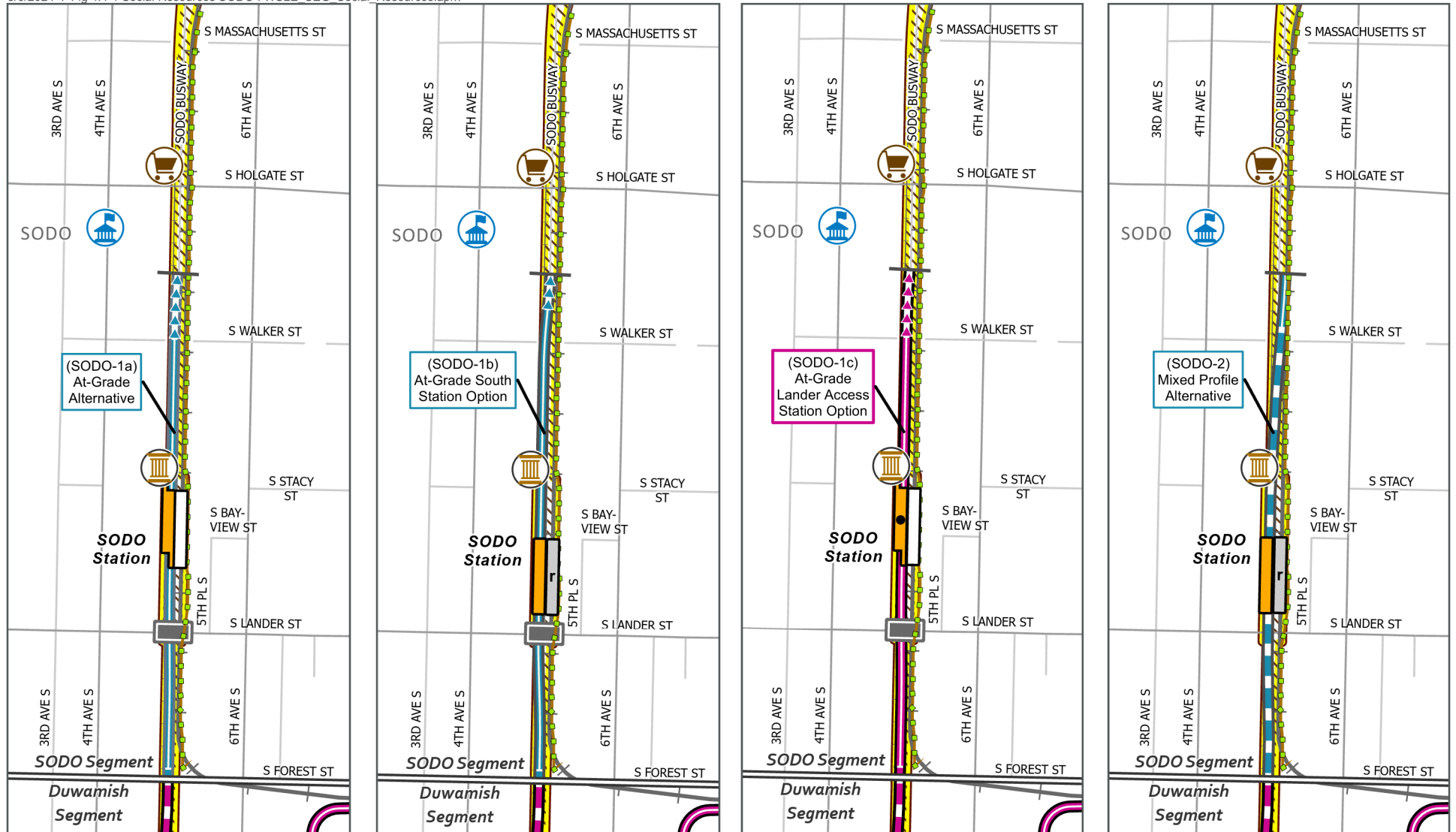
4.4.2 Affected Environment

The study area for social impacts, community facilities, and neighborhoods is the area within a 0.5-mile radius from the alternative alignment centerlines. While the area of effects is expected to be smaller, the 0.5-mile study area reflects the distance residents and workers could easily walk to the new stations and is large enough to include areas that would be affected by the construction of the light rail facilities. The impact analysis for this section considers impacts identified in other Final Environmental Impact Statement (EIS) sections, with references to those sections included where appropriate. Appendix L4.4, Social Resources, lists all the social resources identified in the study area. Figures 4.4-1 to 4.4-4 identify the locations of social resources in the study area by segment. Figure 4.4-5 shows the neighborhoods in the study area.

The study area covers four Seattle neighborhoods: Beacon Hill, Industrial District, Delridge, and West Seattle. The neighborhoods are described by segment in this section and are shown on Figure 4.4-5. The Beacon Hill neighborhood on the east side of Interstate 5 is effectively cut off from the project by the freeway; therefore, this neighborhood is not discussed further.

The Industrial District neighborhood in the SODO and Duwamish segments is primarily commercial and industrial areas with very few residential uses. Residential communities are primarily found in the Delridge and West Seattle neighborhoods.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Retained Cut

Station (● Indicates Preferred Alternative)

- New
- Existing
- Relocated

- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Proposed Overpass
- Trail

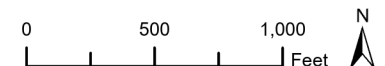
- Study Area (boundary beyond the map extent)

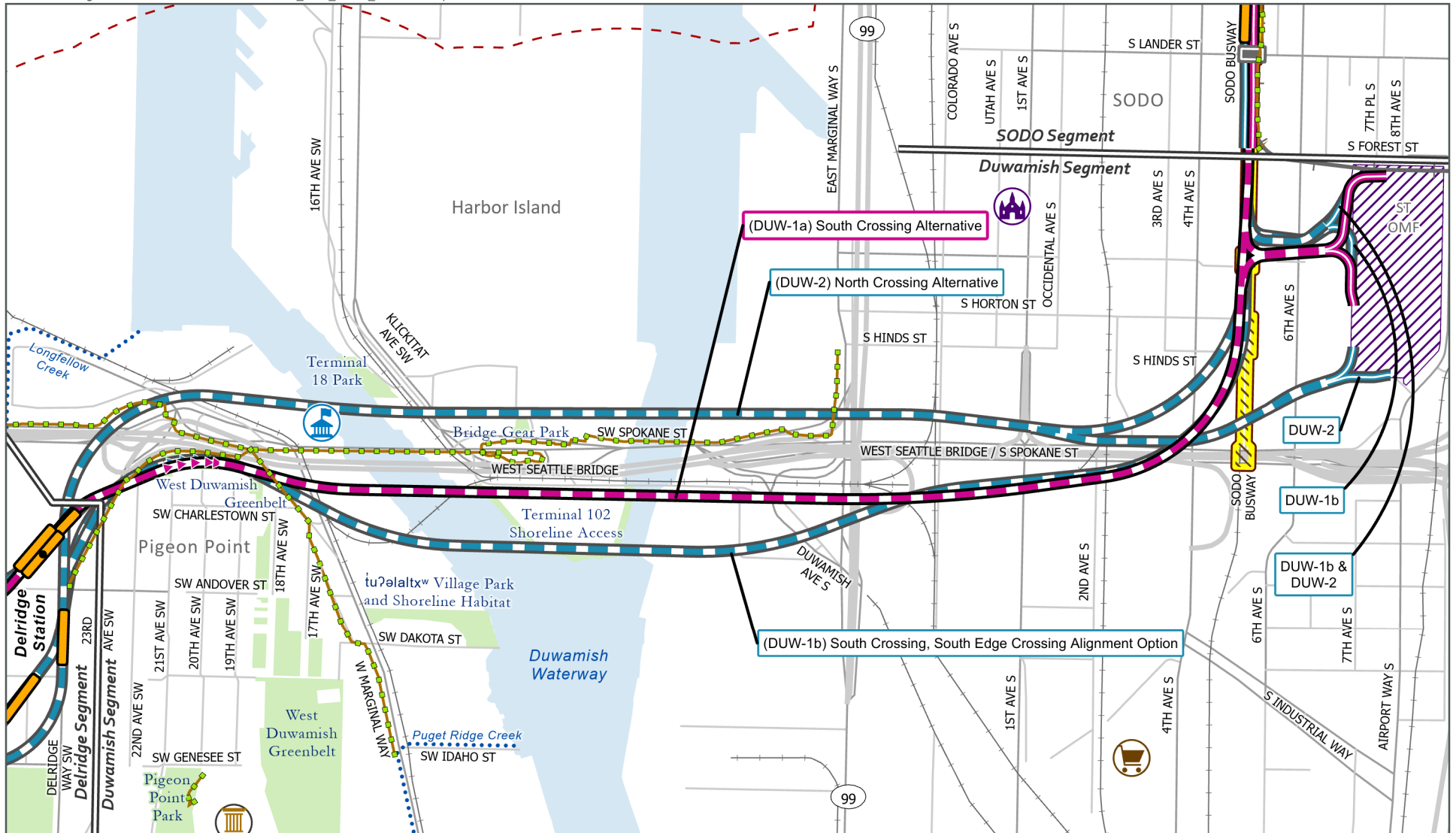
- Community Facility
- Grocery Store/Market
- Social Service

Notes: SODO Track not shown on map.
Amazon Fresh Grocery Store/Market is outside the map extent.

FIGURE 4.4-1
Social Resources
SODO Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Retained Cut

Station (● Indicates Preferred Alternative)

- New

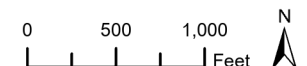
- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Proposed Overpass
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Piped Stream
- Park
- Trail

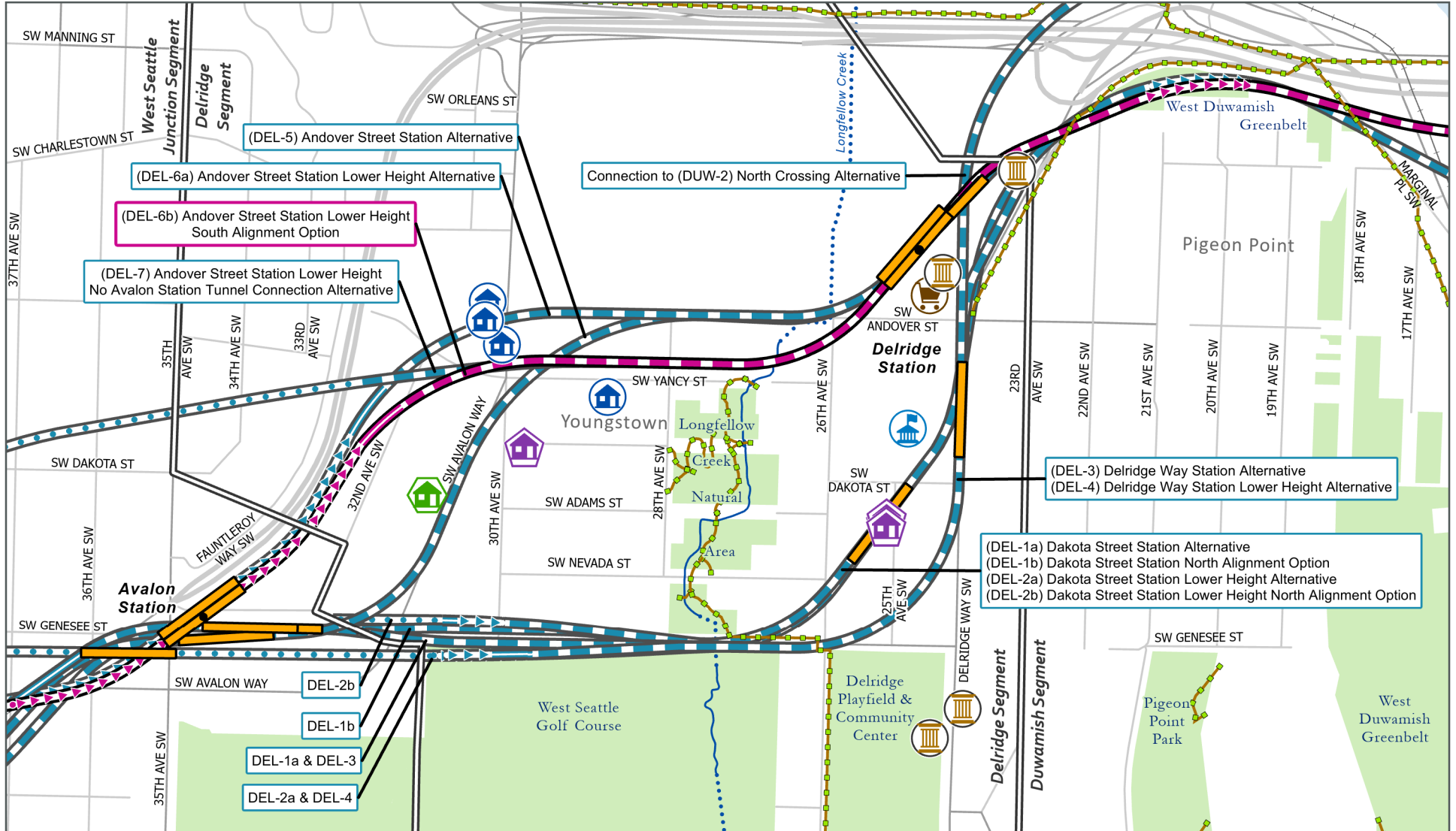
- Study Area
- Church/Religious Institution
- Community Facility
- Grocery Store/Market
- Social Service

Note: SODO Track not shown on map.

FIGURE 4.4-2
Social Resources
Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

Segment Line

Railroad

Stream

Piped Stream

Park

Trail

Study Area (boundary beyond the map extent)

Community Facility

Grocery Store/Market

Housing with Services

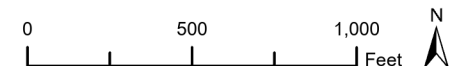
Income-restricted Housing

Seattle Housing Authority (SHA) Property

Social Service

FIGURE 4.4-3
Social Resources
Delridge Segment

West Seattle Link Extension



Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

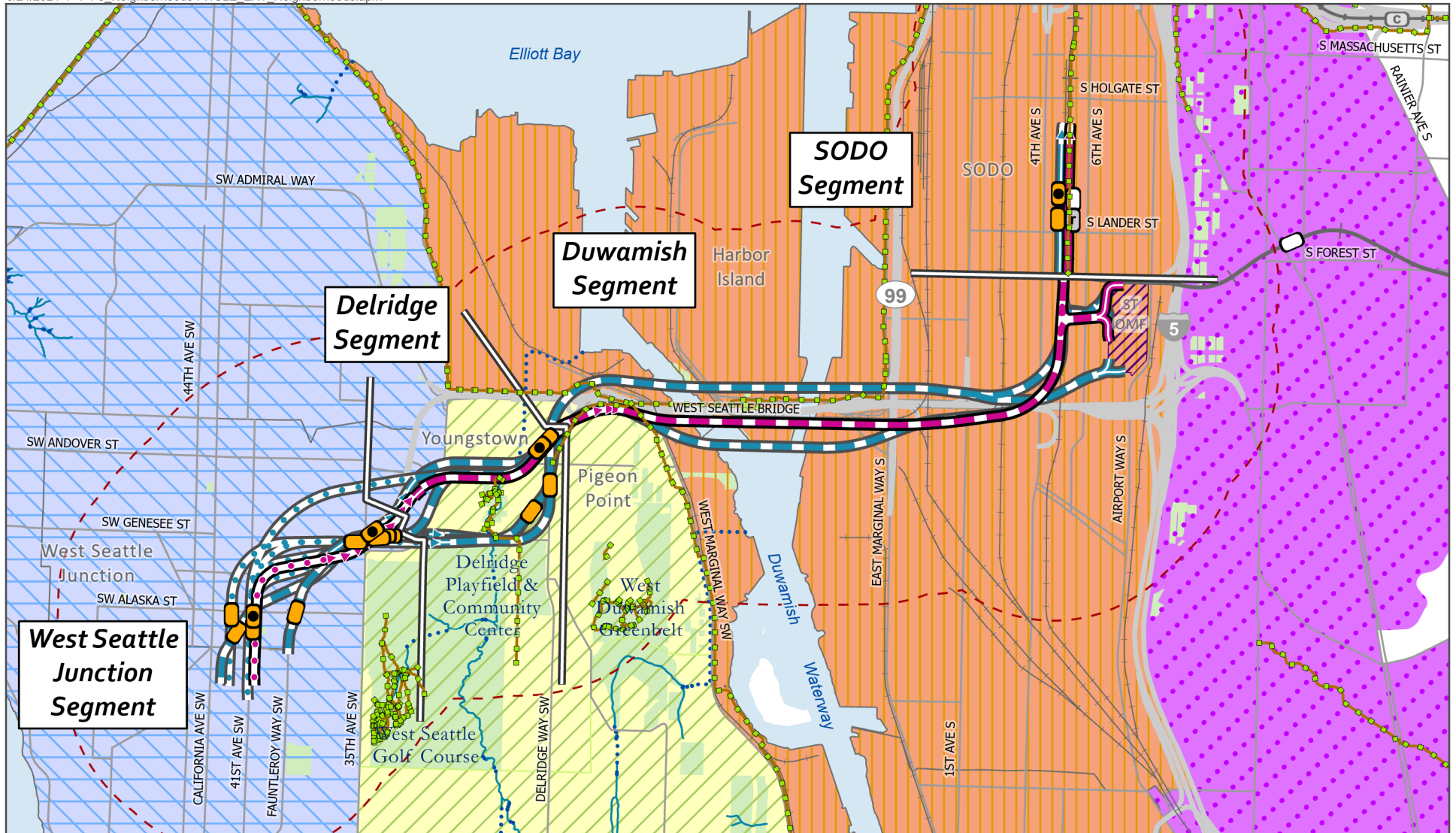
- New

Legend:

- Segment Line
- Stream
- Piped Stream
- Park
- Trail
- Study Area
- Church/Religious Institution
- Community Facility
- Grocery Store/Market
- Mandatory Housing Affordability (MHA) Property
- Income-restricted Housing
- Seattle Housing Authority (SHA) Property
- Social Service
- Theater/Performance Venue

FIGURE 4.4-4
Social Resources
West Seattle Junction Segment

0 500 1,000 Feet



Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

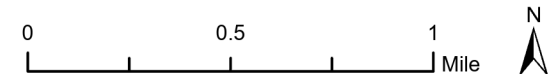
- New
- Relocated
- Existing

- Segment Line
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park
- Trail

- Study Area
- Beacon Hill
- Industrial District
- Delridge
- West Seattle

**FIGURE 4.4-5
Neighborhoods**

West Seattle Link Extension



The Delridge and West Seattle neighborhoods are in an area of Seattle that has seen considerable development in the last 15 years, focused on increasing residential density and new commercial buildings.

4.4.2.1 Neighborhood Cohesion and Social Resources

Neighborhood cohesion is qualitatively evaluated in terms of transportation network and services, linkages to community facilities and activity centers, patronage of businesses and cultural institutions, interaction of people (which considers locations where people interact and the likelihood of interaction at those locations), and neighborhood uniqueness. Based on the extent to which all or some of these factors are present in a neighborhood, Sound Transit categorized the neighborhood as having high, medium, or low cohesion.

Neighborhood cohesion is defined as the extent to which residents have a sense of belonging to their neighborhood.

The level of cohesion (that is, low, medium, or high) considers the interactions between the residents and the resources in that neighborhood.

4.4.2.1.1 SODO Segment

The primary neighborhood in the SODO Segment is the Industrial District, with a small area of the Beacon Hill neighborhood on the eastern edge.

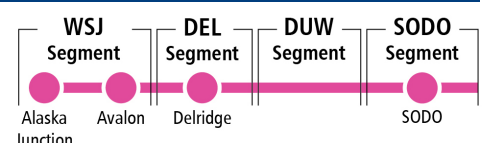
The Industrial District is characterized by industrial uses, with a mixture of commercial, warehouse, and office space throughout. It contains one of Seattle's designated manufacturing industrial centers, the Duwamish Manufacturing/Industrial Center; the Port of Seattle; private marine terminals; BNSF Railway and Union Pacific Railroad rail yards; and the Sound Transit Operations and Maintenance Facility Central. This neighborhood also includes SODO, the area "south of Downtown," with a mixture of commercial uses, including the Starbucks company headquarters, warehouse stores, businesses and the SODO Trail.

The Industrial District neighborhood primarily includes business and industry with very little residential community, except for some low-income housing. As a result, there are very few social resources present; there is one social service, a food bank near the alignment, and two grocery stores farther from the alignment. Services in the area include restaurants, supply stores, a daycare, and a few community facilities that support the employees in the business and industry community. The SODO Track along the SODO Busway is a major public art installation that provides beauty and a sense of place for those traveling through the SODO Busway either on transit or on the SODO Trail. Although there are few residents in this industrial neighborhood, businesses, services, and employees report that cohesion is high.

4.4.2.1.2 Duwamish Segment

The primary neighborhood in the Duwamish Segment is also the Industrial District, with small areas of Beacon Hill to the east and Delridge to the west.

As described for the SODO Segment, the Industrial District neighborhood is characterized by industrial uses, in particular water-based industrial uses along the Duwamish Waterway (also known as the Duwamish River) and on Harbor Island. Harbor Island is also home to a Port of Seattle shoreline access area, two parks, a fishing pier, and two marinas. The Harbor Island Marina allows live-aboard boats. Many of the businesses on Harbor Island are related to Port of Seattle operations. The Duwamish Waterway also supports recreational and Tribal treaty-protected fishing, including the informal recreational and subsistence fishing pier on the Spokane Street Bridge, accessible by car and from the West Seattle Bridge Trail. The services



present in this neighborhood are found primarily on the east side of the Duwamish Waterway and include restaurants, supply stores, the International Longshore and Warehouse Union Local 19, and equipment rental businesses that mostly support local industry. Neighborhood cohesion is medium and relates to access to work and the infrastructure and services to support business and industry.

A portion of the Delridge neighborhood within the Duwamish Segment includes the Pigeon Point and Riverside communities, both areas that residents describe as having a “small town” feel. There are several parks and a school, which provide opportunities for social interaction. Another social resource in this area is the northern end of the West Duwamish Greenbelt, which is the largest greenbelt in the city and contains hiking trails to the south of the study area. Neighborhood cohesion is high in the Delridge neighborhood.

The Beacon Hill neighborhood characteristics described for the SODO Segment also apply to this segment. The connections across Interstate 5 to Beacon Hill are limited to South Spokane Street/South Columbian Way.

4.4.2.1.3 Delridge Segment

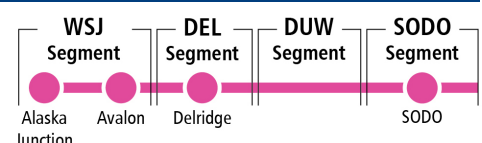
The primary neighborhood in the Delridge Segment is Delridge, which includes the Youngstown community in the Delridge valley. The segment also includes a small area of the Industrial District to the north (previously described) and part of West Seattle to the west (described below in the West Seattle Junction Segment).

The Delridge neighborhood is mostly single-family residential with some multi-family homes. Low-income and supportive housing in Delridge is discussed in Section 4.4.2.5, Income-restricted and Supportive Housing. It has several parks and recreational areas, including the West Seattle Golf Course, Longfellow Creek Natural Area, and Delridge Playfield and Community Center. People use the Longfellow Creek Legacy Trail, which runs through the Longfellow Creek Natural Area. The West Seattle Golf Course is one of five public golf courses in the city. The Delridge Playfield and Community Center provides play, social, and activity space. Delridge is also home to the Youngstown Cultural Arts Center, which is focused on the arts, youth empowerment, and sustainable initiatives. Tenants at the cultural center include Arts Corps, Interagency Beacon Academy, Y.M.C.A. Social Impact Center, Totem Star, Twelfth Night Productions, and West Seattle Tool Library. An Indian Child Welfare Office, which is part of the Washington State Department of Children Youth and Families, is located in this neighborhood. The Delridge Segment also includes Mode Music and Performing Arts, which is a non-profit arts organization associated with Mode Music Studios that was created to address disparities in children’s arts education.

Residential uses (both single and multi-family) surround the parks and recreational areas, and residents in the study area can walk to the parks and other social resources on sidewalks. This area is dominated by homes and parks, with some community businesses and social resources such as cafes, a neighborhood deli-mart, a daycare, and other businesses that cater to residents and workers and provide opportunities for interaction. As described in the Duwamish Segment, neighborhood cohesion is high in the Delridge neighborhood.

4.4.2.1.4 West Seattle Junction Segment

The primary neighborhood in the West Seattle Junction Segment is West Seattle, with a small part of Delridge (as described above in the Delridge Segment) to the east.



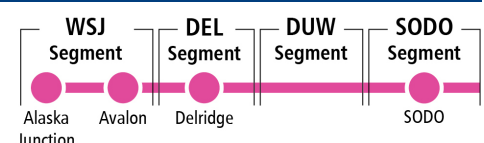
The community character of the West Seattle neighborhood, which includes the areas around the Avalon and Alaska Junction stations, reflects the City’s goal of having a small-town community with its own distinct identity, composed of a large single-family residential community, some senior multi-family housing, and a vibrant mixed-use business and multi-family district. The West Seattle Junction, a City of Seattle-designated “hub urban village,” is in this segment. Hub urban villages are areas where both housing and job growth are expected to occur. The West Seattle Junction hub urban village is a higher-density area comprising commercial businesses, offices, schools, multi-family residential housing, and services such as such as doctor’s offices, banks, salons, and exercise studios. Grocery stores, churches, and private schools are all social resources that provide opportunity for social interaction in this area. Many of these resources draw people from the greater West Seattle area. West Seattle Junction hosts neighborhood events such as the weekly farmer’s market and the West Seattle Summer Fest festival. Parks and recreational areas are also in the West Seattle Junction Segment, including Camp Long and the West Seattle Stadium in the eastern edge of this segment. There are several social resources in this neighborhood, including childcare facilities, a Y.M.C.A., and the Senior Center of West Seattle. The West Seattle Junction neighborhood has high neighborhood cohesion.

4.4.2.2 Demographics

Table 4.4-1 shows demographic information for the West Seattle Link Extension study area. The data is based on a geographical information system analysis of United States Census 2017 to 2021 American Community Survey data for the census block groups that intersect with the segment boundaries. The segment demographic information is presented alongside the demographic information for the entire West Seattle Link Extension study area and City of Seattle and Sound Transit Service District demographic information for context. See Appendix G, Environmental Justice, for more detailed demographic data and maps. The term “minority” is used in Appendix G for consistency with the Environmental Justice Executive Order 12898. This section uses the term “communities of color” and “people of color.”

Based on the information in the table, the SODO Segment’s population has the highest percentage of people of color, limited-English-proficiency speakers, and households with no vehicles compared to the other segments. The percentage of people of color and limited-English proficiency speakers in the SODO Segment is also greater than the City of Seattle and the Sound Transit Service District overall; however, the SODO Segment has the lowest population of all the segments. The Duwamish and Delridge segments have similar percentages of people of color, limited-English proficiency speakers, and households with no vehicles as the City of Seattle and Sound Transit Service District. The percentage of the population in the West Seattle Junction Segment who are people of color is less than that of the City of Seattle and the Sound Transit Service District overall.

The SODO Segment has a small overall population and the lowest median household income of all comparison geographies, but a similar percentage of low-income people compared to the City of Seattle and the Sound Transit Service District. The Duwamish Segment has the greatest percentage of low-income households, while the Delridge and West Seattle Junction segments have the lowest percentage of low-income people compared to the other segments, the City of Seattle, and Sound Transit Service District.



4.4 Social Resources, Community Facilities, and Neighborhoods

Table 4.4-1. West Seattle Link Extension Study Area Demographics

Geographic Area	Total Population	People of Color	Low-Income Population ^a	Limited-English - Proficiency Households ^b	Under 18 Population	Over 65 Population	Households with No Vehicle	Median Household Income
Seattle	725,319	38%	18%	7%	15%	12%	18%	\$109,336
Sound Transit Service District ^c	3.36 million	42%	20%	10%	21%	13%	9%	\$103,824
West Seattle Link Extension Study Area	35,288	32%	16%	6%	14%	12%	11%	\$113,717
SODO Segment	2,692	49%	19%	14%	9%	13%	25%	\$92,616
Duwamish Segment	6,339	46%	23%	10%	13%	14%	6%	\$100,867
Delridge Segment	4,672	38%	14%	8%	15%	6%	8%	\$107,570
West Seattle Junction Segment	21,585	24%	14%	3%	15%	13%	10%	\$123,554

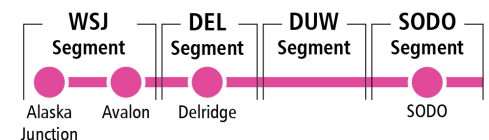
Source: 2021 American Community Survey 5-Year Estimates (United States Census Bureau 2023).

Note: Numbers rounded to nearest percentage point.

^a Sound Transit's low-income threshold is defined as two times the federal Health and Human Services poverty level.

^b Limited English Proficiency is defined as people over 5 years of age that speak English "less than very well."

^c The Sound Transit Service District includes portions of King, Pierce, and Snohomish counties.



4.4.2.3 Transportation Linkages

There are transportation facilities throughout the study area. In the SODO Segment, a bus-transit-only roadway called the SODO Busway runs north-south through the segment. There are four bus stops on the SODO Busway that provide access to surrounding businesses and industries; two provide a transfer opportunity to light rail at the existing SODO Station at South Lander Street and the existing Stadium Station at South Royal Brougham Way. King County Metro Transit (Metro) and other bus transit providers use this busway for several routes providing connections to and from Downtown Seattle. The SODO Segment also has freight rail lines and truck routes to support the industrial businesses in the area. In the Duwamish Segment, the West Seattle Bridge is the primary transportation connection between West Seattle and the rest of Seattle. The Spokane Street Bridge also provides a connection to other parts of Seattle and access to Harbor Island, and a multi-use trail connects SODO to West Seattle via the Spokane Street Bridge in this segment. Bus service is not provided directly to or from Harbor Island. In the Delridge and West Seattle Junction segments, there are bicycle facilities, transit, and sidewalks that provide connections within West Seattle. Delridge Way South has several bus routes connecting to Downtown Seattle and locations south, including White Center. Metro also provides a passenger-only water taxi service between West Seattle (Alki area) and the Seattle waterfront (Colman Dock).

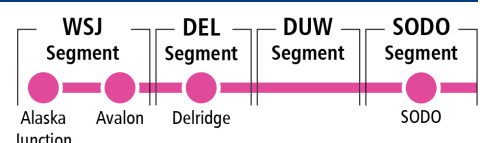
The existing roadway, bicycle, and pedestrian network and the presence of several bus transit routes provide connectivity to the jobs, public services, and facilities that support the communities within the study area. See Chapter 3, Transportation Environment and Consequences, for more information on the transportation infrastructure in the study area.

4.4.2.4 Social Equity

In support of the Seattle 2035 Comprehensive Plan, the City of Seattle conducted an equity analysis to identify how growth within the city may benefit or burden marginalized populations (City of Seattle 2016). The City used demographic, economic, and physical factors to determine current displacement risk and access to opportunity for communities in Seattle. The City defined “displacement” as the involuntary relocation of marginalized populations from their current neighborhood. “Access to opportunity” was defined as access to services, amenities (such as shop, parks, or transit), and other key determinants of social, economic, and physical well-being (City of Seattle 2016). The City found that there is a low to medium displacement risk and low to medium access to opportunity in the study area, depending on location. Preliminary updated mapping for displacement risk provided by the City in January 2024 remains consistent with these findings. The City’s analysis did not consider future light rail in the project corridor, which would increase access to opportunity and could increase displacement risk near stations. Access to light rail is one of 15 factors for displacement risk and 1 of 13 factors for access opportunity.

4.4.2.5 Income-restricted and Supportive Housing

Seattle has many organizations that provide income-restricted, transitional, or supportive housing, and some have housing in the study area. There are 13 Seattle Housing Authority complexes in the West Seattle Link Extension study area, and Transitional Resources owns and leases several properties within the study area. Transitional Resources is a non-profit organization in Delridge that provides behavioral health services and supportive housing to help people make a transition to stable living in the community. Three of its buildings include a total of 104 units of supportive housing, and an additional building has 15 units of supportive housing as well as outpatient behavioral health offices.



Seattle also has Mandatory Housing Affordability (M.H.A.) zoning in some neighborhoods in the project study area, which requires developers to either build affordable housing or contribute to an affordable housing fund. One building with M.H.A. units is under construction in the study area, and others could be developed here in the future. There are also four multi-family residential buildings in the study area with income-restricted units through Seattle's Incentive Zoning program. Figures 4.4-3 and 4.4-4 show the housing resources described above.

Some multi-family residential buildings in the study area also currently have rent- or income-restricted units through Seattle's Multifamily Tax Exemption (M.F.T.E.) program, although buildings currently in the program will likely no longer qualify by the time the project opens in 2032. Additional properties in the study area could be built in the future under this program.

4.4.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would avoid the property acquisitions and other built environment impacts associated with building and operating light rail in an urban area. Those who reside in or travel to and from neighborhoods within the study area would not be provided with the reliability of light rail or increased transit accessibility. The neighborhoods and communities in the study area would develop according to adopted plans, dependent upon economic conditions, which could change the character of neighborhoods or neighborhood cohesion.

4.4.4 Environmental Impacts of the Build Alternatives during Operation

The analysis of potential impacts of the project on neighborhoods considers changes in neighborhood quality, barriers to social interaction, impacts on social resources, and impacts on public services, safety, and security. Much of the impacts evaluation in this section is based on analyses conducted for other sections of this Final EIS, including Chapter 3, Transportation Environment and Consequences; Section 4.1, Acquisitions, Displacements, and Relocations; Section 4.5, Visual and Aesthetic Resources; Section 4.7, Noise and Vibration; and Section 4.17, Parks and Recreational Resources. Impacts on other resources do not automatically constitute a social impact or impact on neighborhood cohesion. Instead, these impacts are evaluated collectively, with potential mitigation measures taken into account, for their effects on social resources and neighborhoods. Appendix G, Environmental Justice, addresses potential impacts and benefits to people of color and low-income people.

4.4.4.1 Impacts Common to All Alternatives

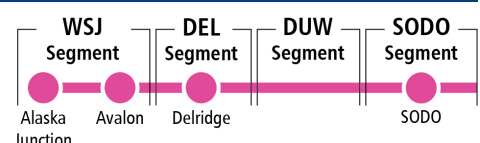
Introducing a new light rail facility within a densely populated urban area could result in benefits and impacts that would be common to all Build Alternatives.

Incentive Zoning

Incentive Zoning is a voluntary program in some Seattle land use zones that allows developers to achieve additional development capacity by contributing to or providing affordable housing units or other public amenities. Affordable housing units in this program remain restricted for a minimum of 50 years.

Multifamily Tax Exemption Program

The Multifamily Tax Exemption program, or M.F.T.E., is an incentive to create affordable housing in Seattle. Buildings participating in the M.F.T.E. program receive a property tax exemption for up to 12 years in exchange for lowering rents for tenants meeting income requirements. The M.F.T.E. program requires 20 or 25 percent of the apartments in a participating building to be affordable. Program rents are typically hundreds of dollars less per month than market rate.



4.4.4.1.1 Benefits

Neighborhoods served by light rail stations would benefit from increased transit access to Downtown Seattle and other areas in the Puget Sound region accessible by light rail. Light rail service would be a fast, frequent, and reliable alternative to car travel and local bus service for many people in the travel corridor. Light rail access benefits include easier access to employment opportunities; educational facilities; cultural facilities and activities; medical, social and public service providers; sporting events and recreational activities; and other regional transportation terminals and hubs. The project would provide increased access to locations around the city for pedestrians, bicyclists, and those with mobility challenges. The station areas would include bus bays on adjacent streets, which would facilitate transfers between buses and light rail for people who live or work outside of the station's walkshed. Neighborhoods close to light rail stations could experience increased social activity due to improved access, residential and business redevelopment, or transit-oriented development (TOD) projects. Local businesses could experience greater patronage and an increased employment base.

Equitable Transit-Oriented Development

The City of Seattle has received a grant from FTA to support equitable TOD along the West Seattle Link Extension Project corridor. The priorities of this grant-funded program are to advance racial equity and community agency in access, public realm, and TOD investments throughout the project corridor and improve City of Seattle accountability and transparency regarding racial equity.

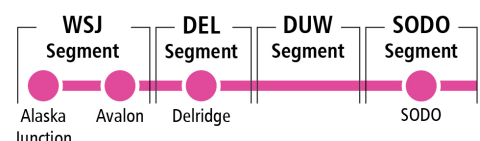
The project generally would have health benefits as the alternatives would increase the opportunity for physical activity by encouraging walking and biking to the stations through incentives such as limited parking around the stations, bicycle lockers at the stations, and bicycle racks on the trains. The project would also increase access to city parks and recreation destinations and new connections to bus transit routes at the light rail stations. The project would improve air quality by reducing vehicle miles traveled in the study area. Maintaining good health also depends on access to health services. The project would provide more frequent and reliable transit service throughout the study area and the region, which means that people would have better access to services that promote good health, such as healthcare providers, grocery stores, and gathering spaces.

4.4.4.1.2 Property Acquisitions and Land Use Changes/Neighborhood Cohesion

The project would result in property acquisitions. Some of these acquisitions would displace existing uses, while others would allow the existing use to continue. The project could also displace housing where tenants use Housing Choice vouchers; however, because vouchers are assigned to individuals rather than properties, the specific location of residents using these vouchers is not identified. The Build Alternatives would not displace existing or currently planned buildings with income-restricted M.H.A. housing units. Displacement of homes and businesses could change the neighborhood cohesion. The manner in which a neighborhood changes in response to new light rail facilities could impact neighborhood cohesion positively or negatively. The street-level entrances to stations would be designed to fit in with the surrounding neighborhoods and would be designed with community input. Sound Transit would coordinate with the City of Seattle on design in station areas.

Housing Choice Vouchers

The Seattle Housing Authority helps low-income families, individuals, seniors, and people with disabilities to pay their monthly rent in eligible privately owned apartments or houses within the city through its Housing Choice Voucher program. Qualifying households typically earn 50 percent or less of the area median household income.



Section 4.1, Acquisitions, Displacements, and Relocations, discusses expected property acquisitions for each alternative and the relocation process. Appendix L4.1, Acquisitions, Displacements, and Relocations, shows potentially affected parcels. Appendix L4.4, Social Resources, shows individual social resources that would be affected by each alternative. Section 4.2, Land Use, discusses the project's potential impacts on neighborhood land uses, and potential redevelopment and TOD opportunities.

4.4.4.1.3 Visual Impacts

Elevated guideways could result in visual impacts, including light from the trains and shading and visual intrusion from elevated guideways, to varying degrees on adjacent and nearby viewers. The height of the guideway and size of the light rail station and facilities would be factors in how visually intrusive the project would be within neighborhoods. Adding a visually intrusive element would change the visual character of the neighborhood, which could result in changes to the way neighbors perceive their surroundings and affect their everyday experience. The project would remove trees and vegetation as necessary, which would make a visible change. Where possible and consistent with light rail operation and maintenance needs, the removed trees and vegetation would be replaced. Section 4.5, Visual and Aesthetic Resources, discusses potential visual impacts and mitigation.

4.4.4.1.4 Transportation and Parking

The project would have localized impacts on property access and circulation associated with the placement of the light rail facility adjacent to or within existing roads. Affected property access points would be redesigned or relocated to maintain use of the property. Impacts to traffic circulation could include turn movement limitations, modified routing, new traffic signal movements, and new signalization at previously unsignalized intersections. Neighborhoods with stations could be affected by light rail riders using street parking in their neighborhoods. See Chapter 3 for discussion of this potential impact and mitigation measures.

4.4.4.1.5 Noise and Vibration

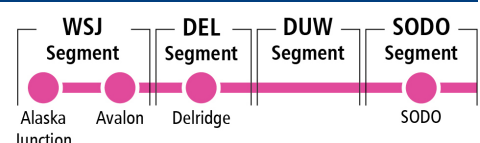
In general, operation of the new light rail facility would create a new source of noise and vibration in the community. Noise and vibration impacts would vary by segment with each alternative and are also dependent on the types of sensitive noise receivers adjacent (such as schools, residences, and parks) to the project. Sound Transit would mitigate noise and vibration to levels below FTA impact criteria as discussed in Section 4.7.

4.4.4.1.6 Safety and Security

Typically, crime around stations mirrors what is occurring in the neighborhood in which they are located (Moudon et al. 2018, Billings et al. 2011, City of Seattle 1999). The project is not anticipated to have safety and security impacts. See Section 4.14, Public Services, Safety, and Security, for additional information.

4.4.4.2 SODO Segment

In general, social resource and community impacts would be minor in the SODO Segment because it contains very few social resources, with the exception of impacts on the SODO Track. This “urban art gallery” spans 2 miles of the SODO Busway and consists of 51 murals produced by 64 artists between 2016 to 2018 with funding and support by Sound Transit, King County Metro Transit, SODO Business Improvement Area, cultural organizations 4Culture and



Urban ArtWorks, and private funders. Table 4.4-2 summarizes the number of murals that would be removed when buildings adjacent to the SODO Busway are removed for the project. Murals would be removed permanently under all SODO Segment alternatives and options. Figure 4.4-6 shows a mural that would be removed permanently by all of the SODO Segment alternatives.

Table 4.4-2. Mural Displacements by Alternative, SODO and Duwamish Segments

Alternative ^a	Number of Murals Displaced
Preferred Option SODO-1c	14
Alternative SODO-1a	14
Option SODO-1b	14
Alternative SODO-2	15
Preferred Alternative DUW-1a	9
Option DUW-1b	7
Alternative DUW-2	6

^a Murals are only located in SODO and Duwamish segments.



Figure 4.4-6. Snakes & Ladders, Mural by Jesse Brown, 2018

Source: @wiseknav 2023

There would be no impacts to neighborhood cohesion. The alternatives would not create new barriers, hinder access to social resources, or notably change traffic patterns in a way that would make neighborhood access difficult.

All four SODO Segment alternatives would run parallel to the existing at-grade Link light rail line. The addition of light rail in this segment would be consistent with the existing character of the area, which already contains a Link light rail line, a bus-transit-only roadway (SODO Busway), and freight and commuter trains. There would be no land use changes or displacements that would change the neighborhood quality.

Preferred Option SODO-1c was added to enhance access from the station platform to South Lander Street by providing a direct pedestrian connection to South Lander Street. Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would convert the SODO Busway from bus and light rail use to light rail use only. If bus stops are removed, Metro would alter the routes that use the SODO Busway and bus riders would have to modify their access to bus stops. Chapter 3 discusses the impacts to the SODO Busway in more detail.

The addition of a new station in this segment would provide enhanced transit connectivity to and from West Seattle. Beacon Hill, a neighborhood on the east side of Interstate 5 and at the edge of the study area for this project, would benefit from the new connections made at the SODO Station. Each alternative includes design elements to enhance traffic flow for access to the station and circulation around the at-grade station area. Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would include a new roadway overcrossing of South Lander Street, which would improve traffic circulation at that intersection.

4.4.4.3 Duwamish Segment

Social resources and community impacts would be minor in the Duwamish Segment, as there are very few social resources or community resources in the segment. All alternatives in this segment would have displacements.

Preferred Alternative DUW-1a and Option DUW-1b would have a similar number of business and residential displacements and would also impact parks, which are social resources. Preferred Alternative DUW-1a and Option DUW-1b would span parts of the Port of Seattle Harbor Marina Corporate Center at Terminal 102 public access on Harbor Island but would not impact the use of the public access. Option DUW-1b would have guideway columns that impact the Terminal 102 shoreline public access. These alternatives would also permanently acquire a part of the West Duwamish Greenbelt to accommodate the guideway, but the acquisition does not include areas with trail facilities or amenities, and the project would not alter the use of the remaining portions of the greenbelt.

Alternative DUW-2 would avoid impacting the Harbor Marina Corporate Center at Terminal 102 shoreline public access and West Duwamish Greenbelt. Preferred Alternative DUW-1a and Option DUW-1b would displace the 22nd Avenue Southwest Street-end, which is an improved street-end in Pigeon Point.



Figure 4.4-7. Escaping a Burning Culture, Mural by Baso Fibonacci and Jean Nagai, 2017

Source: @wiseknav 2023

The SODO Track urban art gallery also runs through a portion of the Duwamish Segment along the SODO Busway. Table 4.4-2 summarizes the number of murals that would be permanently removed by an alternative. An example of a mural that would be removed under every Duwamish Segment alternative is provided on Figure 4.4-7.

The visual appearance of the alternatives would be consistent with existing views and land uses; industrial and commercial uses and the West Seattle Bridge shape the general character of the corridor.

The elevated guideway and trains would be too low in elevation to be seen at the north

end and area of highest elevation of Pigeon Point, but they would be visible from remaining residences at the lower-elevation area of Pigeon Point along 22nd Avenue Southwest and 23rd Avenue Southwest. The north end of Pigeon Point is currently adjacent to a large transportation corridor. The project would widen that corridor but would not create a new barrier that would impact neighborhood cohesion.

The project would not alter the overall land use or character of the neighborhoods, nor would it result in changes in neighborhood cohesion because the interactions and resources in this segment are largely related to business and industry and largely would not be disrupted. The alternatives would not create barriers, hinder access to social resources, or notably change traffic patterns in a way that would make neighborhood access difficult.

Some business displacements would occur, but much of the area would remain intact. A discussion on the types of businesses and employees that would be displaced is discussed in Section 4.3, Economics.

4.4.4.4 Delridge Segment

All alternatives in the Delridge Segment would affect residential communities and social resources, but to different degrees. All alternatives in this segment would displace a neighborhood coffee shop, sandwich shop, the deli-mart located in the Frye Commerce Center as well as Mode Music Studios. Preferred Option DEL-6b and Alternatives DEL-5, DEL-6a, and DEL-7 would displace the full Frye Commerce Center, which also includes a daycare. All Delridge Segment

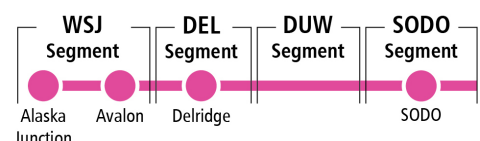
alternatives would increase access to social resources near the Alaska Junction Station and along the entire system.

Alternatives DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b would all displace approximately two residential blocks in the southeast corner of the Youngstown area for the elevated guideway and Delridge Station, including some Seattle Housing Authority residences. These alternatives would have the greatest impact on neighborhood character due to the location and extent of displacements and the extent of visual change. There are many older homes in the proposed station area. Station design and TOD development would likely be similar to the many newer multi-family developments that are being built in the area (particularly along Delridge Way Southwest). Newer development and the visual presence of an elevated guideway structure and facilities would dominate views from adjacent properties and would affect the character in the Youngstown neighborhood. Many homes that would remain would no longer have views of neighboring houses, but of light rail facilities, including elevated guideway columns and the station. These alternatives could also affect cohesion due to the isolation of the residences that would remain near the intersection of Delridge Way Southwest and Southwest Genesee Street. Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would displace four Washington State Department of Children, Youth, and Families offices. Sound Transit would work with this agency to identify relocation site(s) and minimize disruption to services. Alternative DEL-2a and Alternative DEL-4 would both permanently impact the playable area of the West Seattle Golf Course, as detailed in Section 4.17, Parks and Recreational Resources.

Alternative DEL-3 and Alternative DEL-4 would also displace homes in the southeast corner of the Youngstown area, but there would be fewer displacements, and displacements would be closer to the arterial roads; therefore, neighborhood cohesion would not be affected. The elevated station and facilities would dominate views from adjacent properties. Station design and TOD development would likely be similar to the many newer multi-family developments that would affect the character in Delridge, but due to their location, the affects for Alternative DEL-3 and Alternative DEL-4 would be less than Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b. The new station would be elevated above Delridge Way Southwest, with much of the station within the road right-of-way. Traffic operations on Delridge Way Southwest would be altered to accommodate station access. Although traffic patterns would be different than existing conditions, the surrounding community would retain access to roads around the station. These alternatives would also require acquisition of a small area in the northwest corner of the Delridge Playfield property but would not affect the use of the property.

Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would avoid impacting the residential blocks impacted by the other alternatives because their alignments generally follow existing arterials. These alternatives would have fewer residential property acquisitions and avoid impacts to the parks and recreational facilities in the segment. However, Preferred Option DEL-6b and Alternative DEL-7 would impact one single-family residence owned by Transitional Resources, Alternative DEL-5 would displace a duplex owned by Transitional Resources, and Alternative DEL-6a would displace the Transitional Resources main office, onsite supportive housing, and adjacent apartment building.

The Delridge Segment light rail stations would be next to existing residences in Youngstown and would result in more people passing through this community to get to and from the stations. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would be at the edge of the residential area; therefore, people passing to and from the stations would not be as noticeable to residents. The Dakota Street station alternatives (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b) would be in the middle of the Youngstown community and affect the residents more than the Andover and Delridge station alternatives.



The Delridge Segment stations would provide increased connectivity and mobility for communities within West Seattle, including the communities to the south of the study areas. The communities to the south are ethnically diverse and generally have a lower income than the Delridge community. Bus routes would connect to this station, allowing riders to transfer from buses to more reliable and efficient light rail service to Downtown Seattle and other destinations served by the system. The mobility benefits of this station would be felt by the larger West Seattle community.

The West Seattle Link Extension Minimum Operable Segment (M.O.S.) would result in the Delridge Station becoming a transfer point to and from the more populated areas of West Seattle, which would introduce approximately twice as many buses and riders as the full-Build Alternatives. The West Seattle Link Extension M.O.S. with the Dakota Street station alternatives (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b) would have the most noticeable change in the number of people traveling through the Youngstown community due to the station location.

Buses that would serve the Avalon and Alaska Junction stations would be routed to the Delridge Station under the M.O.S. However, access to the Delridge Station would be less convenient for riders who would otherwise access Avalon or Alaska Junction stations via other modes. See Section 3.4, Affected Environment and Impacts during Operation – Transit, in Chapter 3, Transportation Environment and Consequences, for more information.

4.4.4.5 West Seattle Junction Segment

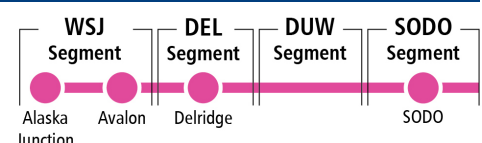
The West Seattle Junction Segment is the densest segment in the project study area and contains the most social resources, including grocery stores, small parks, a senior center, and childcare facilities.

Preferred Option WSJ-5b would have similar impacts to Alternative WSJ-5a, but there would be an increase in the impacts associated with residential and business displacements. The Preferred Option WSJ-5b Alaska Junction Station entrance would be closer to the West Seattle Junction and the commercial areas on California Avenue Southwest.

Alternative WSJ-1 and Alternative WSJ-2 would have the most impact on the community because the guideway would be entirely elevated and primarily outside of public right-of-way. These alternatives would have the most residential displacements. Under both of these alternatives, Fauntleroy Place Park would be permanently removed, so there would be no visual impacts to view from the former park site; however, adjacent residential viewers would see a change of visual character in the neighborhood due to the elevated guideway. Alternative WSJ-1 and Alternative WSJ-2 would also displace a Seattle Housing Authority property that other alternatives would avoid.

The West Seattle Junction Segment tunnel alternatives would have fewer neighborhood impacts because all or some of the alignment would be below grade, which would minimize surface impacts and retain neighborhood character and cohesion.

Alternative WSJ-1 would permanently displace 44 rent- and income-restricted units at the Spruce West Seattle apartment complex, and Alternative WSJ-2 would permanently displace 22 rent- and income-restricted units at the Huxley Apartments and 58 rent- and income-restricted units at the Maris Luxury Apartments. The income-restricted units in each building are commitments through their participation in the M.F.T.E. program and are assumed to expire 12 years after the building was constructed, although Washington Senate Bill 5287, passed in 2021, allows for 12-year extensions. These buildings were built between 2012 and 2018, and



the income restriction for these units could expire between 2024 and 2030 without an extension or as late as 2042 with an extension. These alternatives would affect these tenants and the inventory of income-restricted housing at the time the displacements occur. Displaced tenants would receive relocation assistance as described in Section 4.1.8, Sound Transit Real Property Acquisition and Relocation Policy, Procedures, and Guidelines Summary.

Alternative WSJ-1 would displace a Safeway grocery store and Trader Joe's grocery store, while Alternative WSJ-2 would displace only the Trader's Joe's store. The displacement of grocery stores would impact the neighborhood, as options to shop would be reduced. However, a QFC grocery store and a Whole Foods grocery store are located within three blocks of both stores. A Safeway is also located approximately 1.5 miles north and a Thriftway about the same distance south.

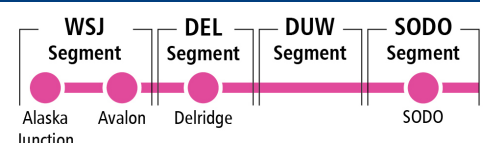
Alternative WSJ-1 and WSJ-2 would also include a hi-rail access road for maintenance, which would start at-grade and transition to an elevated structure to reach the height of the guideway. Neighborhood character and cohesion would be affected by the removal of businesses, the guideway location outside of the public right-of-way, and the visual changes from the elevated guideway and stations. Under Alternative WSJ-2, the installation of both the tail track and the hi-rail access road would have visual impacts on the surrounding neighborhood resulting from the removal of residences associated with these actions..

Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6 would have fewer neighborhood impacts because the alternatives would be mostly below grade except for station entrances. Therefore, they would have only minor impacts on neighborhood character. Preferred Option WSJ-5b, Alternative WSJ-4, and Alternative WSJ-5a would have greater neighborhood impacts than Alternative WSJ-3a, Option WSJ-3b, or Alternative WSJ-6 because more of these alternatives would be above-grade. Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, and Alternative WSJ-5a would displace a single-family Seattle Housing Authority property. Preferred Option WSJ-5b, Alternative WSJ-1, and Option WSJ-3b would displace Jefferson Square (which includes a Safeway store). These impacts would not substantially affect neighborhood character because there are other grocery stores and several multi-story mixed-use developments around the area that would remain. Option WSJ-3b would displace Junction Plaza Park for a station entrance. This would not affect neighborhood character because an equivalent replacement park property would be provided.

Alternative WSJ-4 would have an elevated Avalon Station with impacts similar to those described for Alternative WSJ-1 and Alternative WSJ-2. The Avalon light rail station would be next to existing single-family residential housing and would result in more people passing through the surrounding residential community to get to and from the station. This is especially true for Alternative WSJ-1, Alternative WSJ-2, and Alternative WSJ-4, which would be elevated adjacent to a residential community along 32nd Avenue Southwest.

The Avalon and Alaska Junction stations would provide increased connectivity and mobility for communities within West Seattle, including the communities to the south of the study areas. The communities to the south are ethnically diverse and generally have a lower income than the West Seattle Junction community. Bus routes would connect to these two stations, allowing riders to transfer from buses to more reliable and efficient light rail service to Downtown Seattle and other destinations served by the system. The mobility benefits of these stations would be felt by the larger West Seattle community.

Alternative WSJ-6 would not have an Avalon Station. It would have the least impact on the community and result in fewer residential displacements but longer walks to other stations for those who would have used the Avalon Station. See further discussion of walksheds in Appendix N.1, Transportation Technical Report.



4.4.5 Environmental Impacts of the Build Alternatives during Construction

4.4.5.1 Impacts Common to All Alternatives

West Seattle Link Extension project construction would impact adjacent social resources and neighborhoods. Although the entire project would have an extended multiple year construction period, the impacts on specific adjacent neighborhoods would last a shorter duration while the project components in that area are built.

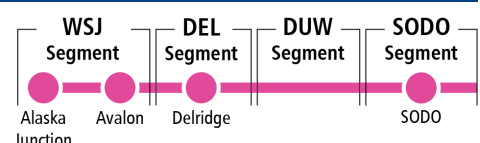
Construction activities that would temporarily affect neighborhood quality in adjacent areas would include:

- The presence and movement of equipment and materials to and from construction areas
- Clearing, grading, and exposure of soils
- Construction lighting for nighttime work
- Storage of construction materials onsite and at staging areas
- Road closures, access changes, and detours

Increases in noise, dust, and traffic congestion, as well as temporary road or lane closures and detours, would occur along the project alignment and at staging areas and may affect people using some community resources. Visual impacts of an active construction area, such as construction equipment and fencing, would occur. There would be impacts on some public parks and recreation facilities in the form of temporary access changes; see Section 4.17, Parks and Recreational Resources. Neighborhoods adjacent to the project could experience cut-through traffic due to road or lane closures and detours. These construction impacts would be felt primarily by those closest to the construction areas and could temporarily affect social interaction and neighborhood cohesion. In areas where the project alignment moves away from an existing arterial and into developed city blocks, these construction impacts may feel more intense for the neighborhood. Unsheltered people living near the project construction areas would experience increases in noise, dust, and vehicle exhaust; project construction may result in the need for them to move elsewhere.

Temporary road and lane closures on arterials would affect neighborhood circulation and access to and from study area neighborhoods. Durations of roadway construction closures would vary from nights and weekends to multi-year closures. See the discussion of key construction closures on arterials and local streets in Section 3.11, Construction Impacts, for further detail. Attachment N.1E, Construction-Related Roadway Modifications, in Appendix N.1, Transportation Technical Report, includes all proposed roadway closures by alternative. Major arterial closures are listed in the segment-specific discussions below. In some areas where major truck routes are not available, arterial, and local streets would be used to access construction areas. People living in, working in, and traveling through these areas would experience construction traffic in their neighborhood.

As part of roadway closures during construction, sidewalks would be closed or the sidewalk width could be reduced within the construction areas along the impacted roadways. Sound Transit would provide protected sidewalks next to the construction area when detour routes are not feasible. In some locations, crosswalks may be closed for construction, although they would remain open to the extent feasible. The project may result in Americans with Disabilities Act-accessible curb ramps being removed temporarily to accommodate the project or to facilitate construction; however, there will be detours or temporary accessible facilities provided during construction. There might also be bicycle facility closures and reduced bicycle lane widths within or adjacent to construction areas.



Bus reliability could potentially degrade along arterials with lane and road closures needed for construction of the West Seattle Link Extension. In these locations, bus routes would need to use alternate pathways and temporary bus facilities may need to be installed. See the discussion of temporary construction impacts to transit in Section 3.11 for further detail.

The availability of on-street parking could be reduced by construction workers driving to their worksite. Because the West Seattle Link Extension segments are in urban areas where parking may be limited or require payment, Sound Transit anticipates that staging areas could be used for construction employee parking but that construction workers could also park on local streets and arterials where parking is unrestricted and in off-street pay parking lots or garages, which may affect the parking supply.

See Section 2.7, Construction Approach, in Chapter 2, Alternatives Considered, for a description of the construction activities for this project.

4.4.5.2 SODO Segment

Construction activities would impact businesses and those who work near the construction area. Traffic and business access along South Lander Street between 4th Avenue South and 6th Avenue South would experience disruptions due to the roadway closure to construct the new overpass with Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b (see Table 3-13 for details on the road closures and durations of closures). For Alternative SODO-2, South Lander Street would be closed temporarily on nights and weekends for guideway construction over the roadway.

Under all SODO Segment alternatives, the SODO Trail would be closed for the duration of construction between South Royal Brougham Way and South Forest Street. During that closure, pedestrians and bicycles would be detoured to 6th Avenue South, with east-west access maintained at adjacent street crossings. The SODO Track murals that would not be displaced by this project would still be visible for 1 Line light rail riders but would not be visible to bus and trail users for the duration of construction.

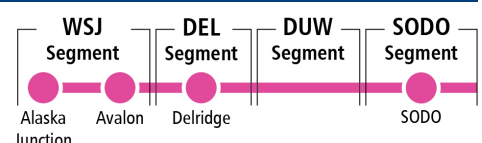
4.4.5.3 Duwamish Segment

Adjacent businesses and industry would be impacted by the construction activities. On the west side of the waterway, the Pigeon Point community could be impacted by construction-related noise, visual changes, and construction traffic during construction of Preferred Alternative DUW-1a and Option DUW-1b. All alternatives would have closures on roadways used to access West Seattle; however, these closures would occur on nights and weekends, or would only be partial closures, and therefore, traffic impacts to the West Seattle community would be minimized. All alternatives would result in partial closures on the West Seattle Bridge or its ramps, but these closures would be limited to nights and weekends.

4.4.5.4 Delridge Segment

All the alternatives would have construction in residential areas, and nearby residences and social resources could be impacted by construction-related noise, visual changes, the presence of construction equipment, and construction traffic and road closures (see Table 3-13 in Chapter 3 for details on the road closures and durations of closures).

Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would follow Southwest Andover Street, which would be fully closed between 26th Avenue Southwest and Southwest Charlestown Street on nights and weekends during project construction.



Southwest Avalon Way would be temporarily closed during construction of Alternative DEL-5 and closed on nights and weekends during construction of Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7.

Alternative DEL-1a, Option DEL-1b, and Alternative DEL-3 would result in full closures on Southwest Genesee Street during construction. Alternative DEL-2a would have full closures on Southwest Genesee Street during nights and weekends only. All alternatives, except for Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would result in partial closures to Delridge Way Southwest. However, these alternatives would require closures on Delridge Way Southwest (north of Southwest Andover Street) in the Duwamish Segment when connecting to Preferred Alternative DUW-1a or Option DUW-1b. Alternative DEL-5 would also include a full closure on Southwest Avalon Way during construction. Southwest Genesee Street, Delridge Way Southwest, and Avalon Way are arterials heavily used by residents in the adjacent neighborhoods and by those traveling through the Delridge neighborhood.

Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 guideway construction activities would take place near the Washington State Department of Children, Youth, and Families offices. However, impacts are not anticipated because any full closures of Delridge Way Southwest (north of Southwest Andover Street) are expected to be limited to nights and weekends, which are outside of their operating hours; Sound Transit would coordinate with this agency to avoid or minimize disruption to access.

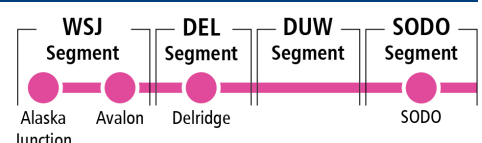
Tunnel portals for Alternative DEL-2a, Option DEL-2b, and Alternative DEL-4 would result in neighborhood construction traffic near the edge of the West Seattle Golf Course.

4.4.5.5 West Seattle Junction Segment

The West Seattle Junction Segment is denser than Delridge, so more people and businesses would be impacted by construction. Surface construction activities, including road closures and detours, could disrupt the West Seattle Junction area (see Table 3-14 for details on the road closures and durations of closures). Some of the events, activities, and services enjoyed by the larger community of West Seattle could be affected.

Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6 would have reduced construction impacts on the community compared to other segment alternatives because much of the construction activity would be underground. However, the tunnel alternatives would have greater nighttime construction noise at the tunnel portals. Tunnel alternatives would still have station and tail track construction surface impacts, and Alternative WSJ-4 would have an elevated Avalon Station, which could result in the similar surface construction impacts described for Alternative WSJ-2 in the following paragraph. Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, and Alternative WSJ-5a would require roadway closures on 35th Avenue Southwest between the West Seattle Bridge and Southwest Avalon Way. All of the tunnel alternatives except for Alternative WSJ-6 would result in partial closures on Fauntleroy Way Southwest between the West Seattle Bridge and Southwest Avalon Way. Alternative WSJ-6 would result in partial closure of the West Seattle Bridge for ground improvements at the tunnel portal. Closures of main arterials during construction would impact the ability to navigate the neighborhood, thus affecting neighborhood cohesion and, possibly, access to social resources.

For Alternative WSJ-1 and Alternative WSJ-2, nearby homes, businesses, and social resources would experience construction noise, visual changes, and the presence of construction equipment. Fauntleroy Way Southwest would have full closures on nights and weekends and lane closures to construct the Alternative WSJ-1 guideway. Southwest Alaska Street between



38th Avenue Southwest and Fauntleroy Way Southwest would be fully closed to construct the Alaska Junction Station with Alternative WSJ-2, which would change travel patterns in this area and could affect access to social resources.

Portals for the West Seattle Junction Segment tunnel alternatives (Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6) as well as the station areas and tail tracks for all alternatives, including the elevated alternatives, would result in neighborhood construction traffic in the West Seattle Junction.

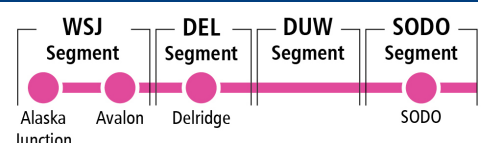
4.4.6 Indirect Impacts of the Build Alternatives

Potential indirect impacts on social resources, community facilities, and neighborhoods would be changes in neighborhood composition or character over time due to the presence of the light rail facilities. The manner in which a neighborhood changes in response to new light rail facilities could impact neighborhood cohesion positively or negatively. The project may encourage redevelopment in station areas (TOD), or the completion of missing transportation links, such as bicycle facilities, sidewalks, or trails. Station area improvements could provide new meeting places for nearby residents and employees, improving community cohesion. Station area redevelopment could promote economic activity by expanding neighborhood business districts consistent with zoning/adopted land use plans and could increase property values (refer to Section 4.3, Economics, for information on potential economic benefits). Increased property values could cause higher rents and property taxes, which could have a negative effect on existing renters, homeowners, and business owners, resulting in some deciding to move away from the neighborhoods. However, redevelopment near station areas would be consistent with the City's zoning, which includes incentives to encourage development of affordable housing. In addition, Sound Transit's Equitable Transit Oriented Development Policy (Board Resolution No. R2018-10) (2018) includes goals for prioritizing affordable housing when redeveloping suitable agency-owned properties. Some light rail facilities (like maintenance roads and elevated guideways) that are not close to stations could adversely affect property values and the living experience of property owners that are directly adjacent.

Indirect impacts of potential TOD are discussed in Section 4.2, Land Use, and Section 4.3, Economics. Potential future transportation or mobility projects built to link to the project are discussed in Chapter 3, Transportation Environment and Consequences.

4.4.7 Mitigation Measures

Sound Transit would coordinate with the SODO Business Improvement Area, 4Culture, and other community organizations to mitigate for the loss of the SODO Track murals with replacement murals or other public art in the area (where appropriate and feasible). Mitigation measures to address project impacts to neighborhoods are discussed in the Mitigation sections of Chapter 3, Transportation Environment and Consequences, and of Section 4.1, Acquisitions, Displacements, and Relocations; Section 4.3, Economics; Section 4.5, Visual and Aesthetic Resources; Section 4.7, Noise and Vibration; Section 4.14, Public Services, Safety, and Security; and Section 4.17, Parks and Recreational Resources.



4.5 Visual and Aesthetic Resources

4.5.1 Introduction to Resource and Regulatory Requirements

This section summarizes the visual and aesthetic resources around the West Seattle Link Extension Project (the project) alternatives and potential impacts on sensitive viewers in these areas. Appendix N.2, Visual and Aesthetics Technical Report, provides additional detail on this analysis. Visual and aesthetic resources are the landscape's natural and cultural features that can be seen and that contribute to the public's appreciation and enjoyment of their surroundings. These resources include elements from both the built and natural environments. They can include solitary built and natural landmarks (such as buildings, trees, and bodies of water) or entire landscapes.

Sound Transit conducted a visual analysis for the project using a modified version of the Federal Highway Administration methodology (1988) for assessing impacts related to transportation projects (see Appendix N.2, Section 2.2, Methodology). Local planning documents, ordinances, and codes were used to identify protected view corridors and viewpoints.

The methodology assesses impacts in terms of the extent to which the project's presence would change the visual quality of a view that would be seen by concentrations of sensitive viewers, especially those with high viewer sensitivity.

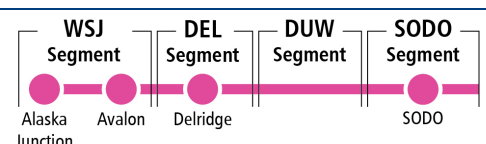
High Viewer Sensitivity

People with high viewer sensitivity are very aware of the existing viewed landscape and are concerned about changes to it. These viewers typically include residents, recreationists, or others for whom the viewed landscape is important.

Visual character is a non-evaluative description of a viewed landscape such as suburban residential, industrial, shoreline, and school campus. Conflicts in visual settings can occur when an object of one visual character type (like a factory with an industrial character) is placed in or next to another visual character type (like a school campus) and visual incompatibility results.

Visual quality assigns "value" or "degree of attractiveness" to a viewed landscape in order to determine changes from a proposed project. Visual quality is evaluated in terms of three components: vividness (distinctiveness, memorability, and drama), intactness (the elements in the views "fit" with their natural and human-built surroundings), and unity (compositional harmony). For this section, the visual quality categories used in the Federal Highway Administration methodology have been simplified to the following categories:

- Low visual quality – Areas with low visual quality have some combination of features that seem visually out of place, lack visual coherence, do not have compositional harmony, and/or might contain unsightly elements.
- Average visual quality – Areas with average visual quality are average-appearing or commonly occurring landscapes that have a generally pleasant appearance but might lack enough vividness, intactness, and unity to place them in the high visual quality category. Because most of the visual quality of the study area is average, Sound Transit further refined the average category to high average, average, and low average to better describe the influence of a Build Alternative on visual quality. In this analysis, a view with high average visual quality would have vividness, intactness, and unity characteristics that would be slightly higher than average, but not enough to qualify as high visual quality. Likewise, a view with low average visual quality would have slightly lower than average vividness, intactness, and unity characteristics, but not enough to be considered to have low visual quality.



- High visual quality – Areas with high visual quality must be outstanding in terms of being very memorable, distinctive, unique (in a positive way), and/or intact. These areas can be natural, park-like, or urban, with urban areas displaying strong and consistent architectural and urban design features.

The following factors were used to assess how the alternatives would affect visual and aesthetic resources:

- Changes to visual character near areas with concentrations of sensitive viewers (this is a qualitative description).
- Changes to the visual quality of views toward the alternative near areas with concentrations of sensitive viewers. If the visual quality category would be lowered one category or more (high to average or average to low), the change was considered an impact.
- Potential blockage of or intrusion on existing views from City of Seattle scenic routes and public places (see below in this section).

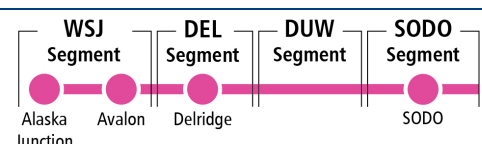
Of the factors identified above, the primary factor used to assess potential impacts from the alternatives was change to the visual quality of views toward the Build Alternatives that would be seen from areas with concentrations of sensitive viewers.

Seattle Municipal Code Section 25.05, Environmental Procedures, contains several policies and regulations of relevance to visual and aesthetic resources. These policies are listed in Appendix N.2 and address light and glare; shadows on open space; height, bulk, and scale; and public view protection of “significant natural and human-made features” that can be seen from specific public places such as viewpoints, parks, scenic routes, and view corridors. Protected features include Mount Rainier, the Olympic and Cascade mountains, the Downtown Seattle skyline, and major bodies of water (including Puget Sound, Lake Washington, Lake Union, and the Lake Washington Ship Canal).

4.5.2 Affected Environment

The study area for visual and aesthetic resources is the viewshed of the Build Alternatives. In many locations, views of the project components such as guideways, stations, and trains by sensitive viewers would be partially or completely blocked by vegetation, terrain, and buildings. In densely developed areas, the viewshed of the alternatives is frequently between 100 and 500 feet on either side of it. In areas where project components would be higher than nearby buildings and vegetation and in areas where bodies of water are crossed, the viewshed can extend out to approximately 0.5 mile. Given the developed urban nature of the areas the Build Alternatives would pass through, being able to see project components beyond approximately 0.5 mile would not alter the visual character or visual quality of views beyond that distance.

The description of the affected environment focuses on visual character, visual quality, locations where there are concentrations of sensitive viewers, and views from City of Seattle Designated Scenic Routes. Sound Transit’s methodology draws upon established Federal Highway Administration guidelines (Federal Highway Administration 1988) with several key differences, such as the identification of viewer sensitivity, and the use of a qualitative rather than quantitative scale. See Appendix N.2, for additional information on visual methodology, affected environment, and project impacts. As described in the technical report, key observation points (KOPs) were selected to represent areas where there is a potential for visual impacts along the alignment of the Build Alternatives.



4.5.2.1 SODO and Duwamish Segments

The description of the affected environment focuses on areas that contain concentrations of sensitive viewers. The SODO Segment and the eastern parts of the Duwamish Segment do not contain areas with concentrations of sensitive viewers. The portion of the Duwamish Segment where there are concentrations of sensitive viewers is between Harbor Island and the boundary with the Delridge Segment. Harbor Island, the West Waterway, and the flat area between the waterway and eastern end of Pigeon Point have an industrial-maritime visual character. The visual quality of views in most of this segment ranges from low to low average. Areas with views of average to high visual quality are found on top of Pigeon Point. Areas with concentrations of sensitive viewers are in residential areas and in three parks. The residential areas are along two streets (17th Avenue Southwest and 18th Avenue Southwest) in the Riverside neighborhood. They are also found in the Pigeon Point community along the top of Pigeon Point along Southwest Charleston Street and on 19th, 20th and 21st avenues Southwest and along the west side of Pigeon Point on 21st, 22nd and 23rd avenues Southwest. The West Duwamish Greenbelt serves as a backdrop to all of these residential areas and blocks views of industrial and commercial areas that lie below Pigeon Point from residences along the top and west side of Pigeon Point. Recreational areas include the Harbor Marina Corporate Center at Terminal 102, Terminal 18, and *tu?əlaɪtʃ*^w Village Park and Shoreline Habitat parks along the West Waterway. East Marginal Way South, State Route 99, the Spokane Street Bridge, and the West Seattle Bridge are City of Seattle Designated Scenic Routes. East Marginal Way South begins in SODO at the south end of Alaskan Way South and travels south along Terminal 30 to the West Seattle Bridge. No key features can be seen by travelers along this route. The West Seattle Bridge connects SODO and West Seattle, passing over Harbor Island, the East and West Waterways, and Longfellow Creek. Key visual features that can be seen from the West Seattle Bridge include the Cascade Mountains, Mount Rainier, Elliott Bay, and the Downtown Seattle skyline. From the West Seattle Bridge at the Longfellow Creek crossing, looking east, key visual features include views of the Downtown Seattle skyline and the Cascade Mountains, and partial views of Elliott Bay.

Visual Terminology

Visual character is an objective assessment of a landscape view that has various natural and human-built elements.

The **visual quality** of a landscape view reflects how well its character-defining features are composed.

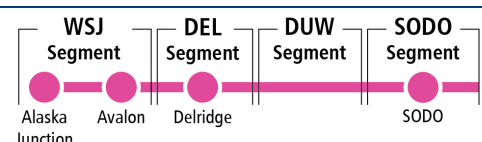
Vividness, intactness, and unity determine the visual quality of landscape views

Visual quality categories help assess how the project would change the visual environment. As a baseline, existing visual quality was categorized as low, average, or high.

Sensitive viewers are people for whom the landscape view is important. They are likely to notice, and be concerned with, changes to the viewed landscape. Residents and park users are more sensitive to changes in landscapes than office workers or motorists.

4.5.2.2 Delridge Segment

The Delridge Segment contains a mixture of land uses and visual character types. The visual character along the west side of Delridge Way Southwest (to Southwest Dakota Street) and the north sides of Southwest Andover Street and Southwest Yancy Street is commercial and industrial. The visual quality of views in this area ranges from low to average. This part of the segment contains concentrations of sensitive viewers near the Dragonfly Pavilion, the Longfellow Creek Legacy Trailhead at Southwest Yancy Street, and residents in the multi-story buildings along the south side of Southwest Yancy Street. The area along the east end of Southwest Yancy Street is also characterized as a forested recreational area and includes the

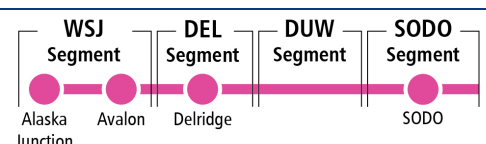


Longfellow Creek Natural Area and the trailhead to Longfellow Creek Legacy Trail. The sensitive viewers to the north from this trailhead have an average visual quality due to the extent of existing vegetation and northerly views of the commercial and industrial buildings. Areas with concentrations of sensitive viewers are also found in residential areas along Delridge Way Southwest and the western boundary of this segment (Southwest Avalon Way). The area north of Southwest Genesee Street is residential in use and visual character, as is the area along Southwest Avalon Way and 32nd Avenue Southwest. Views from these areas generally have average visual quality. The heavily vegetated Longfellow Creek Natural Area passes from north to south through the center (and low elevation point) of the Delridge Segment and is an important visual feature. An entrance to the trail that follows the natural area (the Longfellow Creek Legacy Trail) is on the north side of Southwest Genesee Street and is used by recreationists (sensitive viewers) accessing the trail. The area south of Southwest Genesee Street contains Delridge Playfield and the West Seattle Golf Course (with residences found along the west side of 26th Avenue Southwest). These greenspaces, along with the mature trees that line edge of Southwest Genesee Street, greatly influence the appearance of this part of the segment and create an open-space park-like visual character that is seen by nearby residential and recreational sensitive viewers. The visual quality at the West Seattle Golf Course and Delridge Playfield is high. The visual quality of views from residences along Southwest Genesee Street is high average.

4.5.2.3 West Seattle Junction Segment

The north part of the West Seattle Junction Segment sweeps west through single-family residential neighborhoods that are found on the slope north of Fauntleroy Way Southwest. The segment then turns south to approach the Alaska Junction area. Fauntleroy Way Southwest travels from northeast to southwest through the segment and passes areas that are largely commercial in use and visual character (but does include the small triangular Fauntleroy Place park). The visual quality of views in this area is generally average. Large-scale mixed-use buildings, office buildings and multi-family complexes are found between low-rise commercial land uses. Alaska Junction is surrounded by residential areas with sensitive viewers including a single-family neighborhood between the junction and the segment's southern terminus at Southwest Dawson Street. The visual quality of views in these areas is average. Sensitive viewers include residents in single-family residential areas north of Fauntleroy Way Southwest, residents along the west side of 35th Avenue Southwest, park users at Fauntleroy Place and Junction Plaza Park (Southwest Alaska Street and 42nd Avenue Southwest), residents in multi-story multi-family residential buildings in the Alaska Junction area, and residents in neighborhoods at the south end of the segment.

Three City of Seattle Designated Scenic Routes are in the West Seattle Junction Segment. They are the southwestern portion of the West Seattle Bridge near 35th Avenue Southwest, a portion of Fauntleroy Way Southwest from the off/on ramps with the West Seattle Bridge southwest through and past the West Seattle Junction Segment, and 35th Avenue Southwest. No key features can be seen from the portion of the West Seattle Bridge in this segment. Key features that can be seen from Fauntleroy Way Southwest are more limited because views are blocked by terrain, vegetation, and buildings, but, depending upon location, there are views of the Cascade Mountains, Elliott Bay, and the Downtown Seattle skyline. Along 35th Avenue Southwest, depending upon location along the southern end of this street, there are views of the Cascade Mountains and the downtown skyline.



4.5.3 Environmental Impacts of the No Build Alternative

With the No Build Alternative, the existing visual and aesthetic conditions found throughout the segments described in the affected environment would generally be maintained, subject to changes related to planned development. Light rail stations would not be built in the Delridge, Avalon, and Alaska Junction areas. Development would continue to occur in accordance with zoning and would evolve into denser multi-family development in Delridge, along Southwest Avalon Way, with more mixed use in the Alaska Junction area. It is likely that density in the West Seattle Junction area would continue to increase and that some of the less developed parcels of land would be redeveloped and would contribute to the increasingly urban character of the Alaska Junction area.

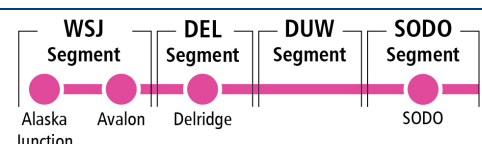
4.5.4 Environmental Impacts of the Build Alternatives during Operation

This section describes the visual and aesthetic impacts of the Build Alternatives during operation. Chapter 2, Alternatives Considered, and Appendix J, Conceptual Design Drawings, detail each of the Build Alternatives. KOPs were selected to represent areas where there is a potential for visual impacts along the alignment of the Build Alternatives; all KOPs are described and shown in Appendix N.2, Attachment N.2A, Key Observation Point Analysis. This section shows the KOPs where simulations were developed to assist in assessing visual impacts, identifies areas along the Build Alternatives with concentrations of sensitive viewers, identifies areas where there would be visual impacts by one of more of the Build Alternatives, and discusses potential impacts to City of Seattle Designated Scenic Routes. Visual impacts occur when an existing visual quality category (high, average, or low) is reduced by one or more categories. Visual impacts are measured in miles along the length of the alternative adjacent to concentrations of sensitive viewers.

4.5.4.1 Impacts Common to All Alternatives

All of the Build Alternatives would change the visual environment to varying degrees. Sound Transit has developed the following design measures that would be incorporated into the Build Alternatives.

- Sound Transit would develop specific design criteria for the project that would guide project design through a balanced set of system-wide elements and contextual elements, such as a consistent architectural theme for elevated elements and stations, consistent signage, and a system-wide art program. Interdisciplinary teams would develop these criteria with input from local communities, and the City of Seattle would integrate these criteria with existing plans, including plans for redevelopment.
- Sound Transit coordination with applicable City of Seattle agencies and adjacent communities will occur throughout the design process to minimize visual impacts and develop a civic aesthetic for each station that is aligned with the community vision.
- Through design review in coordination with the City of Seattle, Sound Transit would consider measures to minimize impacts to visual quality from the bridge alternatives over the Duwamish Waterway, such as design guidelines and context-sensitive design.
- Sound Transit would surplus the remainder of the parcels not needed after construction, which could potentially be redeveloped consistent with Sound Transit's Transit Oriented Development Policies and City of Seattle plans.



- When practicable, Sound Transit would preserve existing vegetation.
- Sound Transit would plant appropriate vegetation within and adjoining the project right-of-way to replace existing street trees and other vegetation removed for the project, and/or to provide screening for sensitive visual environments and/or sensitive viewers. New plantings would be consistent with Sound Transit operations and maintenance requirements and would be selected for the long-term growth and health of the plantings. The planting design would emphasize the use of native, adaptive, hardy, drought-tolerant, low-maintenance plants that attract bees and butterflies, and exist without supplemental water in the local climate after the establishment period.
- Exterior lighting at stations, tail tracks, and hi-rail access would be designed to minimize height and use source shielding to avoid light bulbs that would be directly visible from residential areas, streets, and highways. Shielding would also limit spillover light and glare in residential areas.

4.5.4.2 SODO Segment

The SODO Segment does not contain areas with concentrations of sensitive viewers adjacent to the Build Alternatives; therefore, no visual impacts would occur.

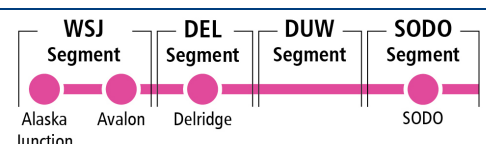
4.5.4.3 Duwamish Segment

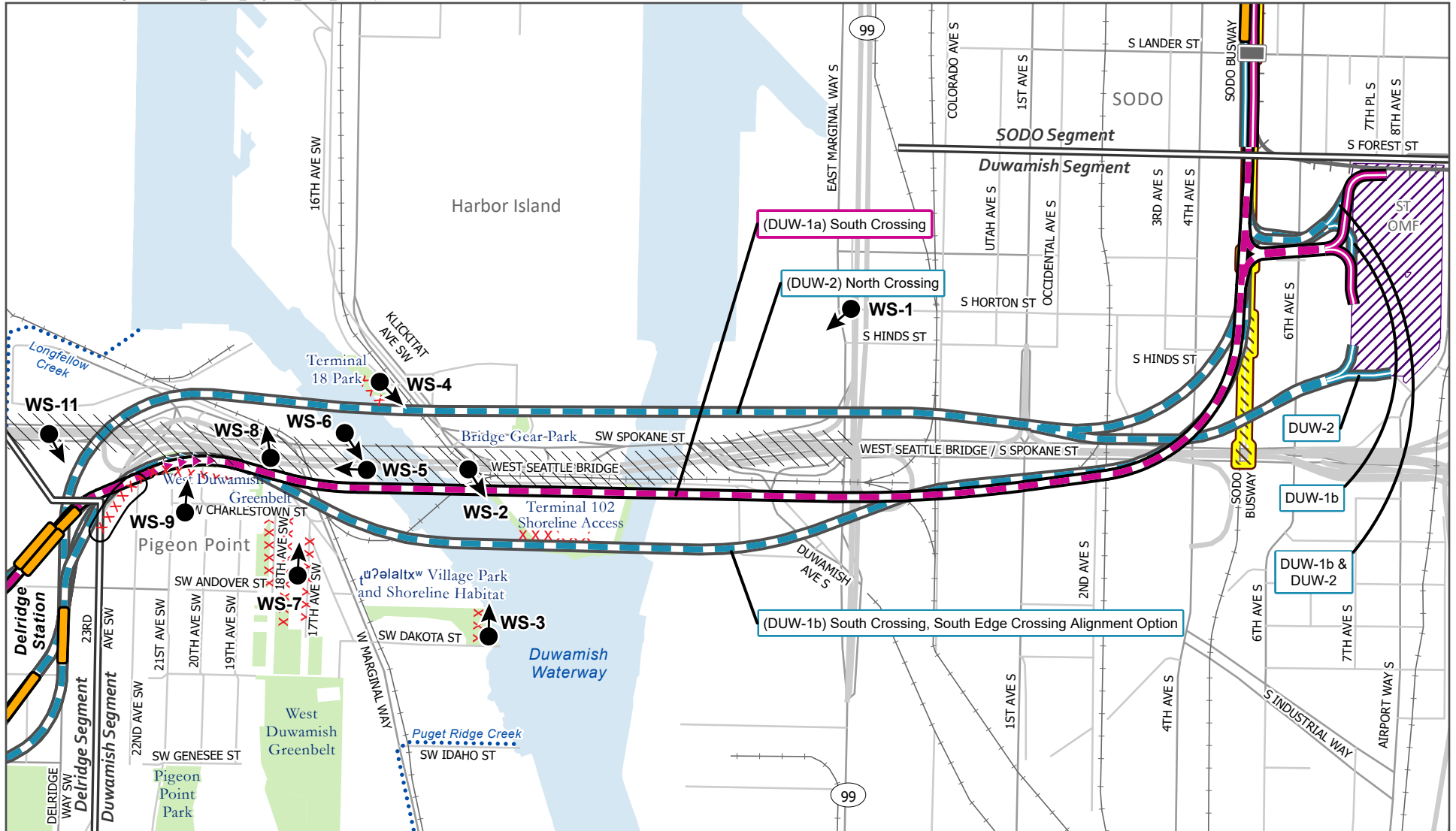
The Duwamish Segment, which would have above-ground components, contains nearby concentrations of sensitive viewers in the western portion of the segment west of Harbor Island who could potentially be concerned with changes to the visual and aesthetic settings from the project. Figure 4.5-1 shows the KOPs where simulations were developed, identifies areas with concentrations of sensitive viewers, identifies areas where there would be visual impacts, and identifies City of Seattle Designated Scenic Routes.

4.5.4.3.1 Areas with Concentrations of Sensitive Viewers

Preferred Alternative DUW-1a and Option DUW-1b would pass south of the West Seattle Bridge and over the public shoreline access at Harbor Marina Corporate Center at Terminal 102, but in different locations. Both alternatives would place guideway columns either in or near the property. This addition of new large-scale transportation elements would somewhat change the character of the shoreline access but would not further reduce the average visual quality of the views from it. Both Preferred Alternative DUW-1a and Option DUW-1b would be seen by Riverside area residences along 17th Avenue Southwest and 18th Avenue Southwest.

Alternative DUW-2 would have the least change to the visual character in areas with concentrations of sensitive viewers and the least impact on visual quality of all the Duwamish Segment Build Alternatives. This alternative would pass north of the West Seattle Bridge. The only nearby areas with concentrations of sensitive viewers would be Terminal 18 Park and *tu?əlaɪtx*^w Village Park (represented in KOP WS-3). This alternative would introduce another large-scale transportation element to views currently dominated by the West Seattle Bridge and the Duwamish Waterway (also known as the Duwamish River). This would not change the existing maritime transportation-oriented visual character of the views toward it from Terminal 18 Park and *tu?əlaɪtx*^w Village Park or further reduce the average visual quality of the view from these parks.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Retained Cut

Station (Indicates Preferred Alternative)

- New

Segment Line

Existing Link Light Rail

Railroad

SODO Busway

Proposed Overpass

Sound Transit Operations and Maintenance Facility (ST OMF)

Piped Stream

Park

Key Observation Point (KOP) and View Direction

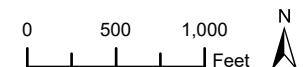
City of Seattle Designated Scenic Route

Location of impact to visual quality with one or more alternatives near areas with concentrations of sensitive viewers

Approximate Areas with Concentration of Sensitive Viewers

FIGURE 4.5-1
Visual Setting and Impacts
Duwamish Segment

West Seattle Link Extension

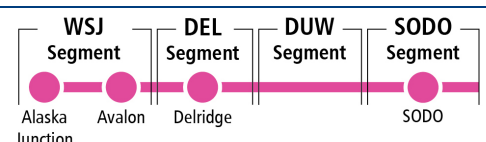


Sound Transit is considering several bridge types for crossing the Duwamish Waterway. In addition to the balanced cantilever segmental box girder bridge over the East Waterway depicted in the simulations (see Attachment N.2A in Appendix N.2), Sound Transit is considering a truss or cable-stayed bridge for Preferred Alternative DUW-1a over the West Waterway. Sound Transit is considering bridge types for Option DUW-1b and Alternative DUW-2, including balanced cantilever segmental box girder, extradosed, truss, and cable-stayed bridges for crossing over the West Waterway (these are also depicted in the simulations provided in Appendix N.2, Attachment N.2A). Each of these bridges would have different visual characteristics that would have different influences on the visual character of views toward the West Seattle Bridge. However, regardless of bridge type, the appearance of the alternatives' elevated structures would not change the existing average visual quality of views toward the bridge by Riverside area residences (represented in KOP WS-7) or recreationists in the parks (represented in KOP WS-4). Preferred Alternative DUW-1a and Option DUW-1b would pass north of residences on top of Pigeon Point. Both would remove trees in the adjacent West Duwamish Greenbelt and would remove some residences next to the greenbelt. The removal of trees within the greenbelt would be noticed, but the remaining residences would be too far back to see the industrial lands to the north toward Elliott Bay that the trees in the greenbelt currently screen. The project components (elevated guideways, overhead catenary system, or trains) associated with Preferred Alternative DUW-1a and Option DUW-1b would not be seen from most remaining residences. The lots where residences would be removed would be used by Sound Transit for construction of the guideway, and their visual character would change from residential to either transportation or unbuilt lot. These alternatives would reduce the high visual quality of views to the north from remaining residences (represented in KOP WS-9) to high average, which would not be a visual impact. From the top of Pigeon Point, trains associated with Alternative DUW-2 would be seen passing in the distance through existing vegetation that would not be removed in the West Duwamish Greenbelt, but would not change the residential visual character of the view or reduce its high visual quality.

The northwestern slope of Pigeon Point would be the only area in this segment where Preferred Alternative DUW-1a and Option DUW-1b would change visual character and impact visual quality (represented by KOP WS-10). Removing trees would result in uninterrupted views from some residences along 21st Avenue Southwest, 22nd Avenue Southwest, and 23rd Avenue Southwest of industrial and commercial areas as well as the West Seattle Bridge and other streets. This would change the current residential and natural character of the views from these residences to industrial-commercial and bridge. In addition, components of the alternatives would be seen, depending on location. The existing average to high visual quality of views to the northwest from this area would be reduced to low, which would be an impact to visual quality. Alternative DUW-2 would not remove trees along the northwestern slope of Pigeon Point within the West Duwamish Greenbelt and would not change the existing visual character or lower visual quality of views in this area. Table 4.5-1 provides the visual quality impacts for each of the Duwamish Segment alternatives.

Table 4.5-1. Duwamish Segment Visual Impacts to Concentrations of Sensitive Viewers

Alternative or Design Option	Visual Impacts (miles)	Areas Where Visual Impacts Would Occur
Preferred South Crossing Alternative (DUW-1a)	0.1	Residences along 21st Avenue Southwest, 22nd Avenue Southwest, and 23rd Avenue Southwest
South Crossing South Edge Crossing Alignment Option (DUW-1b)	0.1	Residences along 21st Avenue Southwest, 22nd Avenue Southwest, and 23rd Avenue Southwest
North Crossing Alternative (DUW-2)	0	None



4.5.4.3.2 City of Seattle Designated Scenic Routes and Public View Protection

East Marginal Way South, State Route 99, the Spokane Street Bridge, and the West Seattle Bridge are City of Seattle Designated Scenic Routes. There are no views of elements identified as protected by the City (such as the Olympic and Cascade mountains, Mount Rainier, Puget Sound, Elliott Bay, and the Downtown Seattle skyline) from the stretch of East Marginal Way South where the Duwamish Segment alternatives would be visible. East Marginal Way South primarily offers views of industrial lands and Port of Seattle terminal activities, and the Duwamish Segment alternatives would not intrude on any protected views from this stretch of East Marginal Way South.

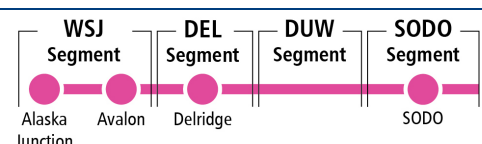
Views to the south from the West Seattle Bridge would be altered with the presence of the elevated guideway associated with Preferred Alternative DUW-1a and Option DUW-1b. Preferred Alternative DUW-1a would be approximately 115 feet south of the West Seattle Bridge. In some locations, the new bridge would block travelers' passing views of the Duwamish Waterway and Mount Rainier. Option DUW-1b would be about 400 feet farther south of the West Seattle Bridge than Preferred Alternative DUW-1a and, because of its greater distance, would intrude less upon passing travelers' views of the Duwamish Waterway and Mount Rainier than would Preferred Alternative DUW-1a. A bridge type has not been selected for Option DUW-1b over the West Waterway. Alternative DUW-2 would be approximately 350 feet north of the West Seattle Bridge and, in some locations, would alter or block short segments of passing travelers' views to the north of features such as Elliott Bay, Puget Sound, and the Downtown Seattle skyline.

As described previously, Sound Transit is considering several bridge types for crossing the Duwamish Waterway. Each of these bridge types would have different visual characteristics. The balanced cantilever segmental box girder bridge (although narrower) would be similar to the existing West Seattle Bridge in scale, form, materials, and overall appearance. Its bridge deck would be supported by a series of guideway columns that are similar in appearance to those supporting the West Seattle Bridge. With the Preferred Alternative DUW-1a cable-stayed bridge, travelers passing on the bridge would see cables (which would not block views), and the tall guideway columns would momentarily block north or south views. The many vertical support arms of a truss bridge would intrude upon views from the West Seattle Bridge more than a cable-stayed or extradosed bridge.

Other than State Route 99, the Spokane Street Bridge, and the West Seattle Bridge, the Build Alternatives would not intrude upon views from City of Seattle specified viewpoints, parks, or view corridors of Mount Rainier, the Olympic and Cascade mountains, the Downtown Seattle skyline, or Puget Sound.

4.5.4.3.3 Light, Glare, and Shadows

As is the case with vehicles currently traveling on the West Seattle Bridge, passing trains from all Build Alternatives would produce lights and glare (from headlights and reflective surface materials) that would be seen from nearby areas. Lights and glare from trains associated with Preferred Alternative DUW-1a and Option DUW-1b would also be seen at locations such as Harbor Marina Corporate Center at Terminal 102, Duwamish Village Park and Shoreline Habitat, the West Duwamish Greenbelt, and the Riverside and Pigeon Point residential areas. Light and glare produced by trains would not impact motorists, pedestrians, or the surrounding area.



Shadows from a bridge built for Preferred Alternative DUW-1a and Alternative DUW-2 would add to existing shadows from the West Seattle Bridge on the Terminal 18 Park and possibly Bridge Gear Park for short periods of time when winter sun angles are low. Preferred Alternative DUW-1a and Option DUW-1b would also cast additional shadows on West Duwamish Greenbelt. Only Option DUW-1b would add shadows to Harbor Marina Corporate Center at Terminal 102.

4.5.4.4 Delridge Segment

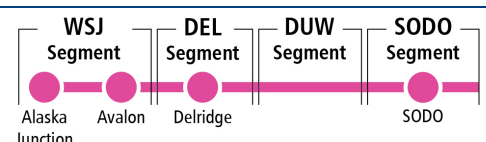
The Delridge Segment, which would have primarily above-ground components, contains nearby concentrations of sensitive viewers. Figure 4.5-2 shows KOPs where simulations were developed, identifies areas with concentrations of sensitive viewers, identifies where there would be visual impacts, and identifies City of Seattle Designated Scenic Routes. Cross sections and 3D views of some stations are shown in the following section to illustrate the general height, bulk, and scale of the stations (see Attachment N.2B, Station 3D Views and Cross Sections, in Appendix N.2 for the complete set).

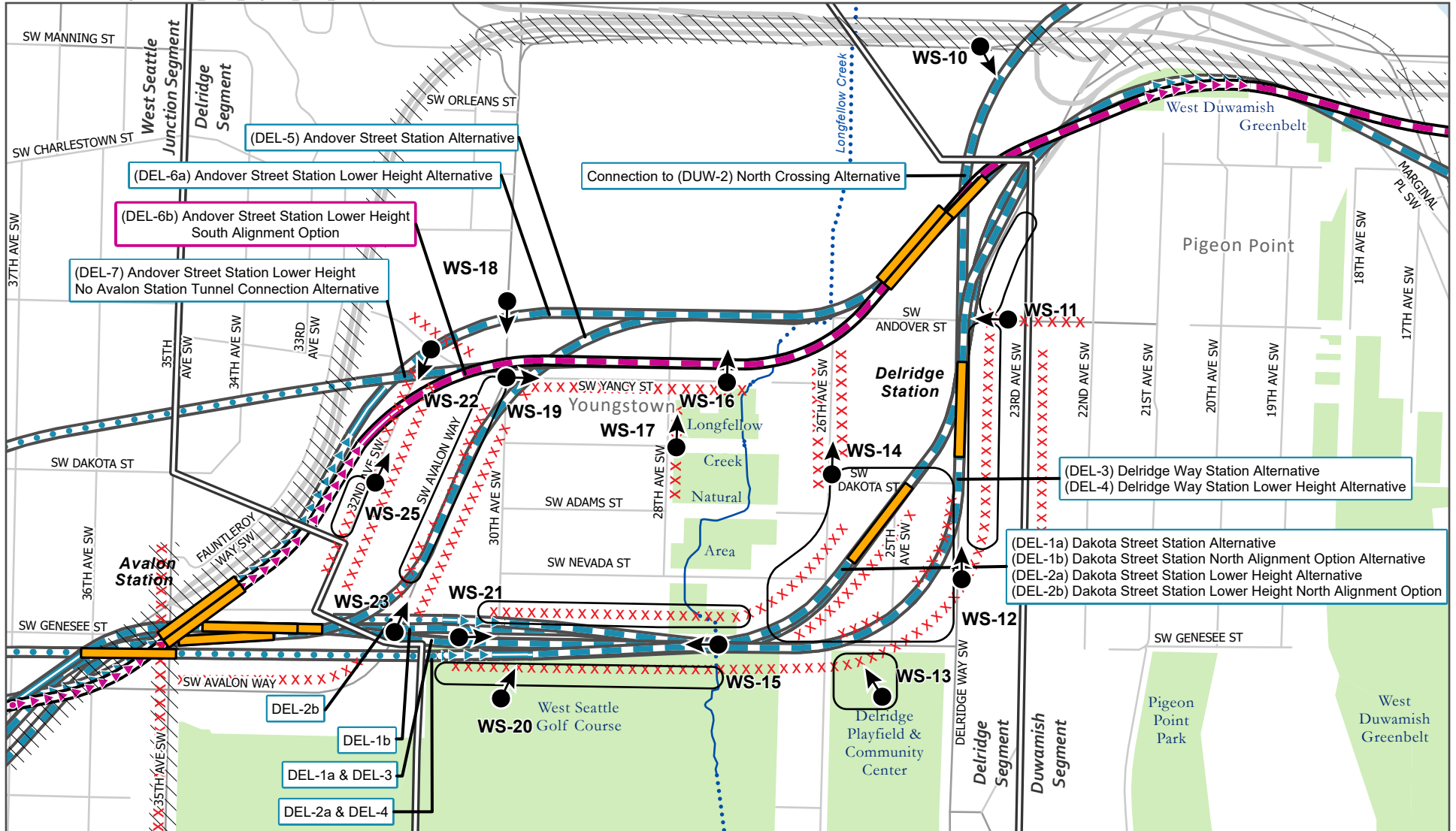
4.5.4.4.1 Areas with Concentrations of Sensitive Viewers

The visual quality impacts of the Delridge Segment alternatives (including Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4) would be similar to each other because they would generally follow the same route. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 also generally follow the same route. However, there would be some differences between the alternatives, particularly in how visible changes would be to sensitive viewers due to their differences in heights and some variations in location. The Delridge Segment visual quality impacts to concentrations of sensitive viewers are provided in Table 4.5-2.

The guideway for Preferred Option DEL-6b and Alternative DEL-7 would be seen primarily by residential sensitive viewers along 26th Avenue Southwest looking north (represented in KOP WS-14) and sensitive viewers at the Longfellow Creek Legacy Trailhead on Southwest Yancy Street (represented in KOP WS-16) and by park users at Longfellow Creek Natural Area (represented in KOP WS-17). The visual quality of average from these residences would remain unchanged for Preferred Option DEL-6b and Alternative DEL-7. The visual quality from the two recreation areas mentioned above would decrease from average to low average due to the scale and proximity of the structures to the sensitive viewers but would be partially screened by existing vegetation and would not be a visual quality impact.

The top of the station structure for Preferred Option DEL-6b and Alternative DEL-7 would be seen by the residential sensitive viewers east of Delridge Way Southwest near Southwest Andover Street (represented in KOP WS-11). The existing average visual quality of views to the station from the residences would slightly increase to high average due to the visual coherence the station and guideway would provide. The height, bulk, and scale of the station would be consistent with the existing commercial and industrial development at the intersection of Southwest Andover Street and Delridge Way Southwest.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (Indicates Preferred Alternative)

New

Segment Line

Railroad

Stream

Piped Stream

Park



Key Observation Point (KOP) and View Direction



City of Seattle Designated Scenic Route



Location of impact to visual quality with one or more alternatives near areas with concentrations of sensitive viewers



Approximate Areas with Concentration of Sensitive Viewers

FIGURE 4.5-2
Visual Setting and Impacts
Delridge Segment

West Seattle Link Extension

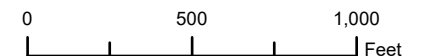


Table 4.5-2. Delridge Segment Visual Quality Impacts to Concentrations of Sensitive Viewers

Alternative or Design Option	Visual Impacts (miles)	Where Visual Impacts Would Occur
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	0.1	Residences along 32nd Avenue Southwest.
Dakota Street Station Alternative (DEL-1a)	1.0	Residences along 23rd Avenue Southwest, 25th Avenue Southwest, 26th Avenue Southwest, Nevada Street, Delridge Way Southwest, and parts of Southwest Genesee Street and part of the Delridge Playfield, West Seattle Golf Course, and some locations within Longfellow Creek Natural Area.
Dakota Street Station North Alignment Option (DEL-1b)	1.0	Similar to Alternative DEL-1a; however, additional residences north of Southwest Genesee Street would be removed and therefore would not have visual impacts.
Dakota Street Station Lower Height Alternative (DEL-2a)	1.0	Similar to Alternative DEL-1a but would impact views from fewer residences.
Dakota Street Station Lower Height Alternative North Alignment Option (DEL-2b)	1.0	Similar to Alternative DEL-1a; however, additional residences north of Southwest Genesee Street would be removed and therefore would not have visual impacts.
Delridge Way Station Alternative (DEL-3)	1.0	Similar to Alternative DEL-1a.
Delridge Way Station Lower Height Alternative (DEL-4)	1.0	Similar to Alternative DEL-1a.
Andover Street Station Alternative (DEL-5)	0.2	Residences along Southwest Avalon Way between Southwest Yancy Street and Southwest Genesee Street.
Andover Street Station Lower Height Alternative (DEL-6a)	0.1	Residences along a small section of 32nd Avenue Southwest.
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	0.1	Residences along 32nd Avenue Southwest.

Preferred Option DEL-6b would traverse in a retained cut (Figure 4.5-3) near the north end of 32nd Avenue Southwest. It would remove a series of residences from both the east and the west side of the street. The view on Figure 4.5-3 represents what the remaining residents would see looking north along 32nd Avenue Southwest (represented in KOP WS-25). The vividness of this view would be lowered from high average to average due to the encroachment of the guideway structure and retaining walls but would still maintain memorable partial views to the downtown skyline and the port facilities. The intactness and unity would be lowered from high average to low due to the guideway structure, retaining walls, fencing, noise walls and street end. A portion of the overhead power lines would be placed underground but would not alter the intactness or unity enough to increase the visual quality. In addition, removal of landscaping and residences would create a discontinuous sense and lack of harmony of the residential neighborhood. The overall visual quality at this location would be lowered from high average to low, which would be a visual impact.

Figure 4.5-3. Preferred Option DEL-6b: 32nd Avenue Southwest Converted to Cul-de-sac



The elevated guideway heights with Alternative DEL-1a and Option DEL-1b would range from between approximately 60 and 70 feet to about 150 feet along Southwest Genesee Street. The height to the top of the Delridge Station associated with these two alternatives would be approximately 110 feet. For configuration, height, bulk, and scale of the station, see Figures 4.5-4 and 4.5-5, Delridge Station 3D view and cross section for Alternative DEL-1a and Option DEL-1b. Both alternatives would introduce a structure that would be taller than the current 30- to 35-foot height allowed by zoning. Both of these alternatives would remove residences in the neighborhood south of Southwest Dakota Street between Delridge Way Southwest on the east and 26th Avenue Southwest on the west.

By removing the residences and introducing the elevated guideway and station, the current residential character of views from remaining nearby residences into this area would change to transportation. The elevated station and guideway would be noticeably higher in elevation than any other structures in this area, and the station would likely have a more contemporary design than many older nearby residential single-family buildings in the area. The new station design would likely be similar to the many newer multi-family developments that are increasingly being built in the area (particularly along Delridge Way Southwest).

The elevated station and guideway would reduce the current average degree of visual unity and integrity of views toward it to low. This reduction would result in a lowering of the current average visual quality to low, which would be considered a visual impact.

Figure 4.5-4. Delridge Station 3D View for Alternative DEL-1a and Option DEL-1b

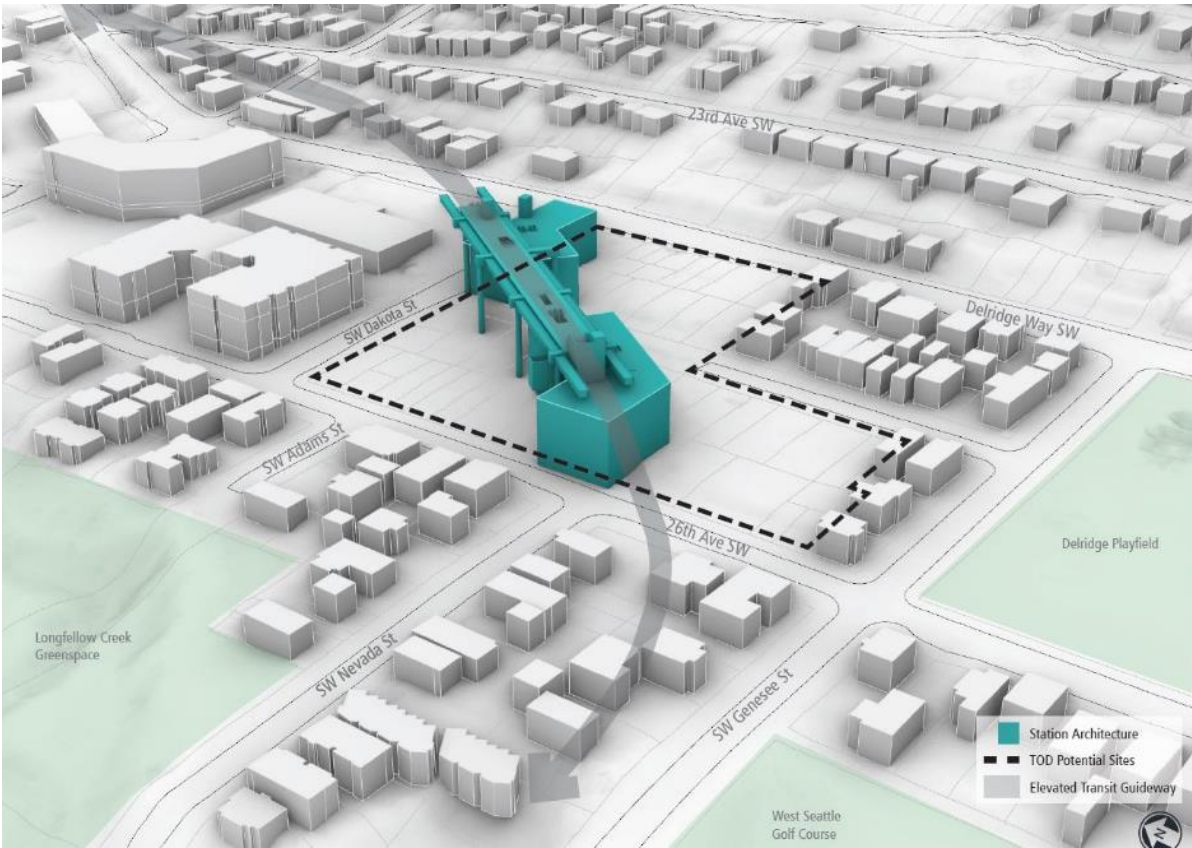
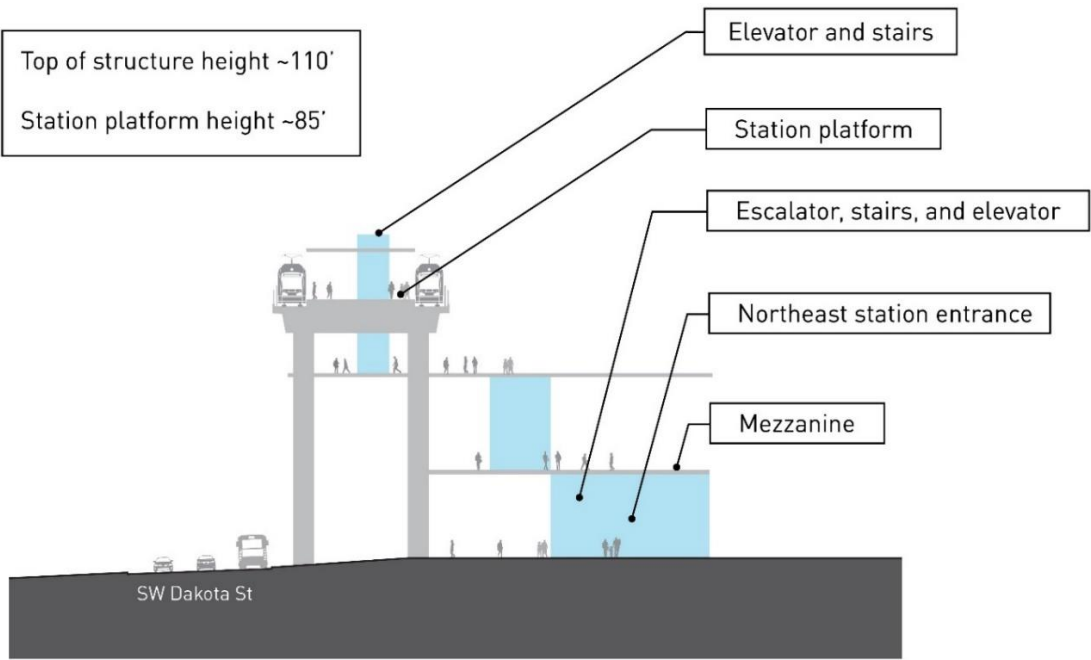


Figure 4.5-5. Delridge Station Cross Section for Alternative DEL-1a and Option DEL-1b



Because Alternative DEL-1a would travel along the south side of Southwest Genesee Street, trees would be removed along both sides of the street and within the northern edge of the West Seattle Golf Course (Figure 4.5-6). This would change the visual character of views toward Southwest Genesee Street from both the golf course (represented in KOP WS-20) and the residences adjacent to the north side of Southwest Genesee Street to transportation. This change would also be seen from other locations within the study viewshed like the Delridge Playfield (represented in KOP WS-13). The removal of trees and residences along with the scale and form of the elevated guideway would reduce the high average visual quality of residences along Southwest Genesee Street and the high visual quality at the West Seattle Golf Course and Delridge Playfield to low, which would be visual impacts (see Attachment N.2A). In the few areas along the Longfellow Creek Legacy Trail where the elevated guideway would be seen, the high average visual quality of views would be reduced to low, which would be a visual impact.

Option DEL-1b would have impacts similar to Alternative DEL-1a, but its alignment would pass along the north side of Southwest Genesee Street rather than along the north edge of the golf course (see Figure 4.5-6). This alternative would require removing all of the residences on the north side of Southwest Genesee Street (represented in KOP WS-15 and WS-21). However, it would remove fewer trees along the south side of Southwest Genesee Street and the northern edge of the West Seattle Golf Course than Alternative DEL-1a. This alternative would reduce the high average visual quality of remaining residences north of those that would be removed along Southwest Genesee Street to low, which would be a visual impact; this would also be a visual impact to northern views from the golf course and views from Delridge Playfield.

Alternative DEL-1a and Option DEL-1b would remove vegetation from the south edge of the Longfellow Creek Natural Area. Remaining trees would screen or partially screen views of the elevated guideways from most of the Longfellow Creek Legacy Trail. In the areas along the trail where the elevated guideway would be seen, the high average visual quality of views would be reduced to low, which would be a visual impact.

From the eastern edge of the Delridge Segment to the east end of the West Seattle Golf Course, Alternative DEL-2a would be similar to Alternative DEL-1a, except that it would be lower in height. The elevated guideway would be up to about 60 feet and the station would be approximately 60 feet, with the platform at a height of 35 feet. This would be taller than the current 30- to 35-foot height allowed by zoning. The influence of this lower station on visual character would be very similar to that described for Alternative DEL-1a, but because the Delridge Station with Alternative DEL-2a would be about 50 feet lower than Alternative DEL-1a, it would be seen from fewer areas and therefore would change less of the residential visual character to a transportation visual character.

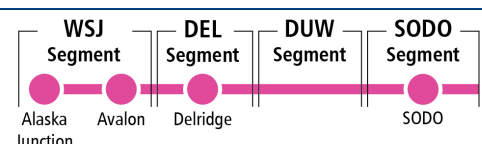
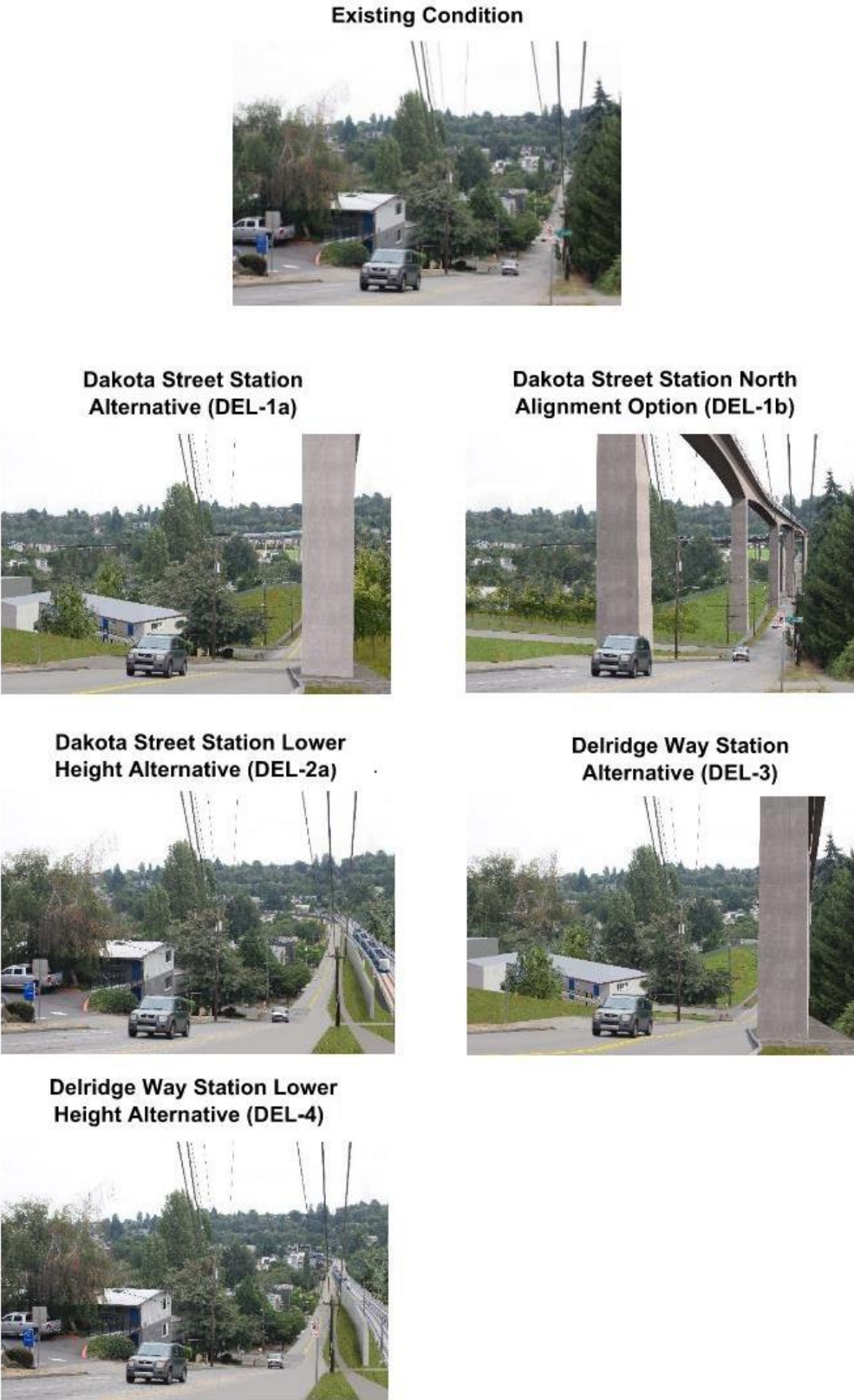


Figure 4.5-6. Looking East along Southwest Genesee Street from Southwest Avalon Way



The average visual quality of views toward the station would be reduced to low, which would be a visual impact. For configuration, height, bulk and scale of the station, see Figures 4.5-7 and 4.5-8, Delridge Station 3D view and cross section for Alternative DEL-2a and Option DEL-2b.

From Southwest Genesee Street, Alternative DEL-2a would pass through the West Seattle Golf Course to a portal at the west end of the golf course and extend farther south into the West Seattle Golf Course than Alternative DEL-1a. The presence of Alternative DEL-2a would change the recreational visual character of views toward it from within the golf course (represented in KOP WS-20), from areas along the north side of Southwest Genesee Street (represented in KOP WS-21; also see Figure 4.5-6), and from other nearby areas like the Delridge Playfield (represented in KOP WS-13) to transportation in character. The removal of trees and presence of this alternative through the north end of the West Seattle Golf Course would lower the existing high unity and intactness of views in this area to average. It would reduce the high visual quality of views from within the West Seattle Golf Course and the Delridge Playfield to low average, which would be a visual impact.

Alternative DEL-2a would also reduce the high average visual quality of views from along both sides of Southwest Genesee Street (represented in KOP WS-15 and WS-21) to low average, which would not be a visual impact. This alternative would remove some vegetation along the edge of the Longfellow Creek Natural Area. Trees would screen or partially screen views of the elevated guideways along most of the Longfellow Creek Legacy Trail. The elevated guideway would be seen from some locations along the trail, but its presence would not lower visual quality of views along the trail.

Up to the east end of the West Seattle Golf Course, the impacts associated with Option DEL-2b would be essentially the same as those described for Alternative DEL-2a. The Delridge Station for this design option would also be about 60 feet high and have similar influences on the visual character and quality of views toward it from remaining residences. Unlike Option DEL-1b, Option DEL-2b would only require the removal of trees at the east end of the West Seattle Golf Course. It would also be lower elevation and would have the least impact on views from the West Seattle Golf Course of all the Delridge Segment alternatives that would pass along Southwest Genesee Street. With this design option, the existing high visual quality of views from the West Seattle Golf Course (represented in KOP WS-20) would be reduced to average (which would be a visual impact). Residences north of Southwest Genesee Street would be removed and the alternative would have a visual impact on views toward it from remaining residences north of Southwest Genesee Street (represented in WS-15 and WS-21; also see Figure 4.5-6). It would remove some vegetation along the edge of the Longfellow Creek Natural Area. Like Alternative DEL-1b, trees within the Longfellow Creek Natural Area would generally screen views of the elevated guideway, and people on the Longfellow Creek Legacy Trail would see the elevated guideway from some locations along the trail. However, the elevated guideway would be lower in elevation than Alternative DEL-1a in this area; therefore, its presence would not lower the visual quality of views along the trail.

The height of the Alternative DEL-3 elevated guideway would range between approximately 50 and 150 feet, and the height at the top of the Delridge Station would be approximately 90 feet. Alternative DEL-4 would be lower, with a guideway that ranges between a tunnel and 60 feet high, and the height at the top of the Delridge Station would be approximately 90 feet, with a platform height of 65 feet. For station configuration, see Figure 4.5-9 Delridge Station Cross Section for Alternative DEL-3 and Alternative DEL-4. The height bulk and scale of this station would be less than that shown for Alternative DEL-1a and Option DEL-1b in Figure 4.5-4.

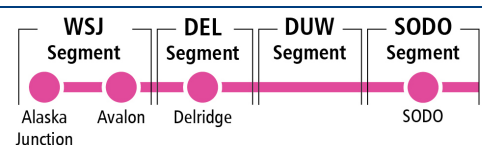


Figure 4.5-7. Delridge Station 3D View for Alternative DEL-2a and Option DEL-2b

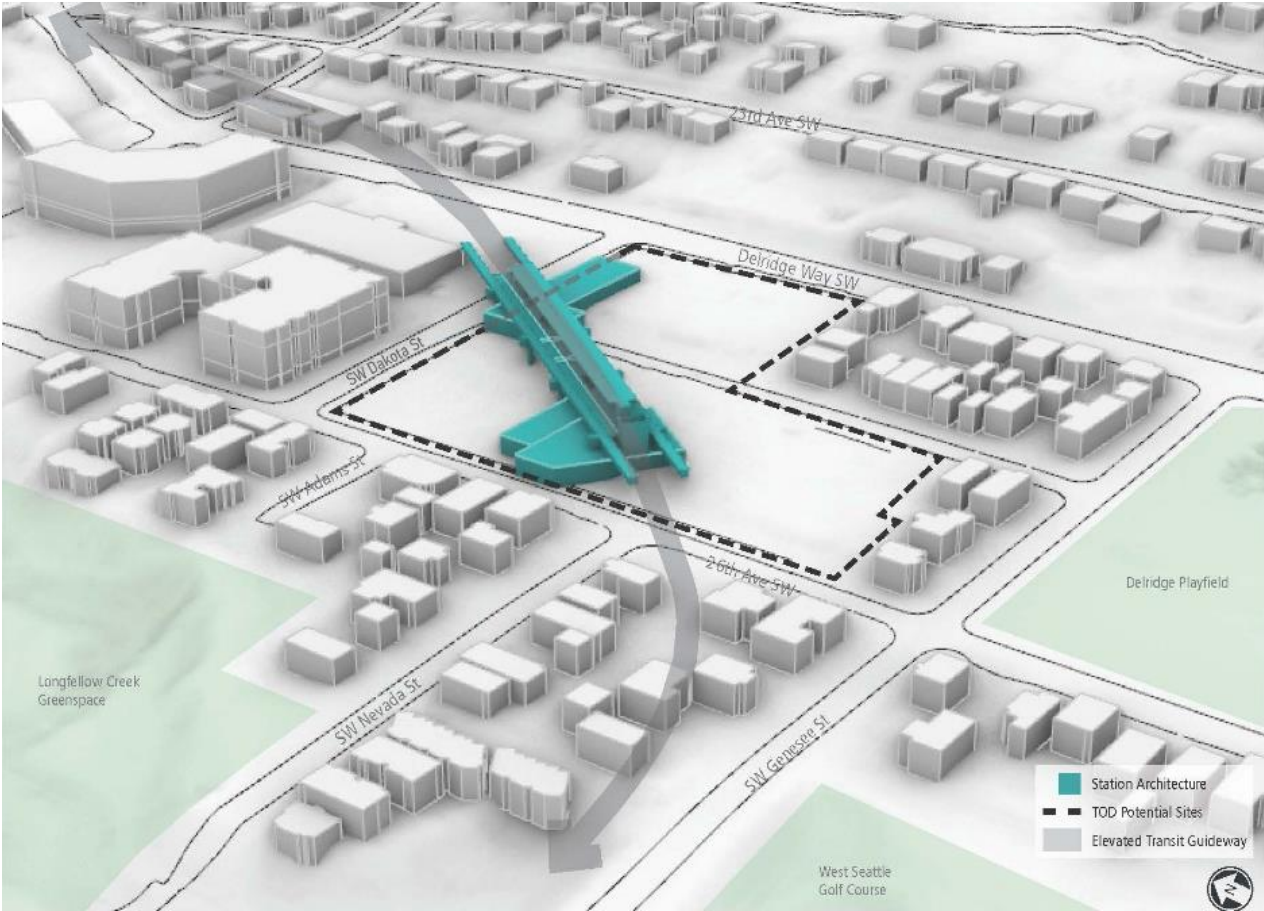


Figure 4.5-8. Delridge Station Cross Section for Alternative DEL-2a and Option DEL-2b

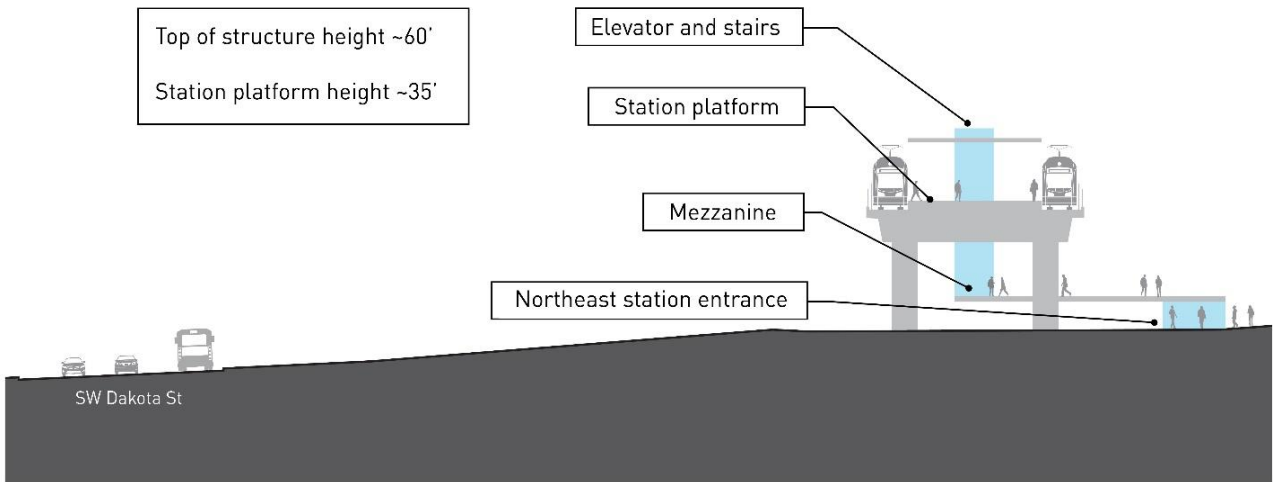
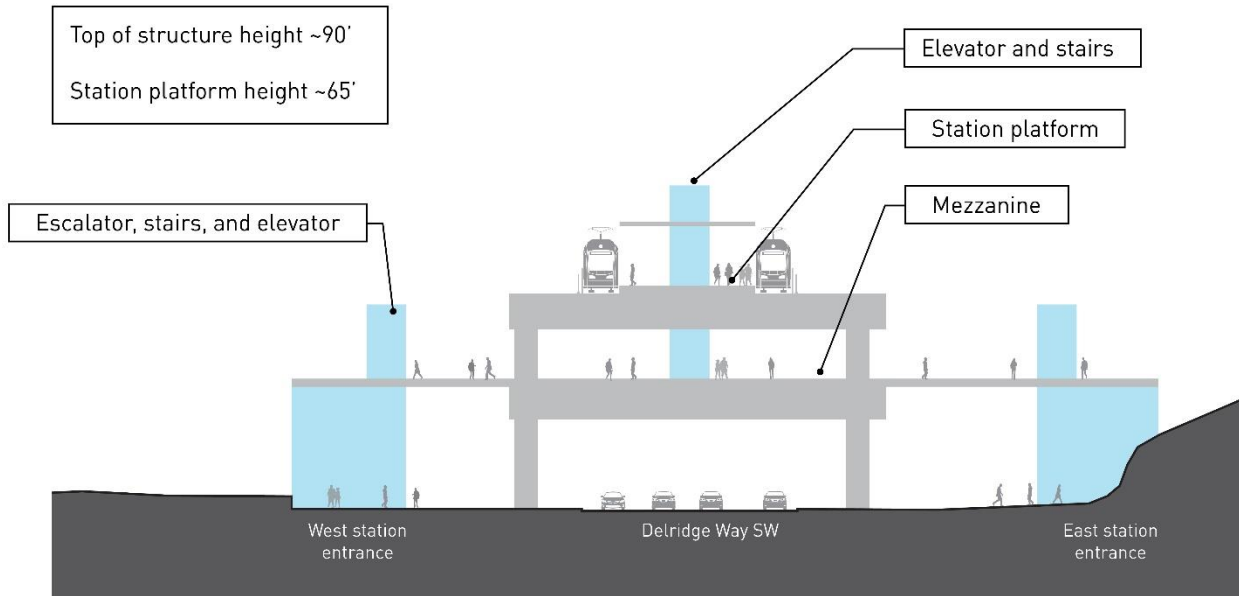


Figure 4.5-9. Delridge Station Cross Section for Alternative DEL-3 and Alternative DEL-4



Alternatives DEL-3 and DEL-4 would pass through more of the residential area east of Delridge Way Southwest than would the other Delridge Segment alternatives and would change the visual character and impact the visual quality of views from residences on the hillside between the east side of Delridge Way Southwest and 23rd Avenue Southwest. These alternatives would remove the most residences and trees between these two streets, which would open up views to the west from remaining residences that are currently screened by trees and buildings. The new views would include commercial and industrial areas, the elevated guideway, and the Delridge Station, which would cross over the middle of Delridge Way Southwest. The removal of trees and buildings and the presence of these alternatives' components would decrease the average visual unity and intactness of views to the west from remaining residences along 23rd Avenue Southwest. This would reduce the average visual quality of views toward the alignment to low, which would be a visual impact.

Alternative DEL-3 would continue south along Delridge Way Southwest and follow it farther south than the other Delridge Segment alternatives before veering west mid-block through the residential area south of Southwest Dakota Street between Delridge Way Southwest and 26th Avenue Southwest. The elevated guideway passing through this area would change the residential character to transportation. The scale of the elevated guideway would lower the generally average visual quality of views from remaining residences (represented in KOP WS-11) toward it to low, which would be a visual impact.

Alternative DEL-3 would pass along the south side of Southwest Genesee Street and require the removal of trees along the south side of the street along much of its alignment (see Figure 4.5-6; note that trees and residences on the north side of the portion of Southwest Genesee Street near Southwest Avalon Way depicted in the Alternative DEL-3 simulation would not be removed). This alternative would remove trees within the West Seattle Golf Course; its appearance from the golf course, Delridge Playfield, and the remaining residences (behind those that would be removed along Southwest Genesee Street) would be similar to that of Alternative DEL-1a. The removal of trees, along with the presence of the elevated guideway, would reduce the high average visual quality of views toward the alignment from the residences to low; this would be a visual impact. The existing high visual quality of views toward the

guideway from the Delridge Playfield and West Seattle Golf Course would be reduced to low average, which would also be a visual impact. Alternative DEL-3 would not remove vegetation from the edge of the Longfellow Creek Natural Area; however, due primarily to its height, it might be seen from a few points along the Longfellow Creek Legacy Trail, and where seen, would lower the high visual quality of views toward the guideway to average, which would be a visual impact.

Alternative DEL-4 would pass along the south side of Southwest Genesee Street and require the removal trees on the south side of the street. It would begin to enter into a tunnel near the northern part of the West Seattle Golf Course, where it would remove trees and some roads, paths, and greens. The part of the alternative passing through the West Seattle Golf Course would be very similar in appearance to that of Alternative DEL-2a (Figure 4.5-6), as would its impact on visual character and visual quality. Alternative DEL-4 would not remove vegetation from the edge of the Longfellow Creek Natural Area, although it might be seen from a few points along the Longfellow Creek Legacy Trail. If and where it is seen, it would lower the high average visual quality of views toward the guideway to low average, which would not be a visual impact.

Alternative DEL-5 would have the second least impact on visual quality. It would impact views from multi-family buildings along Southwest Avalon Way where buildings and existing street trees would be removed, and the elevated guideway would be seen along (and over) much of Southwest Avalon Way. The residential character of views along the street from residences would be changed to transportation.

The scale of the elevated guideway from Alternative DEL-5 passing over Southwest Avalon Way through a corridor flanked with residences would reduce the average visual unity and intactness of views along it to low. These reductions would lower the average visual quality of views to low, which is a visual impact.

Alternative DEL-6a would have the least visual quality impacts of all the alternatives in the Delridge Segment to sensitive viewers. Its visual impacts would be restricted to a small area where residences and trees would be removed on the north side of Southwest Yancy Street and on the west side of 32nd Avenue Southwest. The removal of these residences (and the trees behind them that screen views of the West Seattle Bridge on-ramp) would change the character of views from the remaining residences (represented in KOP WS-25) toward the alignment from residential character to transportation. The removal of the residences and the trees would reduce the average unity of these views to low. As a result, the high average visual quality of views from remaining residences would be reduced to average, which is not a visual impact. For configuration, height, bulk, and scale of the Delridge Station under Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7, see Figures 4.5-10 and 4.5-11 (which show a Delridge Station 3D view and cross section under these alternatives).

Under Alternative DEL-7 the elevated guideway would be seen by similar sensitive viewers to Preferred Option DEL-6b. A tunnel portal leading to Alternative WSJ-6 in the West Seattle Junction Segment would be in the vicinity of 32nd Avenue Southwest, east of the West Seattle Bridge and would be seen by primarily residential viewers in the vicinity of 32nd Avenue Southwest (represented in KOP WS-25). 32nd Avenue Southwest would no longer connect to Southwest Andover Street but would end in a cul-de-sac south of the tunnel portal and remove residential buildings. This alternative would be seen by residential viewers on both the north and south side of the portal (see Figure 3-12d in Attachment N.2A). The visual quality in this area would be reduced from high average to low and would be a visual impact.

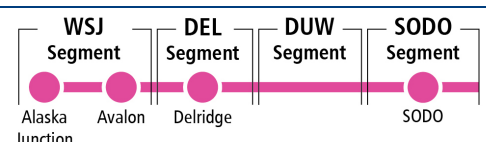


Figure 4.5-10. Delridge Station 3D View for Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL 7

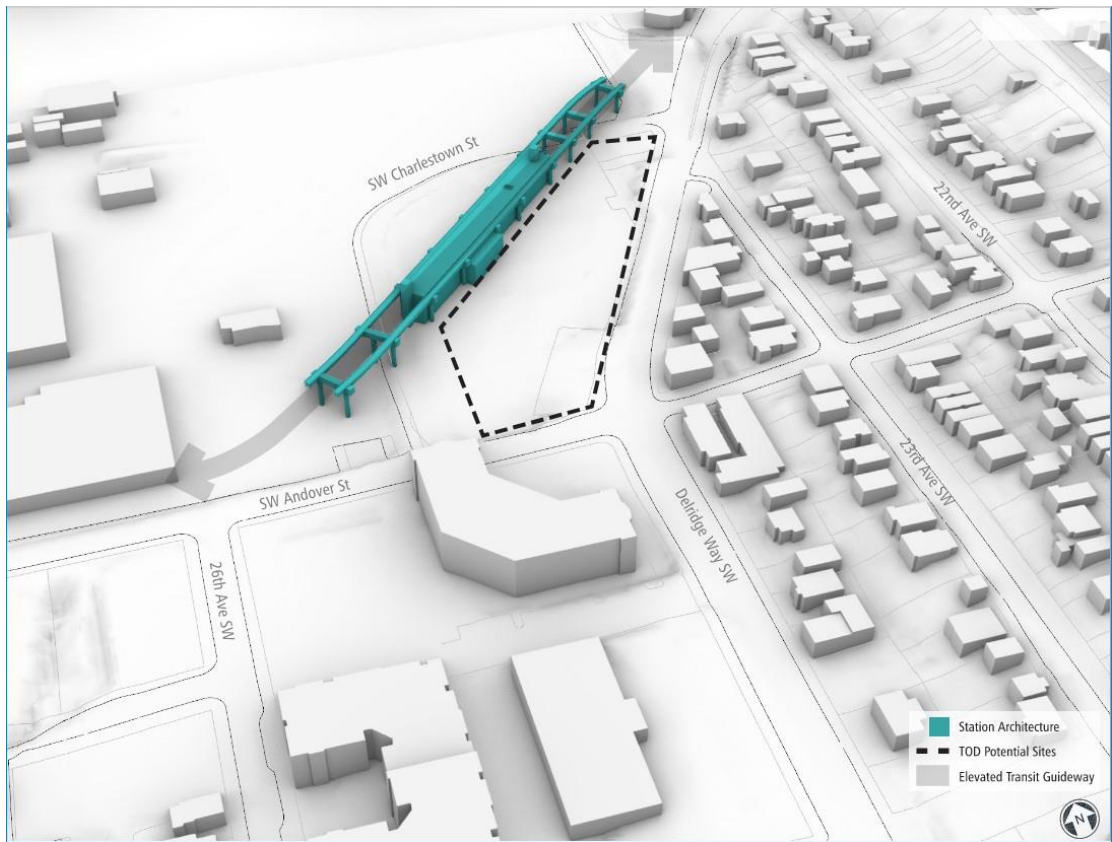
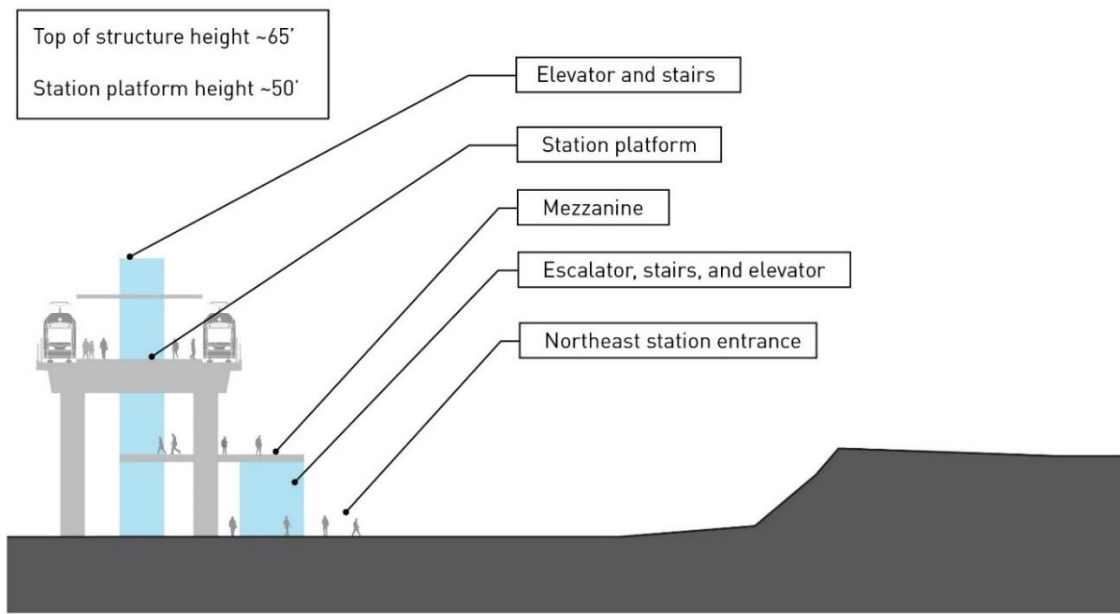


Figure 4.5-11. Delridge Station Cross Section for Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL 7



Note: Heights shown are for Alternative DEL-6b.

4.5.4.4.2 City of Seattle Designated Scenic Routes and Public View Protection

Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7 are the only alternatives in the Delridge Segment that would be near a City of Seattle Designated Scenic Route (the West Seattle Bridge). With Alternative DEL-6a located adjacent to Fauntleroy Way Southwest on the west end of the Delridge Segment, the alignment transitions to at-grade and to a retained-cut condition. Ancillary components such as catenary poles would be noticed by travelers for a brief period; however, due to the depth of the alignment's retained-cut condition, the exposure to residential buildings along 32nd Avenue Southwest would be similar to the current conditions. The elevated guideway or tunnel would not have an effect on City of Seattle protected views.

With the exception of the West Seattle Golf Course, the Delridge Segment alternatives would not intrude upon views from City of Seattle specified viewpoints, parks, or view corridors of Mount Rainier, the Olympic and Cascade mountains, the downtown skyline, or Puget Sound. The West Seattle Golf Course was selected as a KOP, and views of the downtown skyline from this KOP would be partially blocked by Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4. Simulations of views from the West Seattle Golf Course can be seen in Attachment N.2A.

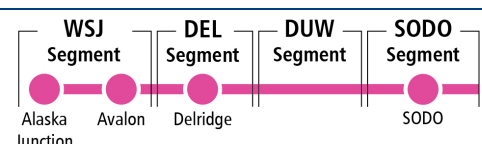
4.5.4.4.3 Light, Glare, and Shadows

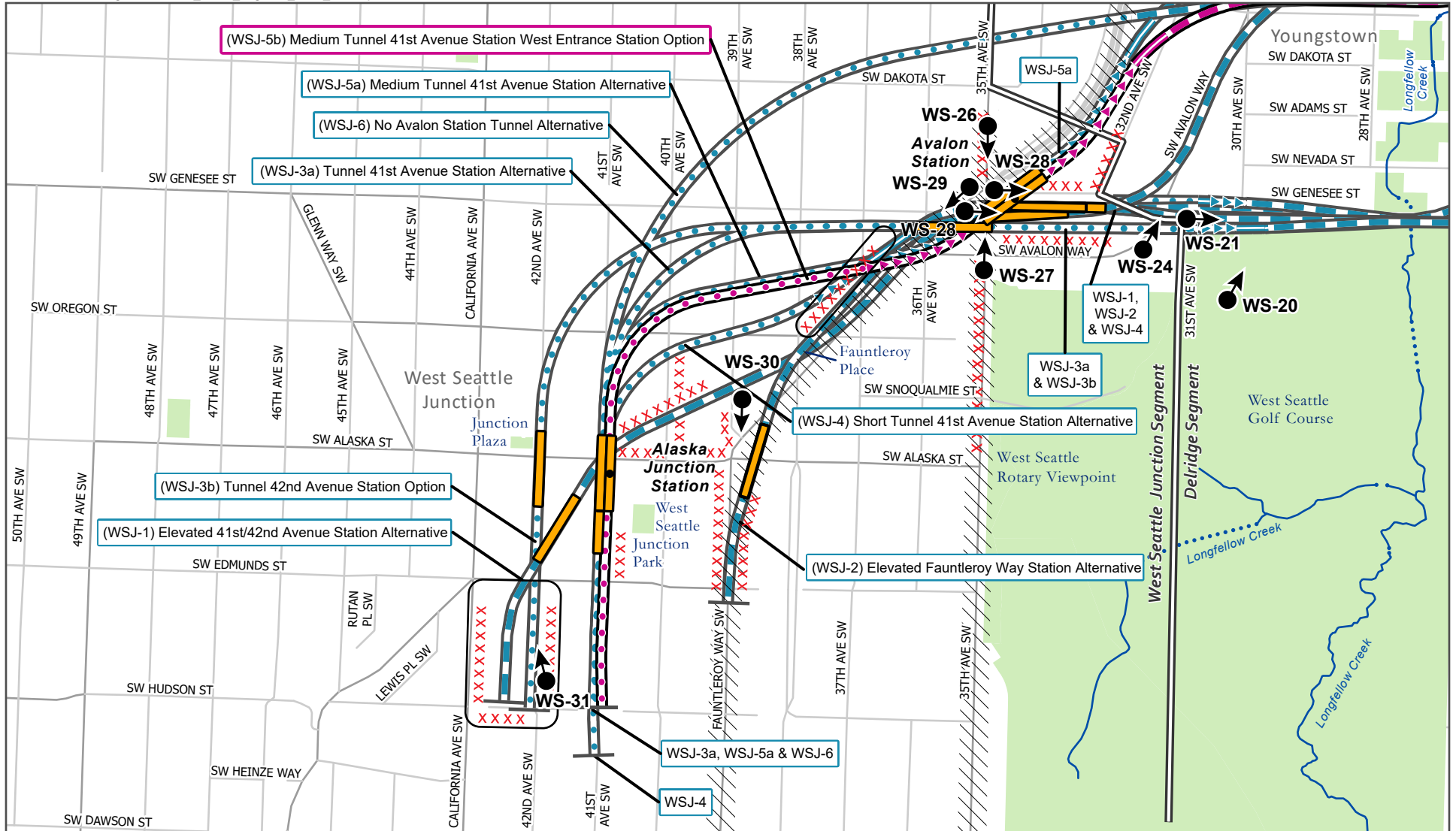
Lights from the elevated Delridge Station would be designed in accordance with Sound Transit design measures and would not have an impact on the surrounding area. Light and glare for passing trains would be most visible with Alternative DEL-1a, Option DEL-1b, and Alternative DEL-3, particularly at night between Delridge Way Southwest and Southwest Avalon Way. Train lights would also be visible from the lower elevation guideways associated with the other Delridge Segment alternatives, but to a lesser degree. Light and glare from Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would be seen from multi-story residences on Southwest Andover Street, 26th Avenue Southwest, Southwest Yancy Street, and 32nd Avenue Southwest, respectively. Preferred Option DEL-6b and Alternative DEL-6a would also remove trees next to the West Seattle Bridge on-ramp that would eliminate the screening value of the trees that now screen lights from vehicles on the on-ramp.

Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would cast shadows on the southern edge of the Longfellow Creek Natural Area adjacent to Southwest Genesee Street and the north end of the West Seattle Golf Course. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would not cast shadows on open spaces used by the public.

4.5.4.5 West Seattle Junction Segment

The West Seattle Junction Segment, which would have above-ground and below-ground components, contains nearby concentrations of sensitive viewers. Figure 4.5-12 shows the KOPs where simulations were developed, identifies areas with concentrations of sensitive viewers, identifies areas where there would be visual impacts, and identifies City of Seattle Designated Scenic Routes. Cross sections and 3D views of some stations are shown in the following section to illustrate the general height, bulk and scale of the stations (see Attachment N.2B in Appendix N.2 for the complete set).





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

Segment Line

Stream

Piped Stream

Park



Key Observation Point (KOP) and View Direction



City of Seattle Designated Scenic Route

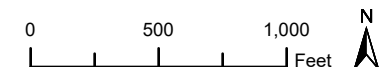


Location of impact to visual quality with one or more alternatives near areas with concentrations of sensitive viewers

Approximate Areas with Concentration of Sensitive Viewers

FIGURE 4.5-12
Visual Setting and Impacts
West Seattle Junction Segment

West Seattle Link Extension



4.5.4.5.1 Areas with Concentrations of Sensitive Viewers

Preferred Option WSJ-5b and Alternative WSJ-5a would result in the removal of single-family residences between the West Seattle Bridge on-ramp and the southern portion of 32nd Avenue Southwest (see Figure 4.5-13). These alternatives would also result in the removal of single-family residences along Southwest Genesee Street. The removals could change the existing residential visual character of views from remaining residences to more of a transportation visual character. Although the removal of residential buildings and associated vegetation in a residential neighborhood would be very noticeable to residents, the average visual quality of views from the remaining residences toward Preferred Option WSJ-5b would not be reduced and would not be considered a visual impact.

Figure 4.5-13. Preferred Option WSJ-5b: Looking South along 35th Avenue Southwest toward Intersection with Fauntleroy Way Southwest



Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, and Alternative WSJ-5a would also remove some residences in the Southwest Genesee Street area near the Avalon Station and remove residences near the Alaska Junction Station. The removal of the residences would change the existing residential character of these areas to a vacant lot (that will be developed in the future). None of these tunnel alternatives (Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, and Alternative WSJ-5a) would lower the average visual quality of views in these areas. Existing retail and commercial buildings at the intersection of 35th Avenue Southwest and Southwest Genesee Street would be removed, but the visual quality of the view from the residences along 35th Avenue Southwest would slightly increase to average, or would remain low, and there would not be a visual impact. Figures 4.5-14 and 4.5-15 show an Avalon Station 3D view and cross section under Preferred Option WSJ-5b.

Figure 4.5-14. Avalon Station 3D View for Preferred Option WSJ-5b

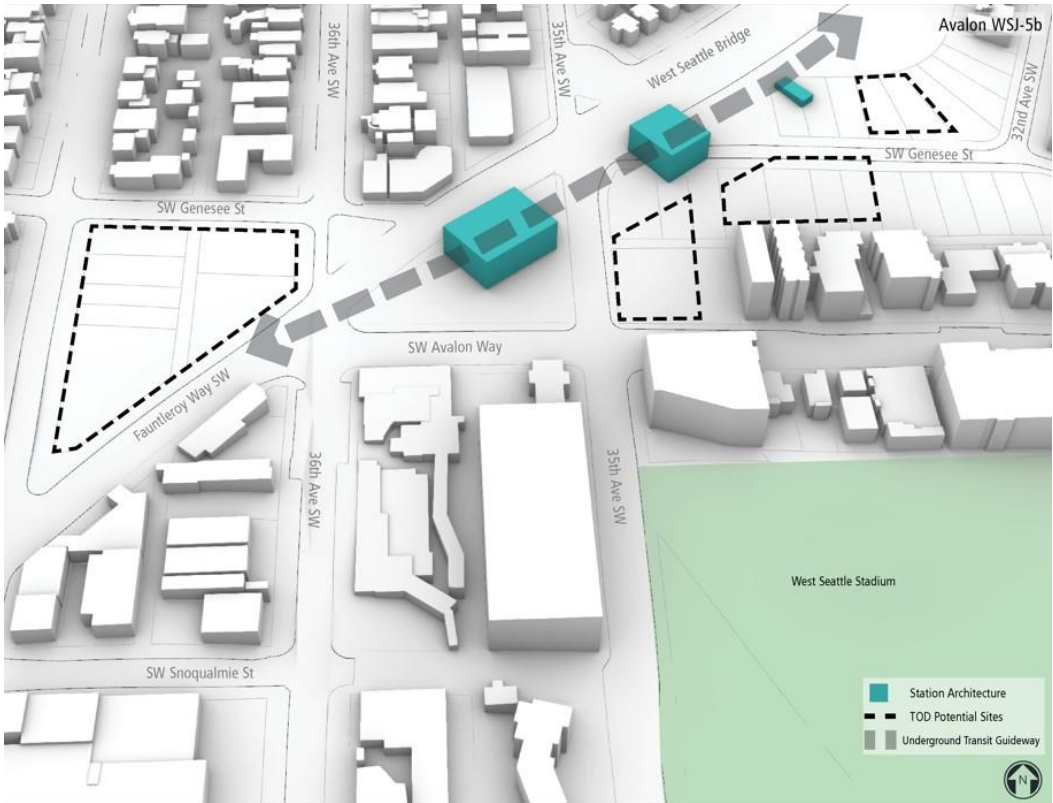
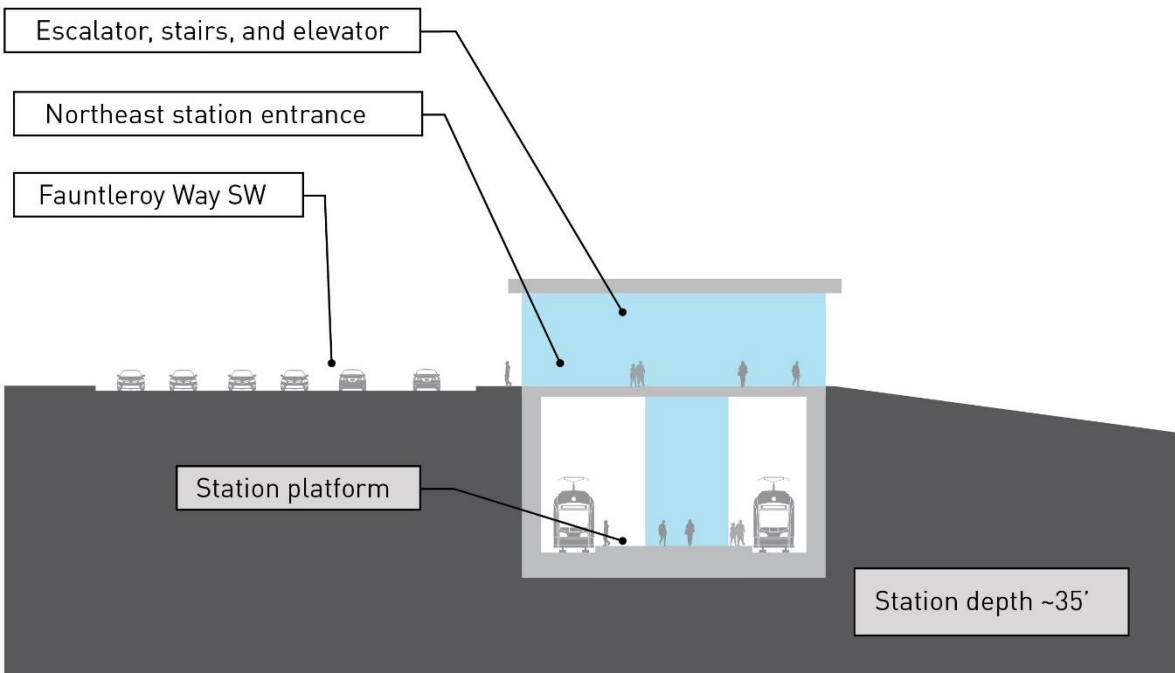


Figure 4.5-15. Avalon Station Cross Section for Preferred Option WSJ-5b



In Figure 4.5-13 (Preferred Option WSJ-5b), the view is from residential viewers to the north of Fauntleroy Way Southwest looking southeast across this major intersection. The above-ground portion of the east and west station buildings would not change the memorability of the view because it would blend into this view in architectural size and style. The intactness of the view would increase by replacing surface parking and strip retail buildings on both sides of the intersection. The station architecture would add to the unity of the view by appearing more in common with the contemporary large-scale multi-family buildings and by mirroring the east and west buildings. The addition of the east and west entrance buildings would simplify an otherwise visually disconnected setting consisting of commercial, retail, and residential land uses. The east and west station buildings would be of a similar scale and height as the existing residential development. The vividness would remain as low average, and the intactness and unity would increase to low average, therefore increasing the overall visual quality to low average. The influence of Alternative WSJ-5a on the visual quality of this view would be similar to that of Preferred Option WSJ-5b. The low visual quality rating would increase to low average, which would be a visual quality benefit.

Alternative WSJ-6 would result in the least amount of visual change because it would enter a tunnel within the Delridge Segment on the east side of the West Seattle Bridge, and the alignment and light rail vehicles would not be visible through the entire West Seattle Junction Segment.

Station entrances for Preferred Option WSJ-5b, Alternative WSJ-5a, and Alternative WSJ-6 would be a similar height, bulk, and scale as the adjacent buildings. The stations would increase the visual coherence of the area and would be considered a visual benefit. Figures 4.5-16 and 4.5-17 show the configuration, height, bulk, and scale of the Alaska Junction Station for Preferred Option WSJ-5b as an example of a tunnel Alaska Junction Station.

With Alternative WSJ-3a, the station building would be on the west side of this major intersection. The station platform would be at the tunnel level and unseen in this view. The above-ground portion of the station would not add to the memorability of the view because it would blend into the setting with both architectural scale and style. Likewise, vividness would remain the same because the view of the hilltop and trees would remain. The intactness of the view would increase by replacing the strip retail buildings. The station building would add to the unity of the view by appearing more in harmony with the contemporary large-scale multi-family buildings. The addition of the station would simplify an otherwise visually disconnected setting consisting of commercial, retail, and residential. The station building would be of a similar scale, height, and bulk as the existing residential development. The view intactness and unity would improve to low average, therefore increasing the overall visual quality to low average. This alternative would have a visual quality benefit.

The Alternative WSJ-1 and Alternative WSJ-2 elevated guideways would change the appearance of the West Seattle Junction area the most. The alternatives would connect with the Avalon Station, the top of which would be between approximately 60 and 80 feet high. Although this height would be much higher than the single-family residences that would remain north of Southwest Genesee Street, it would be similar to the five- to six-story multi-family residential buildings that line Southwest Avalon Way to the south of the Avalon Station. The scale and character of the stations and elevated guideways associated with these alternatives would be different than the residential character of areas to the north but would be similar to the dense urban scale and residential character of the area to the south.

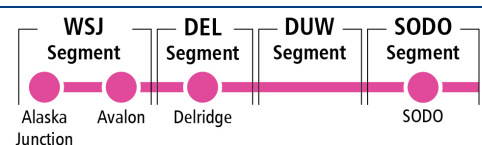


Figure 4.5-16. Alaska Junction Station 3D View for Preferred Option WSJ-5b

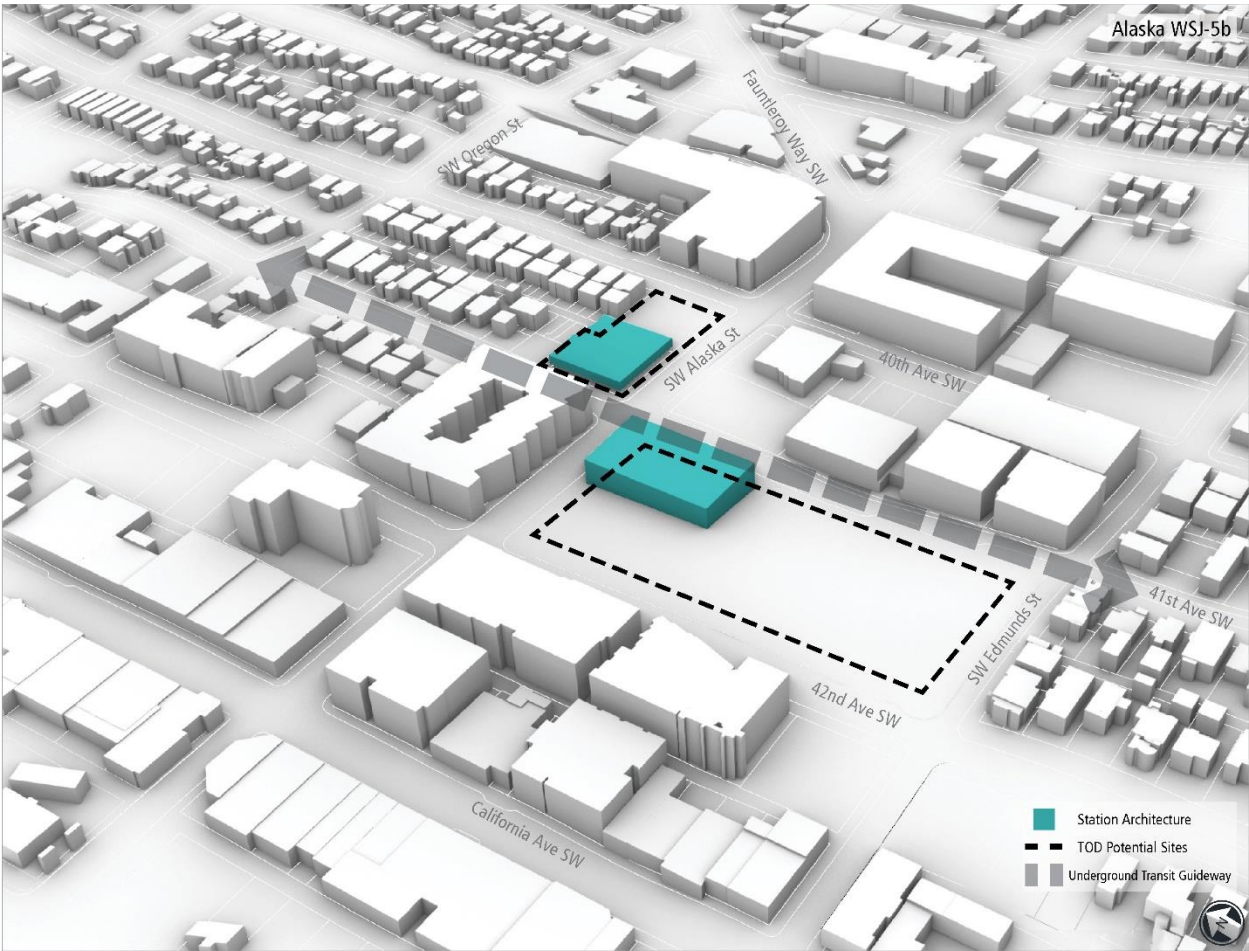
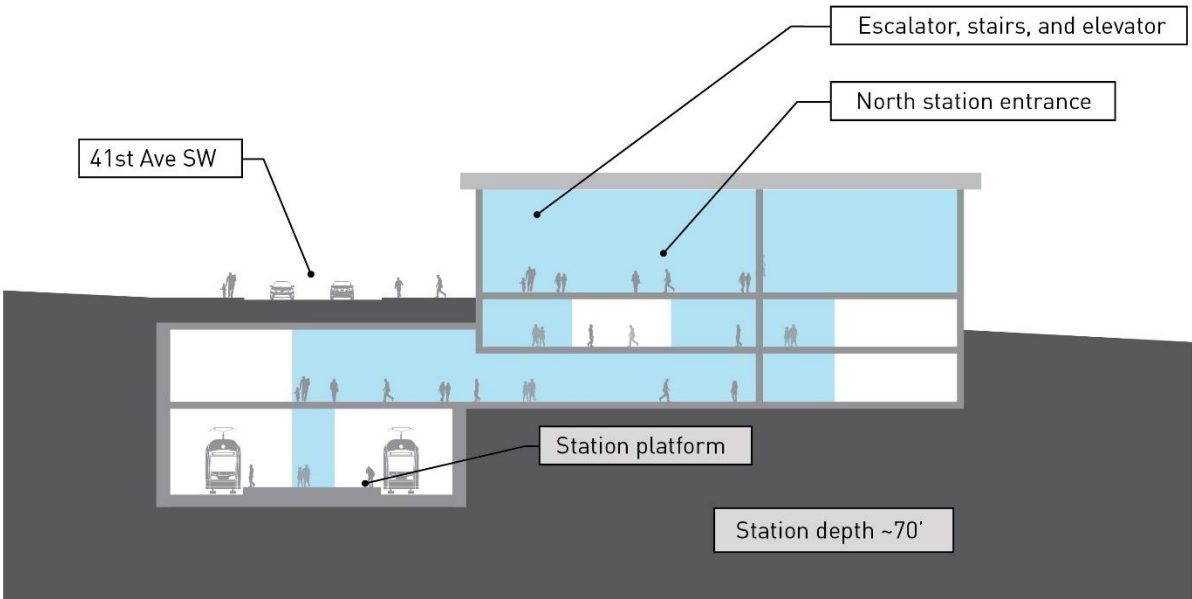


Figure 4.5-17. Alaska Junction Station Cross Section for Preferred Option WSJ-5b



Throughout the remainder of this segment, Alternative WSJ-2 would have the most visual quality impacts (Table 4.5-3). The removal of buildings and vegetation to accommodate the elevated guideway in the area northwest of Fauntleroy Way Southwest between 36th Avenue Southwest, 37th Avenue Southwest, and 38th Avenue Southwest would open up views to the south from remaining residences. Most views to the south in these areas are currently blocked by the buildings and trees that would be removed. The new open views to the south would include Fauntleroy Way Southwest and the elevated guideway (which would range from about 30 to 80 feet in height) which would change the residential character of most of the views to transportation. The existing average visual quality of views to the south from the remaining residences would not change.

Alternative WSJ-1 would pass along the south side of Fauntleroy Way Southwest at heights of approximately 70 to 80 feet and would remove fewer buildings on the north side of this part of Fauntleroy Way Southwest compared to Alternative WSJ-2. It would not reduce the overall average visual quality of views to the south from areas with concentrations of sensitive residential viewers. The Fauntleroy Place greenspace would be permanently removed with both Alternative WSJ-1 and Alternative WSJ-2, so there would be no visual impacts to views from the removed greenspace. Adjacent residential viewers would see a change of visual character in the neighborhood with an elevated guideway but due to the alignment being consistent with an existing transportation system it would not be enough to change the visual quality.

Table 4.5-3. West Seattle Junction Segment Visual Quality Impacts to Concentrations of Sensitive Viewers

Alternative or Design Option	Visual Impacts (miles)	Where Visual Impacts Would Occur
Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	0	None
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	0.1	Residences along 42nd Avenue Southwest, Southwest Hudson Street and California Avenue Southwest
Elevated Fauntleroy Way Station Alternative (WSJ-2)	0.2	Residences along 36th Avenue Southwest, 37th Avenue Southwest, 38th Avenue Southwest
Tunnel 41st Avenue Station Alternative (WSJ 3a)	0	None
Tunnel 42nd Avenue Station Option (WSJ-3b)	0	None
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	0	None
Medium Tunnel 41st Avenue Station Alternative (WSJ-5)	0	None
No Avalon Station Tunnel Alternative (WSJ-6)	0	None

Most of the impacts to visual quality from Alternative WSJ-1 would occur at the south end of the alignment, where the elevated tail track and hi-rail access would remove residences along the west side of 42nd Avenue Southwest between Southwest Edmunds Street and Southwest Hudson Street. Tail tracks would be needed to allow for the temporary layover of a train and could allow trains to switch tracks. Hi-rail access would be needed so that hi-rail vehicles (which can operate on both rail tracks and conventional roads) could reach the guideway for track inspection and maintenance.

Removal of these residences for the tail track and hi-rail access would change the visual character of this area from residential to transportation facility (represented in KOP WS-31). The existing high average visual quality of views toward this area from remaining residential areas would be reduced to low, which would be a visual impact.

None of the Build Alternatives would impact visual quality in the Alaska Junction area north of Southwest Edmunds Street and south of Southwest Oregon Street. However, the alternatives with elevated guideways and stations would change the existing visual character of the area.

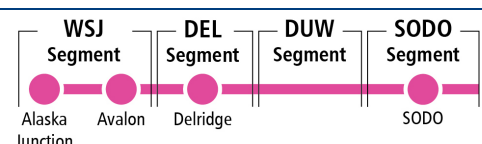
The Alternative WSJ-1 and Alternative WSJ-2 stations at Alaska Junction would remove buildings and would be approximately 60 to 80 feet high. The height, bulk, and scale of the stations might differ from some of the land uses that would remain next to them, but would be similar to the height, bulk, and scale of multi-story, mixed-use buildings that are being developed and will continue to be built in the area. The stations would add urban elements into this area that would increase the visual vividness and improve visual quality slightly from average to high average.

The Alaska Junction Station for Preferred Option WSJ-5b would be constructed in an area currently containing small commercial buildings and a parking lot. The elevated station, plaza, and guideway would be more memorable elements in this view than the current mix of land uses and buildings. The height, bulk, and scale of the elevated Alaska Junction Station would be compatible with nearby buildings and follow the street pattern in this location. The station and its associated plaza would simplify the visually complex intersection area and add a unifying architectural element. The low visual quality of views toward the intersection that are seen by nearby residences would improve to average, which would be a beneficial change.

Alternative WSJ-4 would have an Avalon Station about 60 to 70 feet high. The height, bulk, and scale of the station might differ from some of the land uses that would remain next to it, but would be similar to the height, bulk, and scale of multi-story, mixed-use buildings that are being developed and will continue to be built in the area. The Alternative WSJ-4 elevated guideway would be approximately 40 feet high, which would be closer in height to nearby multi-family buildings. Alternative WSJ-4 would remove single-family residences along either side of Southwest Genesee Street and, after passing over Fauntleroy Way Southwest, would remove buildings and vegetation north of Fauntleroy Way Southwest. The new open views to the south from remaining residences would include Fauntleroy Way Southwest and the elevated guideway, which would change the character of most of the views from residential to transportation. The average visual quality of views in these residential areas would be reduced to low average, which would not be a visual impact. This alternative would have an Alaska Junction Station in a tunnel, and the station entrances would be similar in height, bulk, and scale to the surrounding land uses.

4.5.4.5.2 City of Seattle Designated Scenic Routes and Public View Protection

Alternative WSJ-2 would twice pass over the section of Fauntleroy Way Southwest that is a City of Seattle Designated Scenic Route. The elevated guideway would not intrude upon or block views of notable features such as the Downtown Seattle skyline. These alternatives would not intrude upon views from City of Seattle specified viewpoints, parks, or view corridors of Mount Rainier, the Olympic and Cascade mountains, the downtown skyline, or Puget Sound.



The southwestern portion of the West Seattle Bridge does not have views of any City-specified notable features, so none of the alternatives would block important views. Preferred Option WSJ-5b and Alternative WSJ-5a would parallel the West Seattle Bridge, which is a City of Seattle Designated Scenic Route. Residences and some vegetation that currently screen views to the east from the bridge would be removed, and views to the east may be opened up to views of the residential buildings.

Along 35th Avenue Southwest, the distant presence of the elevated guideway of the Preferred Option WSJ-5b, Alternative WSJ-2, and Alternative WSJ-5a alignments in the background of the view looking north would not intrude on views due to the natural topography, existing buildings, and existing vegetation in the foreground.

4.5.4.5.3 Light, Glare, and Shadows

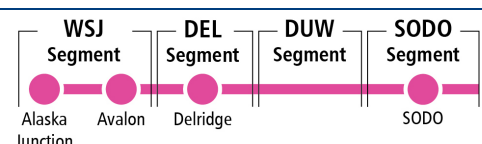
Although vehicle lights along Fauntleroy Way Southwest and nearby streets are common sights along most of the West Seattle Junction Segment, lights on elevated light rail trains would be new additions seen by residents. Lights from elevated stations in this segment would be seen from nearby locations, including some buildings containing sensitive residential viewers. Lights from the elevated Avalon and Alaska Junction stations would be designed in accordance with Sound Transit design measures and would not have an impact on the surrounding area. The tail track and hi-rail vehicle access lighting would be seen from nearby residential areas. Views of lights from passing trains could be disturbing to some residents. Approaches to reduce potential light impacts are described in the design measures discussion in Section 4.5.4.1, Impacts Common to All Alternatives.

4.5.5 Environmental Impacts of the Build Alternatives during Construction

Activities related to building the project would have temporary impacts on the visual environment. Section 2.7, Construction Approach, in Chapter 2 provides an overview of potential construction activities and timing. Many of the construction activities would be seen by sensitive viewers. These activities would include moving and storing equipment and materials; exposing soils; glare and lights associated with nighttime construction; storing construction materials; the presence of construction equipment such as cranes, in-water equipment, and barges for bridge construction; installing and using work trestles on Pigeon Point, and making general visual changes to the viewed landscape during the project construction period.

Guideway construction is estimated to take between 2 and 4 years, bridge construction over the Duwamish Waterway between 3 and 5 years, and station construction between 2 and 4 years. Tunnel and tunnel portal construction is expected to take approximately 2 years. All of these activities would be seen by the public and some would be near and seen by sensitive viewers. Staging areas would be throughout the project corridor and would range in size from about 1 to 5 acres, depending on the location and construction activity. Views toward the project by sensitive viewers would change during the construction period, and there would be impacts of varying degrees.

During construction, Sound Transit would provide visual screening along some areas where construction activities would be seen by nearby sensitive viewers. Visual screening would include construction of a barrier to screen ground-level views into construction areas where practical. Nighttime construction lighting would be shielded and directed downward to avoid light spillover onto adjacent sensitive uses.



4.5.6 Indirect Impacts of the Build Alternatives

The project could support changes to nearby land uses, as allowed in adopted plans. Increases in the density of development as allowed by zoning could occur. This might result in changes to the visual setting of the areas where the project would create changes and support new and more dense development around station areas.

4.5.7 Mitigation Measures

In addition to the design measures described in Section 4.5.4.1, Sound Transit has developed mitigation measures for areas with visual impacts. Site-specific mitigation measures are described below by segment. The design of structures associated with the preferred alternatives (including access ramps, traction power substation facilities and vent structures) will continue to be refined through preliminary design to minimize visual impacts to surrounding sensitive viewers. The areas for each segment where there would be visual impacts are identified on Figures 4.5-1, 4.5-2, and 4.5-12 (shown with ovals). Most of the visual quality impacts would be mitigated by planting screening vegetation where appropriate and where it meets the Sound Transit safety clear zone and setback requirements along the edge of construction footprints or within residential properties (if desired by residents). The vegetation would screen views of new project components and/or areas that are currently screened by vegetation that would be removed. Existing plant material would be protected to the extent possible to preserve a sense of scale and history. Plant material would be used to enhance the visual quality of the station areas and to integrate them with their surrounding environment. Plant selection would be adaptive plants that are suitable for the northwest climate and the environment in which they are planted. Mitigation measures would be further refined if necessary in coordination with the City of Seattle as the project design advances.

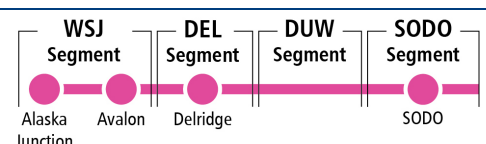
It should be noted that the use of vegetation to buffer or screen views of Build Alternative elements would not provide immediate mitigation. Depending upon the vegetation's location in relationship to sensitive viewers, distance to Build Alternative elements, size of the elements, and the growth rates of the vegetation selected, effective screening of the elements could take between 5 years and 10 years and perhaps as many as 15 years. Impacts associated with some of the higher elements of the alternatives, such as bridges crossing the West Waterway or the taller alternatives passing along Southwest Genesee Street, could not be completely mitigated by vegetative screening. The impacts of these elements on sensitive viewers could be lessened with the strategic planting of vegetation, but the elements themselves would be too large to screen and they would produce unavoidable impacts.

4.5.7.1 Duwamish Segment

4.5.7.1.1 Area 1: Residential Areas along 22nd Avenue Southwest and 23rd Avenue Southwest

The following measure would apply to Preferred Alternative DUW-1a and Option DUW-1b:

- Following construction, plant vegetation where appropriate to screen views of areas to the west, elevated guideway, and Delridge Way Southwest from remaining residences on 23rd Avenue Southwest.



4.5.7.2 Delridge Segment

4.5.7.2.1 Area 1: Residences along Delridge Way Southwest and 23rd Avenue Southwest from Eastern Edge of Segment to Southwest Andover Street

The following measure would apply to Preferred Option DEL-6b, Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, Alternative DEL-4, and Alternative DEL-7:

- Following construction, plant vegetation where appropriate to screen views of areas to the west, the elevated guideway, and Delridge Way Southwest from remaining residences on 23rd Avenue Southwest.

4.5.7.2.2 Area 2: 23rd Avenue Southwest South of Southwest Andover Street

The following measure would apply to Alternative DEL-3 and Alternative DEL-4:

- Following construction, plant vegetation where appropriate to screen views of elevated guideway, Delridge Way Southwest, and views to the west from remaining residences on 23rd Avenue Southwest.

4.5.7.2.3 Area 3: Delridge Way Southwest, 25th Avenue Southwest, and 26th Avenue Southwest

The following measure would apply to Preferred Option DEL-6b, Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, Alternative DEL-4 and Alternative DEL-7:

- Following construction, plant vegetation where appropriate to screen views of elevated guideway and station from remaining residences along Delridge Way Southwest, 25th Avenue Southwest and 26th Avenue Southwest.

4.5.7.2.4 Area 4: Delridge Playfield and Community Center

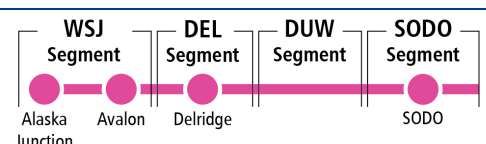
The following measure would apply to Alternative DEL-1a, Option DEL-1b, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4:

- Following construction, plant screening vegetation where appropriate in the northwest edge of the park, if the City of Seattle desires, to screen views of the elevated guideway.

4.5.7.2.5 Area 5: West Seattle Golf Course

The following measures would apply to Alternative DEL-1a, Option DEL-1b, and Alternative DEL-3:

- Although the elevated guideways could not be screened by vegetation, following construction, plant vegetation where appropriate to screen views of Southwest Genesee Street and to frame views of the downtown skyline.
- Following construction, plant vegetation in a manner and pattern similar to the vegetation within the golf course removed for construction.
- For Option DEL-2b, no mitigation measures are proposed because there are no opportunities for screening views of the guideway.
- Applies to Alternative DEL-2a and Alternative DEL-4.



- Redesign and revegetate the north end of the golf course that would be impacted and include vegetative screening where appropriate to block views of the elevated guideway, transition to the portal, and portal.

4.5.7.2.6 Area 6: Residential Areas North of Southwest Genesee Street and Longfellow Creek Natural Area

The following measures would apply to Preferred Option DEL-6b, Alternative DEL-1a, Alternative DEL-2a, Alternative DEL-3, Alternative DEL-4, and Alternative 7:

- Following construction, plant vegetation where appropriate that would not conflict with the light rail operations in front of remaining residences on the north side of Southwest Genesee Street to replace vegetation removed for construction.
- Following construction, plant screening vegetation where appropriate along perimeter of stormwater detention facility to block views from adjacent residences.

The following measure would apply only to Option DEL-1b and Option DEL-2b:

- Following construction, replant vegetation that would not conflict with light rail operations in front of remaining residences on north side of Southwest Genesee Street to replace vegetation removed for construction.

4.5.7.2.7 Area 7: Southwest Avalon Way

Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would place an elevated guideway over the center of Southwest Avalon Way that would be clearly seen by adjacent residents, but there are no mitigation measures that could reduce its impact. Therefore, no mitigation measures are proposed in this area.

4.5.7.2.8 Area 8: Southwest Yancy Street

The following measure would apply to Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7:

- Following construction, plant vegetation where appropriate to help screen views of the elevated guideway from remaining industrial buildings on both sides of Southwest Andover Street and Southwest Yancy Street.

4.5.7.2.9 Area 9: 32nd Avenue Southwest

The following measure would apply to Preferred Option DEL-6b, Alternative DEL-6a, and Alternative DEL-7:

- Following construction, plant vegetation where appropriate to help screen views of the elevated guideway from remaining residences on both sides of 32nd Avenue Southwest.

4.5.7.3 West Seattle Junction Segment

4.5.7.3.1 Area 1: North of Fauntleroy Way Southwest along 35th Avenue Southwest, 37th Avenue Southwest, 38th Avenue Southwest, and 39th Avenue Southwest

The following measure would apply to Alternative WSJ-1 and WSJ-2:

- Following construction, plant screening vegetation where appropriate along the edge of the construction footprint.

4.5.7.3.2 Area 2: Along 42nd Avenue Southwest and California Avenue Southwest

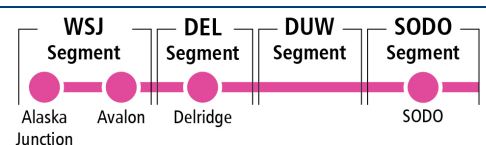
The following measure would apply to Alternative WSJ-1:

- Following construction, plant screening vegetation where appropriate along the edge of the construction footprint.

4.5.7.3.3 Area 3: Along 35th Avenue Southwest and Southwest Genesee Street

The following measure would apply to Alternative WSJ-1:

- Following construction, plant screening vegetation where appropriate along the edge of the construction footprint.



4.6 Air Quality

4.6.1 Introduction to Resource and Regulatory Requirements

This section discusses the potential long-term as well as short-term air quality impacts of the West Seattle Link Extension Project (the project). The analysis evaluates impacts of criteria pollutants, mobile source air toxics, and greenhouse gases during project construction and operation.

The Puget Sound Clean Air Agency, United States Environmental Protection Agency, and Washington State Department of Ecology work together in regulating air quality in the project corridor. Appendix L4.6A, Applicable Laws, Regulations, Guidance, and Policies, presents a list of federal, state, and local laws, regulations, guidance, and policies applicable to the air quality analysis for the project.

Criteria Pollutants

Six criteria air pollutants have been recognized by the United States Environmental Protection Agency as potentially harmful, and National Ambient Air Quality Standards have been established to protect the public health and welfare. These pollutants are particulate matter, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, and lead.

Mobile Source Air Toxics

Mobile source air toxics are hazardous air pollutants emitted from on-road and non-road vehicles, and can cause cancer and noncancer health risks. The nine priority mobile source air toxics include acetaldehyde, acrolein, benzene, 1,3-butadiene, diesel particulate matter, formaldehyde, ethylbenzene, naphthalene, and polycyclic organic matter.

Greenhouse Gases

Greenhouse gases accumulate in the atmosphere and influence long-term average atmospheric temperatures. Greenhouse gases include, but are not limited to, carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

4.6.2 Affected Environment

4.6.2.1 Regional Topography and Climate

The project is in the City of Seattle in King County within the Puget Sound Lowlands region. The climate in the region is a product of the interaction between large-scale wind and weather patterns and the complex topography of the region. Winter temperatures generally range from 10 degrees Fahrenheit to 45 degrees Fahrenheit, and summer temperatures generally range from 50 degrees Fahrenheit to 78 degrees Fahrenheit. Air pollution is usually most noticeable in the late fall and winter season, under conditions of clear skies, light wind, and a sharp temperature inversion. These conditions may prevail a few days before a weather system moves through that removes the pollution by wind and rain (Western Regional Climate Center 2023).

4.6.2.2 Criteria Pollutants

Air quality is affected by pollutants that are generated by both natural and human-made sources. In general, the largest human-made contributors to air emissions are fossil-fuel combustion sources such as transportation and industrial operations. The largest contributors of pollution related to transportation are motor vehicles. Pollutants of concern for transportation typically include carbon monoxide; particulate matter with aerodynamic diameter equal to or smaller than 10 micrometers (PM₁₀) and particulate matter with aerodynamic diameter equal to or smaller than 2.5 micrometers (PM_{2.5}); ozone and its precursors including nitrogen oxides and volatile organic compounds; mobile source air toxics; and greenhouse gases. Sulfur dioxide and lead are not pollutants of concern associated with light rail operation, light rail construction, or automobile emissions, and therefore are not discussed further in this analysis.

4.6.2.3 Existing Air Quality

The United States Environmental Protection Agency has established National Ambient Air Quality Standards to protect public health and welfare, with an adequate margin of safety. The Puget Sound Clean Air Agency monitors criteria air pollutant concentrations at several locations in Seattle. The monitoring stations closest to the project corridor are at 4700 East Marginal Way South, 4103 Beacon Avenue South, and 10th Avenue South and South Weller Street in the Chinatown-International District. Appendix L4.6B, Air Monitoring Data from the Study Area, shows the criteria air pollutant concentrations monitored at these stations during 2020 to 2022. Monitored concentrations of carbon monoxide, nitrogen oxides, PM₁₀, ozone, and sulfur dioxide are below the applicable National Ambient Air Quality Standards in all 3 years. Although the 98th-percentile 24-hour average concentrations of PM_{2.5} measured in 2020 are greater than the PM_{2.5} standard of 35 micrograms per cubic meter, the 98th percentile of the daily concentrations of PM_{2.5} averaged over 3 years is lower than the standard. Therefore, under current conditions, PM_{2.5} is not in violation to the National Ambient Air Quality Standard.

4.6.2.4 Attainment Status

The central Puget Sound region was classified as a nonattainment area by United States Environmental Protection Agency for carbon monoxide in 1978. In 2016, the Puget Sound region reached the end of a 20-year maintenance period for carbon monoxide, and transportation conformity is no longer required for carbon monoxide in the region (Puget Sound Regional Council 2022).

Key Terms

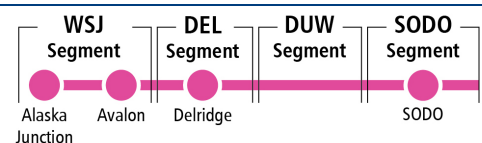
A **nonattainment area** is an area that does not meet the National Ambient Air Quality Standards.

Transportation Conformity is a process required by the Clean Air Act Section 176(c), which prohibits the federal agencies from funding, authorizing, or approving transportation plans, programs, or projects that do not conform to the State Implementation Plan for attaining the National Ambient Air Quality Standards.

Three areas in the Puget Sound region were designated as nonattainment for PM₁₀ in 1987, comprising the Seattle Duwamish Waterway industrial area, the Kent Valley, and the Tacoma Tideflats. In 2014, the United States Environmental Protection Agency approved a limited maintenance plan for these three areas, which ensured continued maintenance until 2021. On August 16, 2021, the areas reached the end of the 20-year maintenance period for PM₁₀; transportation conformity is no longer required for PM₁₀ in the region as of this date (Puget Sound Regional Council 2022). The project study area is in attainment/unclassified for nitrogen dioxide, PM_{2.5}, ozone, sulfur dioxide, and lead.

4.6.2.5 Mobile Source Air Toxics

Mobile source air toxics are hazardous air pollutants emitted from on-road and non-road vehicles that can cause cancer and noncancer health risks. Transportation projects may affect the regional or local air toxic concentrations due to the mobile source air toxics emissions from vehicles. Nationwide mobile source air toxics emissions are expected to be lower than present levels in future years as a result of United States Environmental Protection Agency's national emissions control programs and fuel economy standards. Estimated emissions using the United States Environmental Protection Agency's MOVES3 model indicate that even if vehicle miles traveled increase by 31 percent from 2020 to 2060 as forecast, a combined reduction of 76 percent in the total annual emissions for the priority mobile source air toxics is projected for the same time period. Diesel particulate matter is the dominant component of mobile source air toxics emissions, making up 36 to 56 percent of all priority mobile source air toxics pollutants by mass, depending on calendar year (Federal Highway Administration 2023).



Washington State Department of Ecology began monitoring air toxics at the Seattle Beacon Hill monitoring station in 2000. Carbon tetrachloride presented the highest potential cancer risk from air toxics monitored at the Seattle Beacon Hill site. Carbon tetrachloride is relatively common and has a long half-life, and concentrations are similar in urban and rural areas. Benzene ranked second, and it comes from a variety of sources including vehicle exhaust, wood burning, evaporation of industrial solvent, and other combustion (Puget Sound Clean Air Agency 2022).

4.6.2.6 Greenhouse Gases

Greenhouse gases include both naturally occurring and human-made gases that trap heat in the Earth's atmosphere. Greenhouse gases include, but are not limited to, carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These gases trap the energy from the sun and help maintain the temperature of the Earth's surface, creating a process known as the greenhouse effect. The accumulation of greenhouse gases in the atmosphere influences the long-term range of average atmospheric temperatures.

Carbon dioxide is the most abundant greenhouse gas; while it is a naturally occurring, necessary component of Earth's atmosphere, human activities such as burning fossil fuels, reducing the amount of forest cover, agricultural activities, and industrial activities also release carbon dioxide into the atmosphere. Fossil-fuel combustion is the main source of human-generated carbon dioxide, that is the main driver of climate change. Amounts of greenhouse gases are expressed relative to carbon dioxide, using a metric called carbon dioxide equivalent.

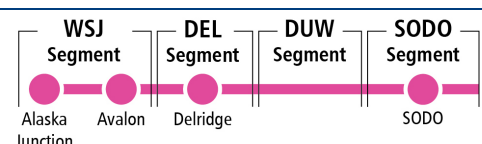
According to the greenhouse gases inventory for King County (Cascadia Consulting Group 2022), the community-wide geographic greenhouse gas emissions in 2019 and 2020 were 27.1 million and 22.9 million metric tons of carbon dioxide equivalent, respectively.¹ Total greenhouse gas emissions in 2019 increased 3 percent compared to the 2017 inventory year and increased 11 percent compared to the 2007 baseline inventory year. Total greenhouse gas emissions in 2020 decreased 13 percent compared to the 2017 inventory year and decreased 6 percent compared to the baseline inventory year. Overall greenhouse gas emissions in 2020 declined approximately 15 percent compared to just a year earlier in 2019—a drastic reduction in just 1 year. Because 2020 marked the beginning of the global COVID-19 pandemic, this reduction should not be interpreted as an indicator of long-term emissions sources or trends. The largest sources of greenhouse gas emissions were building electricity (26 percent in 2019 and 22 percent in 2020), transportation (24 percent in 2019 and 28 percent in 2020), and building natural gas (15 percent in 2019 and 16 percent in 2020).

4.6.2.7 Sensitive Receptors

Sensitive air quality receptors typically include residents and land uses where people are most vulnerable to air pollutants, such as hospitals, schools, daycare facilities, elderly housing, and convalescent facilities. Table L4.6B-1 in Appendix L4.6B is representative of the existing air quality conditions experienced by sensitive receptors near the proposed project.

The land uses in the vicinity of the project are commercial and industrial in the SODO and Duwamish segments with minimal sensitive receptors. Land uses in the Delridge and West Seattle Junction segments include mixed residential with some commercial uses with sensitive receptors such as schools, daycares, elderly housing, and healthcare facilities within 0.5-mile along the project corridor centerline.

¹ A community-wide geographic greenhouse gas emissions inventory quantifies the annual emissions produced within community boundaries due to community activities, such as on-road transportation and energy consumption. A geographic emissions inventory does not account for upstream emissions from goods and services consumed within the community, such as food or furniture.



4.6.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, vehicle miles traveled for cars and light trucks would increase over existing conditions due to regional growth by about 7 percent in 2042, as shown in Table 4.6-1. The future vehicle fleet would have lower emissions than the existing vehicle fleet due to improved emission control technology and fuel efficiency. There would be no construction-related greenhouse gas emissions because the project would not be built.

4.6.4 Environmental Impacts of the Build Alternatives during Operation

This section discusses the impacts of the Build Alternatives due to emissions of criteria pollutants and mobile source air toxics. Impacts from greenhouse gas emissions are discussed in Section 4.6.6, Greenhouse Gases and Climate Change.

Project impacts were evaluated based on the following analysis years and scenarios:

- 2019: existing condition
- 2042: No Build Alternative and Build Alternatives

The Build Alternative evaluated is a combination of alternatives intended to represent the range of alternatives for the project as described in Section 2.1, Build Alternatives, of Chapter 2, Alternatives Considered. Three Build Alternatives scenarios are evaluated in the air quality analysis:

- The low-cost scenario: includes Alternative SODO-1a, Preferred Alternative DUW-1a, Alternative DEL-5, and Alternative WSJ-2.
- The high-cost scenario: includes Alternative SODO-2, Preferred Alternative DUW-1a, Alternative DEL-4, and Alternative WSJ-3a.
- The Preferred Alternative: includes Preferred Option SODO-1c, Preferred Alternative DUW-1a, Preferred Option DEL-6b, and Preferred Option WSJ-5b.

The Build Alternative for 2042 includes Sound Transit 3 planned projects, due to the cumulative nature of the air quality analysis.

4.6.4.1 Criteria Pollutants

Vehicle emissions based on vehicle miles traveled in the Puget Sound region were compared for the No Build Alternative and project Build Alternatives. Vehicle emissions in the region would decrease when the region's vehicle miles traveled decreases. In the long-term, as shown in Table 4.6-1, regional vehicle miles traveled and average daily traffic in 2042 for the Build Alternatives would be lower than the No Build Alternative when some people switch from driving to using light rail, thereby reducing regional vehicle emissions of criteria pollutants, mobile source air toxics, and greenhouse gases. Regional passenger vehicle average daily traffic would decrease, while vehicle miles traveled or average daily traffic of heavy duty trucks would not change. The overall regional vehicle emissions are expected to decrease with the Build Alternatives, and the project is expected to have long-term benefits to regional air quality by reducing pollutants emissions from passenger vehicles.

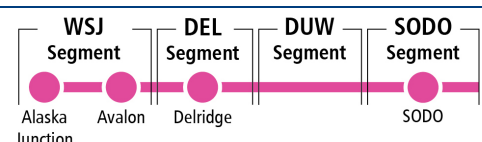


Table 4.6-1. Regional Vehicle Miles Traveled and Average Daily Traffic Change

Parameter	2019 Existing Condition	2042 No Build	2042 Build	Difference in 2042 Build versus 2042 No Build
Cars and light trucks (regional vehicle miles traveled per day)	79,532,300	85,366,700	85,351,300	-15,400
Heavy duty trucks (regional vehicle miles traveled per day)	9,011,700	11,269,700	11,269,700	0
Transit buses (regional vehicle miles traveled per day)	188,800	238,200	237,000	-1,200
Streetcar (regional vehicle miles traveled per day)	600	3,100	3,100	0
Cars/light trucks (average daily traffic)	10,432,700	11,994,200	11,991,900	-2,300
Heavy duty trucks (average daily traffic)	306,500	380,800	380,800	0
Transit buses (average daily traffic)	9,490	12,360	12,200	-160
Streetcar (average daily traffic)	170	330	330	0

4.6.4.2 Mobile Source Air Toxics

Sound Transit evaluated potential mobile source air toxics effects from project operation following the Federal Highway Administration’s memorandum, *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA* [National Environmental Policy Act] *Documents* (Federal Highway Administration 2023). Although there are no established criteria for determining when mobile source air toxics emissions related to transit projects should be considered a problem, the Federal Highway Administration guidance provides an approved approach to evaluating potential effects. According to the guidance, projects that improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that has meaningfully increased mobile source air toxics emissions are considered to have low potential mobile source air toxics effects.

The new light rail would be powered by electricity; thus, there would be no direct emissions of mobile source air toxics from the light rail operation. Because the project is expected to reduce regional vehicle miles traveled and would not involve adding diesel vehicle travel into the region, high levels of mobile source air toxics impacts are unlikely. However, the project may change localized vehicle traffic patterns at some locations, such as near the stations, which has low potential for mobile source air toxics effects.

The amount of mobile source air toxics emitted from vehicles traveling on roadways is proportional to the number of vehicle miles traveled, assuming other variables such as the roadway vehicle mix or light rail power source do not change. As shown in Table 4.6-1, the vehicle miles traveled for the Build Alternatives in the region would be lower than those for the No Build Alternative. As a result, the overall mobile source air toxics emissions from the Build Alternatives would decrease compared to No Build Alternative due to the removal of vehicles from roadways when people switch from driving to take light rail transit.

Light rail operations would have the potential to increase mobile source air toxics emissions when vehicles drive to or from the light rail stations. Therefore, under the Build Alternatives there may be localized areas where ambient concentrations of mobile source air toxics would be higher than under the No Build Alternative. However, the magnitude and the duration of these potential effects cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific health impacts. Also, on a region-wide basis, the United States

Environmental Protection Agency's vehicle and fuel regulations, coupled with fleet turnover, will cause substantial reductions over time such that in almost all areas the mobile source air toxics levels in the future will be substantially lower than today. Local conditions may differ from these national projections in terms of fleet mix and turnover, vehicle-miles-traveled growth rates, and local control measures. The United States Environmental Protection Agency projected reductions are so substantial, that even after accounting for vehicle-miles-traveled growth, mobile source air toxics emissions in the study area are likely to be lower in the future as well.

The mobile source air toxics analysis above is a basic analysis of the likely mobile source air toxics impacts of the proposed project. The limitations of information and methodology of the analysis is discussed Appendix L4.6C, Limitations of the Mobile Source Air Toxics Analysis.

4.6.4.3 Conformity Determination

As discussed in Section 4.6.2.4, Attainment Status, the Puget Sound region has reached the end of the 20-year maintenance period for carbon monoxide and PM₁₀; therefore, transportation conformity is no longer required for carbon monoxide and PM₁₀ in the region.

Nevertheless, the project is listed in Puget Sound Regional Council's long-range transportation plan, *The Regional Transportation Plan – 2022-2050* (Puget Sound Regional Council 2022). Inclusion of the project in the Regional Transportation Plan demonstrated that the project would be consistent with the regional Transportation Improvement Program and would not cause substantial adverse regional air quality impacts.

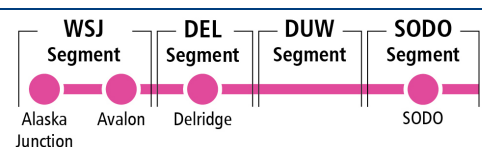
4.6.4.4 Minimum Operable Segment

With the West Seattle Link Extension Minimum Operable Segment (M.O.S.), the long-term reduction in pollutants and greenhouse gases would occur as described in Section 4.6.6.1, Greenhouse Gas Emissions, because vehicle miles traveled would be reduced as people switch from personal vehicles to light rail. However, because there would be fewer stations with the M.O.S. than with the full Build Alternatives, there would be less of a reduction in vehicle miles traveled and, consequently, less of a reduction of pollutants and greenhouse gases. Because the M.O.S. would be shorter than the full Build Alternatives, it would also have fewer air quality impacts during construction. Additional information about the M.O.S. is provided in Section 2.4, Minimum Operable Segment, in Chapter 2.

4.6.5 Environmental Impacts of the Build Alternatives during Construction

Project construction activities could result in short-term increases in dust and equipment-related emissions in and around the project construction area. Exhaust emissions during construction would be generated by fuel combustion in motor vehicles and construction equipment, and particulate emissions would result from soil disturbance, earthwork, and other construction activities. Construction vehicle activity and disruption of normal traffic flow may result in increased motor vehicle emissions within certain areas. Potential air quality impacts would be short-term, occurring only while construction work is in progress. Best management practices as described in Appendix L4.6D, Air Quality Best Management Practices, would be implemented to minimize air pollutants emissions during the construction phase.

Due to the cumulative nature of the greenhouse gas impacts, greenhouse gas emissions from the project construction are discussed in Section 4.6.6, Greenhouse Gases and Climate Change.



4.6.6 Greenhouse Gases and Climate Change

4.6.6.1 Greenhouse Gas Emissions

Lifecycle greenhouse gas emissions associated with the project construction and operation were quantified using the Federal Transit Administration's (FTA's) Greenhouse Gas Estimator V3.0 (FTA 2022). Lifecycle emissions for construction include those resulting from the embodied energy and emissions associated with the extraction, transport, and production of the materials (e.g., asphalt, concrete, base stone, and steel) used in the construction of the transportation facilities, the fuel used to transport materials to site, and the energy and fuel used in construction equipment. Lifecycle operation emissions include the upstream emissions associated with the extraction, production, and transportation of the vehicle fuel and the downstream emissions from the operation of a transit vehicle.

Greenhouse gas emissions were used as a proxy to evaluate the project's impacts to the environment, as discussed in the following sections. The greenhouse gas emission analysis was performed for the Build Alternatives in 2042, and included the low-cost, high-cost, and the Preferred Alternative scenarios. Detailed emissions calculations are provided in Appendix L4.6E, Greenhouse Gas Analysis.

The No Build Alternative is used as the baseline of the analysis. Greenhouse gas emissions from each scenario represent the net change compared to the No Build Alternative in each analysis year.

4.6.6.1.1 Operation Emissions

FTA's Greenhouse Gas Estimator V3.0 (FTA 2022) was used to estimate the lifecycle greenhouse gas emissions during project operation, including the upstream and downstream emissions from the facility operation and maintenance, transit vehicle operation and maintenance, and the displaced emissions due to reduced vehicle miles traveled. Light rail trains would be electrically powered, using 100 percent renewable energy; therefore, the project would not have greenhouse gas emissions from transit vehicle operations. In addition, Sound Transit would use 100 percent renewable hydroelectric energy for station electricity and heating and there would therefore be zero direct or indirect greenhouse gases emissions from station operation. The FTA Greenhouse Gas Estimator model estimates the station operation emissions based on the electricity and station heating needs, and it does not allow customized input of energy use and sources. For the reasons described above, the FTA Greenhouse Gas Estimator modeling output in Appendix L4.6E reports emissions for stations under facility operations, those emission data were not used in this analysis, as shown in Table 4.6-2. Displaced emissions were estimated based on the reduced vehicle miles traveled for the Build Alternatives. The reduced vehicle miles traveled are the same for the three scenarios of the Build Alternatives.

As shown in Table 4.6-2, the Build Alternatives would result in net decrease of greenhouse gas emissions in the horizon year of 2042. In the project horizon year of 2042, the Build Alternatives would have net decrease of greenhouse gas emissions due to the increase in light rail ridership and the subsequent reduction in regional vehicle miles traveled. Greenhouse gas emissions of the low-cost scenario would be lower than the emissions from the high-cost scenario and the Preferred Alternative. The reduced vehicle miles traveled with the project would help King County achieve its target of a 28 percent reduction in passenger vehicle traveled by 2050, which is needed in order to achieve greenhouse gas emissions reduction goals (Cascadia Consulting Group 2022).

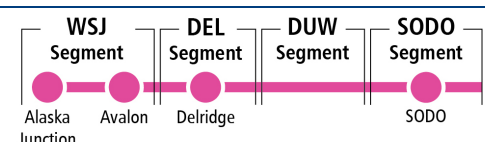


Table 4.6-2. Greenhouse Gas Operational Emissions from Project Operation in Year 2042 (Metric Tons Carbon Dioxide Equivalent per Year)

Scenario	Low-cost	High-cost	Preferred Alternative
Transitway Maintenance	39	46	41
Facility Operations ^a	0	0	0
Transit Vehicle Operations	0	0	0
Transit Vehicle Maintenance	19	19	19
Displaced Emissions from Reduced Vehicle Miles Traveled	-3,001	-3,001	-3,001
Annual Operation Emissions	-2,943	-2,936	-2,941

^a Facility operation emissions are set to zero because Sound Transit would use 100 percent renewable hydroelectric energy for stations operation.

4.6.6.1.2 Construction Emissions

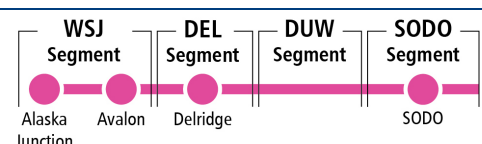
Greenhouse gas emissions from the project construction were estimated using the FTA *Transit Greenhouse Gas Estimator* (Estimator) V3.0 (FTA 2022). The Estimator is a Microsoft Excel–based spreadsheet tool that allows users to estimate greenhouse emissions generated from and the energy used in the construction, operation, and maintenance phases of a project across select transit modes. The Estimator is built off the Infrastructure Carbon Estimator, which is a related model that evaluates lifecycle greenhouse gas emissions for a broader range of transportation facilities. Users input general information about a project, and the Estimator calculates annual greenhouse emissions by project phase. The Estimator includes embodied emissions from the production and transport of fuel and materials. FTA describes the tool as providing “a resource to generate coarse but informative estimates of GHG [greenhouse gas] emissions using limited project information and can be used for a broad range of transit projects” (FTA 2022). Information entered into the model consists of length of track and stations by profile type (at-grade, tunnel, or elevated) and station profile type and size. As described below, the Estimator’s results do not necessarily reflect actual emissions, however, it does enable relative comparison of alternatives. Table 4.6-3 shows the estimated construction-related greenhouse gas emissions for each of the scenarios. Detailed emissions calculations are provided in Appendix L4.6E.

Table 4.6-3. Greenhouse Gas Emissions during Construction

Scenario	Total Construction Emissions (metric tons of carbon dioxide equivalent) ^a	Adjusted Total Construction Emissions (metric tons of carbon dioxide equivalent) ^b
Build Alternative: Low-cost	80,508	80,508
Build Alternative: High-cost	509,544	206,723
Build Alternative: Preferred	380,181	140,952

^a Construction emissions were modeled using FTA Transit Greenhouse Gas Emissions Estimator v3.0. The model inputs include miles of track by profile type (at-grade, elevated, or tunnel) and number of stations by profile type (at -grade, elevated, or tunnel).

^b Upstream construction material emissions estimates for tunnel trackway reduced by 90 percent based on a literature review of peer-reviewed studies as described below.

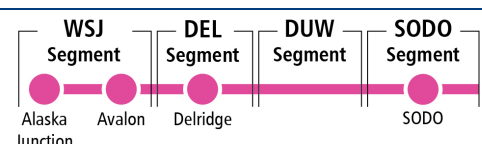


The low-cost scenario would have the lowest construction emissions and the high-cost scenario would have the highest construction emissions among the three scenarios analyzed. The largest contributor to these emissions are upstream (embodied) emissions from production of concrete, and tunnel construction is assumed to use the greatest amount of concrete in the FTA Greenhouse Gas Estimator. Calculations from the FTA Greenhouse Gas Estimator show the construction of tunnels producing approximately 395 times more upstream (embodied) emissions per track mile than at-grade guideway (FTA 2022). The quantification of embodied emissions is an emerging field and there is no single accepted model for estimating greenhouse gas emissions from construction. A relevant critical literature review was published in 2019 that estimated the emissions of light rail projects, and concluded that tunnel construction has 22 to 32 times more embodied carbon than at-grade construction per kilometer, an order of magnitude closer than the FTA Greenhouse Gas Estimator estimate (Olugbenga et al. 2019). Accordingly, the estimates of embodied material greenhouse emissions for tunnels were reduced by 90 percent in this analysis. It is expected that future versions of the FTA Greenhouse Gas Estimator will be updated with reduced estimates of concrete volumes for railway tunnels. These changes are expected to be consistent with pending updates to the Infrastructure Carbon Estimator.

The analysis of the social cost of greenhouse gas emissions estimates the monetary value of the net harm to society associated with emission of carbon dioxide, methane, nitrous oxide, or other greenhouse gases in a given year that contribute to climate change (United States Environmental Protection Agency 2023). Following guidance on analyzing greenhouse gases under NEPA (Council on Environmental Quality 2023), the social cost from the project is estimated based on the greenhouse gas emissions from the annualized construction and operation of the Build Alternatives in 2042 (see Table 4.6-2 and Table 4.6-3) multiplied by the social cost rates from the United States Environmental Protection Agency ². The social cost of greenhouse gas emissions in 2042, using the adjusted emissions in Table 4.6-3, would be \$-33,959 for the preferred alternative, -\$370,568 for the low-cost scenario, and \$333,213 for the high-cost scenario. Greenhouse gas emissions from the project in 2042, using the adjusted emissions in Table 4.6-3, would be equivalent to between a reduction of 317 (low-cost scenario) to 29 (preferred alternative) and an increase of 285 (high-cost scenario) gasoline-powered passenger vehicles driven for 1 year, as estimated using United States Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator (United States Environmental Protection Agency 2024).

To reduce embodied emissions, Sound Transit will use lower-carbon concrete, such as 1L concrete, for non-guideway construction at stations and for roadway improvements, as has been used on other Sound Transit projects in recent years. Sound Transit is committed to following best practices to lower the embodied carbon impact of the project. The technology and regional market opportunities of lower-carbon materials and construction practices continues to advance. The project team will be studying and incorporating new requirements for the contractor to lower the embodied carbon impacts overall. This effort builds on the work the agency has already done to lower the carbon footprint of cast-in-place concrete on maintenance buildings and parking garages. Lower-carbon concrete options for guideway and tunnel construction, steel, rebar, and other materials will be considered and included where practical. The project corridor is also in close proximity to concrete plants, which would minimize emissions associated with transport of the concrete to construction areas. Implementation of best management practices, such as using energy-efficient construction equipment and limiting the equipment and vehicle idling time during construction would reduce greenhouse gas emissions from construction activities.

² The projected 2.0 percent near-term discount rate per million tons of carbon dioxide was used in the social cost calculation. United States Environmental Protection Agency projects social cost rates at 10-year increments. The social cost rate of 2042 was linearly interpolated using 2040 and 2050 rates.



In addition, the greenhouse gas emissions from the construction phase of the project would be partially offset by the emission reduction during project operation due to the reduction of regional vehicle miles traveled, as indicated in Table 4.6-2. Emissions could be further offset beyond what is shown here by the “land-use effect.” This is described in FTA’s *Greenhouse Gas Emissions from Transit Projects: Programmatic Assessment* (FTA 2024) as follows: “In addition to reducing VMT [vehicle miles traveled], transit can help reduce congestion and spur more compact, transit-oriented development, thus avoiding GHG [greenhouse gas] emissions that may have otherwise occurred. Even residents who do not ride transit themselves reduce GHG emissions generated because transit enables denser land use patterns that promote shorter driving trips, fewer driving trips, more trips on foot or by bicycle, and a reduction in car ownership and use (TCRP [Transit Cooperative Research Program], 2021 and APTA [American Public Transportation Association], 2018). Some researchers believe that this “land use effect” may result in the largest GHG emissions reductions, albeit over a decade or longer timeframe given the pace of many development projects.”

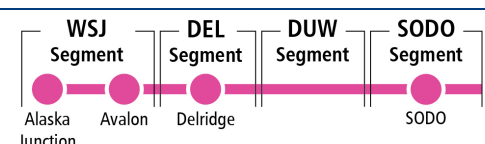
4.6.6.2 Resilience and Adaptation to Climate Change

Climate change is expected to produce increased variability in precipitation, rising temperatures, rising sea levels, variability in storm surges and their intensity, and in the frequency and intensity of floods and wildfires. Effects will vary by location and may, in the most extreme cases, require that a facility be relocated or redesigned. Accordingly, Sound Transit would consider these types of climate stressors in how transit projects are planned, designed, built, operated, and maintained.

The Intergovernmental Panel on Climate Change developed the current set of climate change scenarios in 2013, consisting of four greenhouse gas emissions trajectories called Representative Concentration Pathways for different greenhouse gas emission scenarios ranging from very low emissions to high emissions scenarios. According to the *Projected Changes in Key Drivers of Climate Change for the Puget Sound Region: An Updated Overview* (Sound Transit 2022), climate drivers and effects in the Puget Sound region include the following projections:

- Increases in temperature: Warming is projected to continue in the Puget Sound region for all emissions scenarios and seasons, with the most substantial temperature increases occurring in summer. Average annual temperature is anticipated to rise at least 4.2 degrees Fahrenheit after 2040, relative to the 1970 to 1999 average, accompanied by more frequent and intense heat waves and fewer and less intense cold snaps.
- Changes in precipitation: Average annual precipitation in the Pacific Northwest is expected to increase slightly. Seasonal precipitation is expected to shift, with summer rainfall declining 22 percent and winter precipitation increasing approximately 10 percent by 2050. Also, the frequency and intensity of extreme precipitation is projected to increase.
- Changes in hydrology, including streamflow and flood risk: Increased winter flooding and a 19 to 37 percent increase in the frequency of the 100-year flood event are projected. In summer, streamflow is expected to decline 16 to 27 percent by the 2080s, and the duration of low-flow periods is projected to increase.
- Sea level rise and storm surge: Sea level rise is highly likely to occur in the Pacific Northwest and varies by local elevation, land subsidence, tectonic shifts, and regional wind patterns. In Tacoma, Seattle, and Everett, sea level is projected to increase 2.2 to 2.5 feet by 2100.

Sound Transit is assessing vulnerabilities and resiliency strategies for the project to adapt the climate change effects. Section 2.1.2.3.8, Designing for Climate Change Resilience, includes additional discussion.

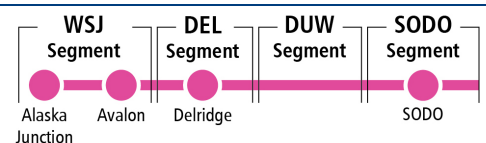


4.6.7 Indirect Impacts of the Build Alternatives

Indirect air quality impacts from a light rail project are usually related to the power generation that supplies the electricity to the light rail operation. The project would use electricity supplied by Seattle City Light that has achieved zero net greenhouse gas emissions since 2005. In addition, Sound Transit's 2019 *Sustainability Plan Update* (Sound Transit 2019) and the Sound Transit 3 Plan (Sound Transit 2016) committed the agency to reduce greenhouse gas emissions, expand the use of renewable energy, and make all facilities and electricity sources carbon neutral by 2030, and all energy used for operations, including diesel, carbon-free by 2050. Therefore, the indirect greenhouse gas emissions associated with the electricity use of the light rail operation and facility operation and maintenance would be minimal, as shown in Table 4.6-2. The greenhouse gas emissions discussed in Section 4.6.6 include both the direct emissions from the project construction and operation, and the indirect greenhouse gas emissions associated with the extraction, production, and transportation of the construction materials, fuel, and other energy consumptions.

4.6.8 Mitigation Measures

Operation and construction of the project would comply with federal, state, and regional regulations related to air quality. Potential impacts to air quality would be minimized or avoided through project planning, design, and the application of required best management practices during operation and construction, as described in Appendix L4.6D. With commitments to continue to evaluate lower carbon concrete options for guideway and tunnel construction, steel, rebar, and other materials and include them wherever practical, no mitigation is proposed for greenhouse gas emissions. The air pollutant analyses demonstrated that no substantial air quality impacts are expected to occur during the operation and construction of the project; therefore, no mitigation measures would be required.



4.7 Noise and Vibration

4.7.1 Introduction to Resource and Regulatory Requirements

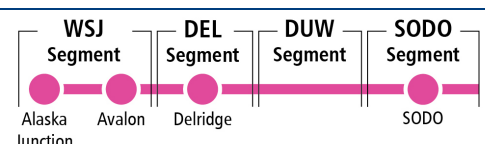
This section discusses the potential long-term and short-term noise and vibration impacts from the West Seattle Link Extension Project (the project). Noise levels were predicted at over 1,500 independent locations along the different alternative alignments in the project study area, representing all noise-sensitive properties in the study area. Vibration levels were also predicted for all sensitive receivers in the project study area where a potential for vibration impacts could occur. Potential noise impacts on fish and wildlife are described in Section 4.9, Ecosystems.

The Federal Transit Administration (FTA) criteria found in the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018) are the primary noise and vibration criteria by which transit-related impacts are identified. The following materials are also considered:

- Code of Federal Regulations Title 23 Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise
- Washington State Department of Transportation *Traffic Noise Analysis and Abatement Policy and Procedures* (2020)
- Sound Transit Light Rail Noise and Vibration Policy (Resolution No. R2023-15; 2023).
- Seattle noise control code, Seattle Municipal Code Chapter 25.08

This section includes a brief introduction to noise and vibration, including a discussion of FTA Noise Impact Criteria to provide context when evaluating project impacts and mitigation, followed by discussions of existing conditions, key differences between alternatives, and a summary of project impacts and mitigation. Appendix N.3, Noise and Vibration Technical Report provides more detailed information on acoustics and the transmission of noise and vibration from light rail operations and includes attachments that summarize the following:

- Noise measurement locations and results with site photographs (Attachment N.3A, Noise Measurement Data, Site Details, and Photographs)
- Vibration measurement site photographs and maps (Attachment N.3B, Vibration Measurement Site Photographs)
- Vibration propagation measurement results (Attachment N.3C, Vibration Propagation Measurement Results)
- Maps of noise impacts before mitigation and proposed mitigation (Attachment N.3D, Maps of Noise Impact Assessment)
- Maps of vibration and groundborne noise impacts before mitigation and proposed mitigation (Attachment N.3E, Maps of Vibration Impact Assessment)
- Tables of noise predictions and proposed mitigation (Attachment N.3F, Tables of Noise Predictions)
- Tables of vibration predictions (Attachment N.3G, Tables of Vibration Predictions)
- Vibration analysis of Category 1 land uses and special buildings (Attachment N.3H, Vibration Analysis of Category 1 Uses and Special Buildings)



4.7.1.1 Background Information on Noise

There are multiple noise sources associated with a light rail project, including noise from light rail operation (wheel/rail rolling noise), warning bells (used at stations), wheel squeal (on tight radius curves), special trackwork (crossovers and storage tracks), and ancillary facilities, like maintenance and storage areas. The noise model does not assume wheel squeal because the level of noise would depend on several factors, including curve radius, light rail speed, and track conditions. For example, during periods of rain, the moisture on the track can reduce or eliminate most wheel squeal. Therefore, to prevent wheel squeal from occurring, Sound Transit requires that track lubricators be installed as part of the project for curves with a radius of less than 600 feet near noise-sensitive properties. Curves with a radius of 600 feet to 1,250 feet must be built to allow for subsequent lubrication if needed to eliminate wheel squeal. Existing installation of track lubrication systems on other parts of the Link light rail have shown that the lubricators are able to eliminate the majority of wheel squeal. The noise analysis also considers the added noise radiated from elevated structures, far track acoustical shielding provided by elevated structures at some locations, and acoustical shielding from retained cuts and existing buildings between noise-sensitive properties and the light rail tracks. Noise from changes in traffic is also considered where the project constructs new roadways, modifies existing roadways, or removes shielding. More details on acoustics and the transmission of noise from light rail operations are provided in Appendix N.3. A brief introduction to noise, how it is measured, and typical noise levels follows.

Noise is defined as unwanted sound. It is measured in terms of sound pressure level and usually expressed in decibels, a conversion of the air pressure to a unit of measurement that represents the way humans hear sounds. The human ear is less sensitive to higher and lower frequencies than it is to mid-range frequencies. To provide a measurement meaningful to humans, a weighting system was developed that reduces the sound level of higher and lower frequency sounds, similar to what the human ear does. This filtering system, known as “A-weighted,” is used in virtually all noise ordinances. Measurements taken with the A-weighted filter are referred to as A-weighted decibel (dBA) readings.

Two primary noise measurement descriptors are used to assess noise impacts from operations of traffic and transit projects: the equivalent sound level (Leq) and the day-night sound level (Ldn). The Leq is the level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time (typically 1 hour). The Ldn is an Leq over a 24-hour period, with a 10-dBA “penalty” added to nighttime sound levels (between 10 p.m. and 7 a.m.) to account for the greater sensitivity and lower background sound levels during this time. The Leq is used for all traffic noise analysis and for light rail analysis on sites that have mainly daytime use, including schools, libraries, and daycare centers. The Ldn is used for analysis of light rail noise for land use with nighttime sensitivity to noise, including residences, hotels, hospitals, fire stations with sleeping areas, and other land uses with sleeping quarters. Table 4.7-1 provides a range of Ldn noise levels and what types of land uses are associated with various noise levels.

Short-term construction noise was also evaluated based on types of construction and proximity to noise-sensitive land uses.

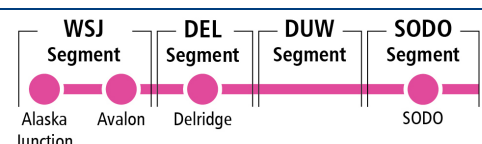


Table 4.7-1. Typical 24-hour Day-night Sound Levels and Land Use Compatibility

Day-Night Equivalent Noise Level in A-weighted Decibels	Description of Typical and Acceptable Land Use
Ldn below 50 dBA	Typically found in rural areas with no major roadways or other major noise sources nearby. Compatible with all noise-sensitive properties.
Ldn of 50 to 55 dBA	Typically found in quiet suburban residential neighborhoods not close to any major roadways and with little nighttime activity. Compatible with all noise-sensitive properties.
Ldn of 55 to 60 dBA	Typically found in many residential areas with minor arterial roadways nearby, typical of many close in suburban and some urban residential areas. Compatible with all noise-sensitive properties.
Ldn of 60 to 65 dBA	Relatively noisy residential area. Usually a major road or airport is nearby. Considered normally acceptable for residential land use.
Ldn of 65 to 70 dBA	Noise levels in this range are typical for a noisy residential area that is close to a major freeway or the end of an airport runway. Considered marginally acceptable for a residential area.
Ldn of 70 to 75 dBA	Typical for areas directly adjacent to a major freeway or very near an airport. Not normally acceptable for residential use without noise mitigation measures.
Ldn greater than 75 dBA	Noise levels above 75 dBA Ldn are not acceptable for residential use and are only found near the ends of airport runways and adjacent to major highways.

Source: Adapted from FTA 2018.

4.7.1.2 Background Information on Vibration

Vibration is an oscillatory (back-and-forth) motion that is often characterized by the velocity of the motion and the frequency. Velocity is the measure used for evaluating vibration from transit projects that corresponds best with human sensitivity. Vibration is expressed in terms of the root-mean-square vibration velocity level in decibels (VdB). The abbreviation VdB is used in place of decibels to avoid confusing vibration decibels with sound decibels. Building vibration might cause groundborne noise, which is a low-volume, low-frequency rumble inside buildings resulting when ground vibration causes the walls of the building to resonate and generate noise. When light rail is in a tunnel or deep retained cut, airborne noise emissions are low or imperceptible and groundborne noise becomes the main potential noise source from light rail operations.

The vibration analysis accounts for vibration at buildings near the light rail guideway as well as vibration-generated groundborne noise inside buildings caused by the passing light rail. Groundborne noise and vibration differ from airborne noise in that they consist of energy transmitted through the earth rather than through air.

Table 4.7-2 presents typical vibration velocity levels for common sources, as well as thresholds for human and structural response to groundborne vibration. The relevant range is approximately 50 to 100 VdB (from imperceptible background vibration to the threshold of damage). The approximate threshold of human perception to vibration is 65 VdB. Humans generally do not find vibration from light rail operations annoying until the vibration exceeds 70 to 75 VdB.

Table 4.7-2. Typical Vibration Level in Decibels and Human/Structural Responses

Vibration Level in VdB	Description of Typical Sources 50 Feet from Source and Human/Structural Response
Below 60	Typical background vibration levels.
60 to 70	Light rail transit on a normal track; bus or truck on a smooth roadway. Approximate threshold of human perception and limit for vibration-sensitive equipment.
70 to 80	Light rail transit near a crossover; bus or truck over pothole. Residential annoyance from infrequent events (e.g., commuter trains), residential annoyance from occasional events, and residential annoyance from frequent events (e.g., light rail transit).
80 to 90	Bulldozers and other heavy tracked vehicles and freight trains. The typical human response would be difficulty with tasks such as reading a computer screen.
90 to 100	Blasting from construction projects. This is the threshold for minor cosmetic damage.

Source: Adapted from FTA 2018.

Groundborne vibration generated from light rail train operations is transmitted from the tracks through the soil and into nearby buildings. Vibration from light rail operations is generated by motion at the wheel and rail interface and is affected by rail condition or roughness, track geometry and structure type, vehicle characteristics, train speed, soil conditions, and special trackwork. For example, crossovers and turnouts are special trackwork that can increase predicted vibration levels by 5 to 10 decibels. Vibration above certain levels can interfere with the use of sensitive equipment, such as microscopes or magnetic resonance imaging (M.R.I.) machines and annoy people within buildings. Transit systems rarely generate vibration with sufficient magnitude to cause even minor cosmetic damage to structures.

Short-term construction vibration could cause minor cosmetic damage to nearby structures. Most construction processes involve vibration well below the levels that could cause minor cosmetic building damage, even if vibration is felt. Analysis based on potential annoyance to building occupants is not required because construction activities are short-term in duration. The exception is groundborne noise and vibration from tunnel muck and support trains, which are evaluated to meet the FTA criteria for operations based on annoyance because the tunnel support trains may run continuously over several years.

4.7.1.3 Project Noise and Vibration Impact Criteria

Sound Transit evaluates light rail noise and vibration impacts for transit projects according to the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). The FTA criteria use the existing noise levels to determine the project's impact criteria, which requires a set of ambient noise measurements throughout the project corridors. The FTA criteria are based on land use categories, and the amount of transit noise that can be added to an area is reduced as the existing noise levels increase. Figure 4.7-1 shows the FTA impact criteria graphically. More detail on the FTA criteria, including tables and examples of how the criteria are applied, can be found in Appendix N.3. Table 4.7-3 summarizes the FTA land use categories used for this noise and vibration analysis.

Sensitive Receivers

Sensitive receivers are locations that may have sensitivities to project-generated noise or vibration. FTA-defined noise- and vibration-sensitive land uses are shown in Table 4.7-3.

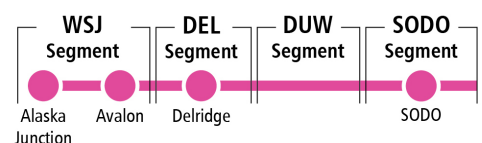


Figure 4.7-1. FTA Noise Impact Criteria

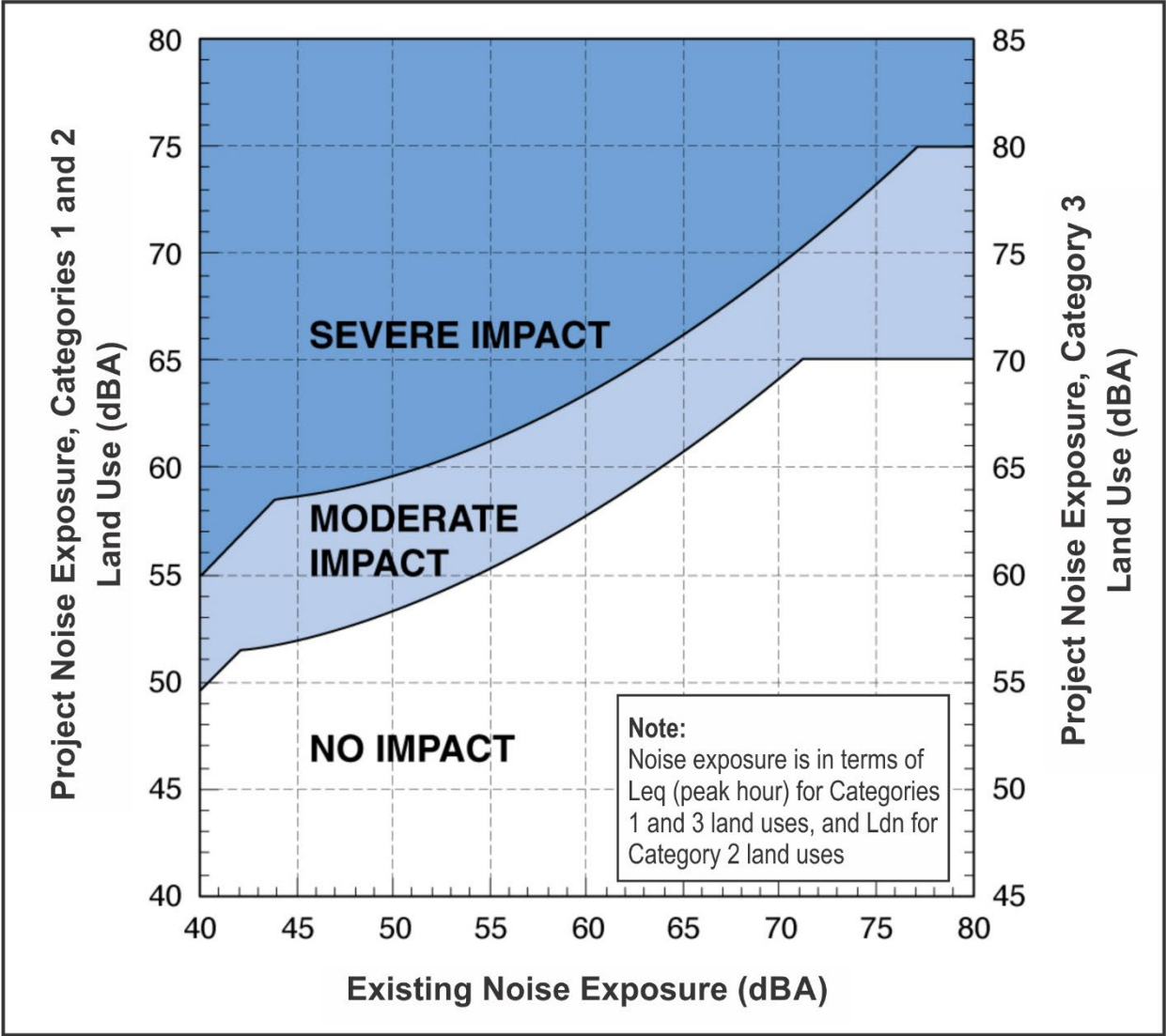


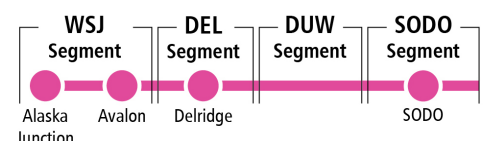
Table 4.7-3. Noise and Vibration Land Use Categories for Assessment

Land Use Type	Noise Land Use Category	Vibration Land Use Category
Special Buildings	This category is not applicable to noise.	This vibration category includes special-use facilities that are very sensitive to vibration and groundborne noise (e.g., concert halls or theaters) that are not included in the categories below and require special consideration.
Category 1 – High Sensitivity	This noise category includes tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included in this category are recording studios and concert halls. This noise category is measured using the outdoor Leq for the loudest hour of project-related activity.	This vibration category includes buildings where vibration levels, including those below the threshold of human annoyance, would interfere with operations within the building. Examples include buildings with vibration-sensitive research and manufacturing equipment, hospitals with vibration-sensitive equipment, and universities conducting physical research operations. The building's degree of sensitivity to vibration is dependent on the specific equipment that would be affected by the vibration.
Category 2 – Residential	This noise category includes residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance. This noise category is measured with the outdoor 24-hour Ldn.	This vibration category includes all residential land uses and buildings where people normally sleep, such as hotels and hospitals. Transit-generated groundborne vibration and noise from subways or surface running trains are considered to have a similar effect on receivers.
Category 3 – Institutional	This noise category includes institutions with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also considered to be in this category. Certain historical sites and parks are also included, but their sensitivity to noise must be related to their defining characteristics, and generally parks with active recreational facilities are not considered noise-sensitive. This noise category is measured using the outdoor Leq for the loudest hour of project-related activity.	This vibration category includes institutions and offices, such as schools, churches, doctors' offices, that have vibration-sensitive equipment and have potential for activity interference. Commercial or industrial locations, including office buildings, are not included in this category unless there is vibration-sensitive activity or equipment within the building. As with noise, the use of the building determines the vibration sensitivity.

Source: FTA 2018.

As previously described, the Ldn is used to characterize noise exposure in areas with nighttime sensitivity (e.g., residences, hospitals, and other sleeping areas). For other noise-sensitive land uses, such as outdoor amphitheaters and school buildings, the maximum 1 hour Leq during the facility's operating period is used. The FTA also has two levels of noise impact, as follows:

- Moderate impacts, where the change in the cumulative noise level is noticeable to most people but might not be sufficient to cause strong, adverse reactions from the community
- Severe impacts, where project-generated noise can be expected to cause a large percentage of people to be highly annoyed



Sound Transit also considered the potential for increased traffic noise at noise-sensitive land uses where roadways are modified or constructed, or where structures that shield traffic noise would be removed as part of the project. The impact criteria for traffic noise are taken from the Federal Highway Administration regulations. Traffic noise impacts occur if the peak hour traffic noise levels meet or exceed 66 dBA Leq for residences, churches, schools, and similar areas and meet or exceed 71 dBA Leq for hotels, motels, offices, restaurants, and other developed land uses. As with the FTA criteria, there are no noise impact criteria for many commercial or any industrial types of land uses.

Sound Transit also analyzed vibration using the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). Unlike the noise analysis, the vibration criteria do not depend on existing vibration levels. Because existing environmental vibration is usually below human perception, a limited ambient vibration survey is sufficient even for a detailed vibration analysis.

A general assessment of construction noise and vibration levels was performed as described in Chapter 7, Noise and Vibration during Construction, of the FTA *Transit Noise and Vibration Impact Assessment Manual*. The noise metrics in the manual can be compared with Seattle Municipal Code Chapter 25.08 and with noise allowances from the Seattle Noise Ordinance for construction activities.

For potential vibration effects during construction, Sound Transit used FTA's recommendation on vibration levels because there are no state, county, or city vibration regulations. Category 1 and special building land uses have the same limits for assessing construction impacts as for assessing long-term impacts based on the sensitivity of equipment to vibration. The potential for construction vibration impacts at Category 2 and Category 3 land uses is based on the potential for cosmetic damage criteria in Section 7 of the FTA *Transit Noise and Vibration Impact Assessment Manual*. Sound Transit assessed potential construction vibration effects to structures using peak particle velocity, which is the maximum velocity recorded during a particular event, such as from a jackhammer.

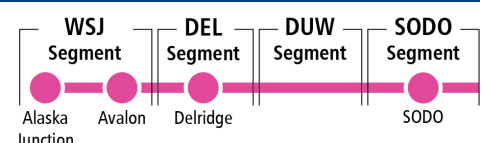
4.7.2 Affected Environment

4.7.2.1 Existing Noise- and Vibration-sensitive Land Uses

This section summarizes sensitive land uses and the existing noise and vibration levels within the project study area. The study area for noise is based on measured noise levels of the existing fleet of Sound Transit light rail vehicles, operational schedule, and train speeds, and is large enough to capture all potential noise impacts from system operations. Because the potential light rail alternatives would be primarily elevated or in tunnels, there are no at-grade crossings with vehicles, which eliminates the need for warning horns and gated crossing bells. Train-mounted warning bells are only used when the light rail arrives and departs stations, which is included in the light rail noise predictions in Attachment N.3F to Appendix N.3. The study area for noise is at least 500 feet from the track alignments, and the vibration study area is 450 feet for Category 1 land uses and 200 feet for Category 2 and 3 land uses. Over 1,500 noise- and/or vibration-sensitive properties were identified within the study area.

Noise- and vibration-sensitive land uses in the project study area include FTA Category 1 (highly noise- and vibration-sensitive, such as research facilities and performance or recording venues), FTA Category 2 residential (single- and multi-family and fire stations), FTA Category 3 institutional (schools, including daycares with educational components) and some parks.

Land uses in the SODO Segment are mostly industrial and commercial, and no noise-sensitive or vibration-sensitive properties were identified in the SODO Segment study area.



In the Duwamish Segment, there are two Category 1 noise- or vibration-sensitive land uses. The Secret Studio Records/Studio 1208 recording studio is both noise- and vibration-sensitive. Harbor Island Machine Works, a precision manufacturing company, is a Category 1 vibration-sensitive land use with vibration-sensitive equipment on Harbor Island. Category 2 noise and vibration-sensitive land uses include residential areas at the west edge of the segment, as well as Fire Stations 14 and 36. A portion of the West Duwamish Greenbelt is near Pigeon Point, but because of high existing noise levels and because it is not designed to provide public access, it is not considered noise-sensitive under FTA criteria. A public staircase connects Southwest Marginal Place to Southwest Charlestown Street in this area, but it does not connect to or provide access to the trail system within the greenbelt. The Bootstrap Music Company is in the industrial area near the east end of the West Seattle Bridge and provides music rehearsal space for rent, but is not considered noise- or vibration-sensitive under FTA criteria because its use is compatible with higher noise and vibration levels. There are freight trains and frequent heavy truck traffic in close proximity to the building. No other noise-sensitive land uses were identified in this segment.

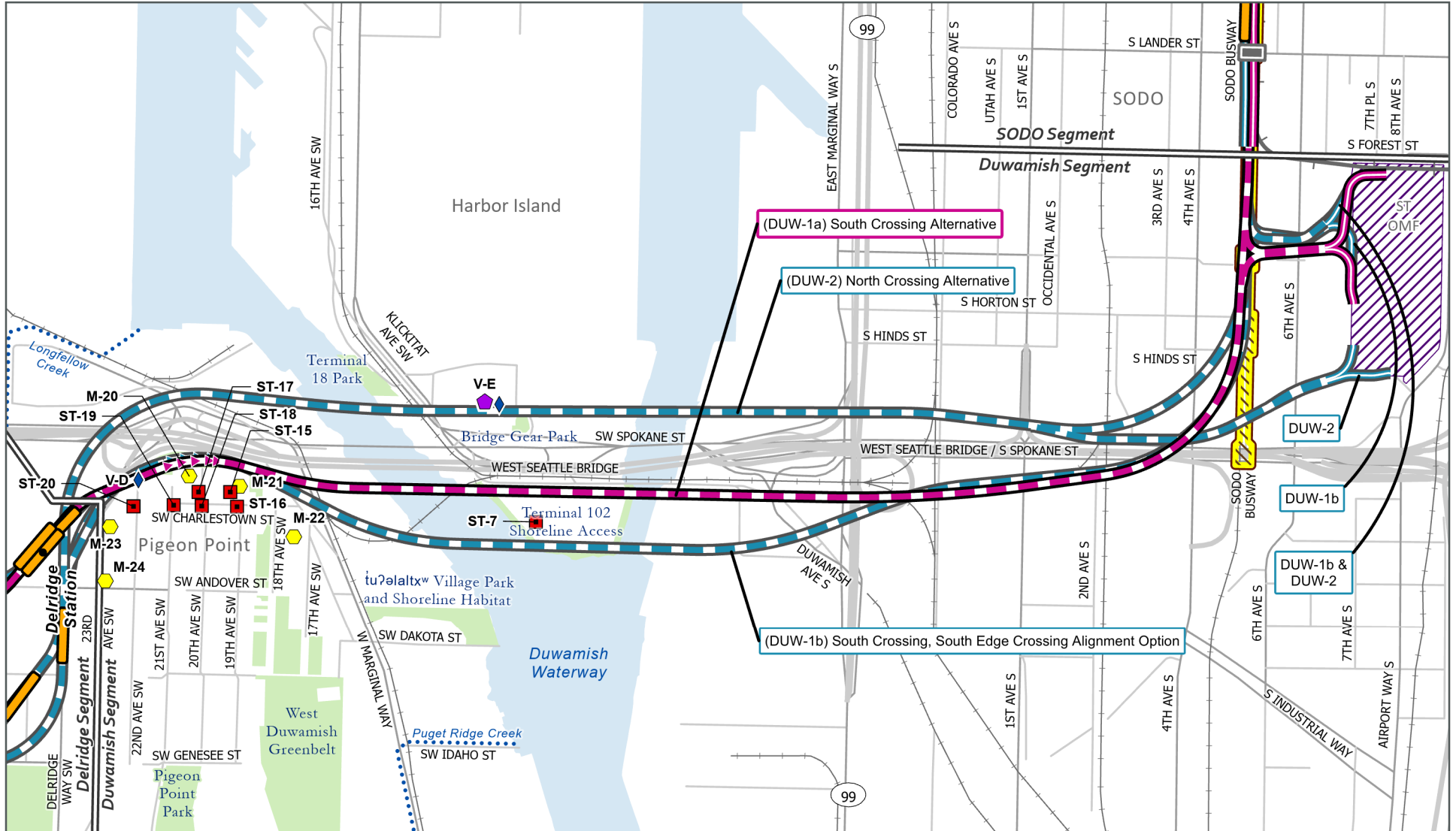
In the Delridge Segment, there are no Category 1 noise- or vibration-sensitive land uses. Category 2 noise- and vibration-sensitive land uses include residential areas. Category 3 noise- and vibration-sensitive land uses include the Alki Beach Academy Daycare, Mode Music Studios, Youngstown Cultural Arts Center, and Longfellow Creek Natural Area. Active outdoor uses include the West Seattle Golf Course and the Delridge Playfield and Community Center. Because the active outdoor facilities are used for sporting activities, they are not considered noise-sensitive under FTA criteria. No other noise- or vibration-sensitive land uses were identified in this segment.

In the West Seattle Junction Segment, there are no Category 1 noise- or vibration-sensitive land uses. Category 2 noise- and vibration-sensitive land uses include residential areas and Fire Station 32. Category 3 noise- and vibration-sensitive land uses include Eastridge Church, Calvary Chapel West Seattle, and childcare centers on Fauntleroy Way Southwest, Southwest Alaska Street, and California Avenue Southwest. The West Seattle Stadium is also in this segment; however, under FTA criteria, active sports complexes are not considered noise- or vibration-sensitive. No other noise- or vibration-sensitive land uses were identified in this segment.

Noise- and vibration-sensitive land uses are shown on maps in Attachment N.3D and Attachment N.3E to Appendix N.3. More detail on land uses in the study area is discussed in Section 4.2, Land Use.

4.7.2.2 Noise Measurements

To establish the existing noise environment, onsite noise monitoring was performed at 42 locations as shown on Figures 4.7-2 through 4.7-4 (22 long-term sites for approximately 48 hours or more and 20 short-term sites with at least two measurements for at least 15 minutes with traffic counts at most locations). More detailed noise monitoring information can be found in Attachment N.3A to Appendix N.3. Noise levels along the project corridor are dominated by transportation-related noise sources, including traffic on the West Seattle Bridge, Fauntleroy Way Southwest, and other arterial roadways. Freight-related facilities in the Duwamish Segment include several noise sources, such as loading and unloading ships, foghorns, heavy truck traffic, and heavy rail service. Lesser contributors to the noise environment include aircraft overflights, commercial and residential activities, and unrelated construction activities.



Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Retained Cut

Station (● Indicates Preferred Alternative)

- New

Segment Line

- Existing Link Light Rail
- Railroad

SODO Busway

- Proposed Overpass

- Sound Transit Operations and Maintenance Facility (ST OMF)

Piped Stream

- Park

Noise Monitoring Locations

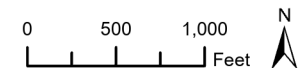
- Short Term Monitoring
- Long Term Monitoring

Vibration Measurement Sites



- Existing Vibration Measurement
- At-grade Vibration Propagation



FIGURE 4.7-2
Noise Monitoring Locations and
Vibration Measurement Sites
Duwamish Segment

West Seattle Link Extension







Preferred Alternative

 Elevated  Tunnel

 At-Grade  Retained Cut

Other Alternatives

 Elevated  Tunnel

 At-Grade  Retained Cut

Station (● Indicates Preferred Alternative)


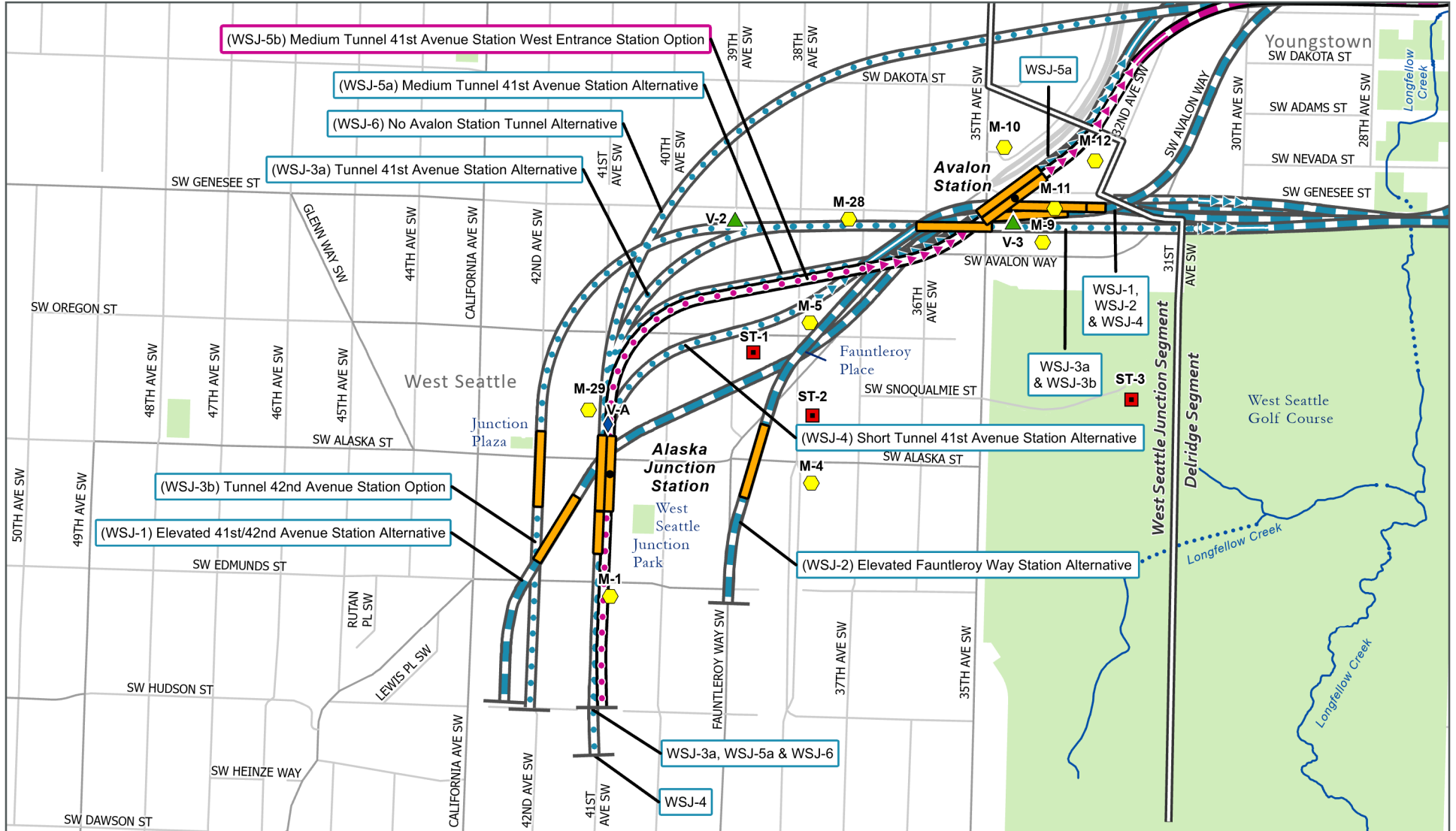
 New

FIGURE 4.7-3
**Noise Monitoring Locations and
 Vibration Measurement Sites**
 Delridge Segment



Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

- Segment Line
- Stream
- Piped Stream
- Park

Noise Monitoring Locations

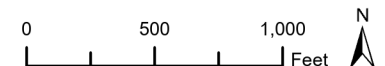
- Short Term Monitoring
- Long Term Monitoring

Vibration Measurement Sites

- At-grade Vibration Propagation
- Below-grade Vibration Propagation

FIGURE 4.7-4
Noise Monitoring Locations and
Vibration Measurement Sites
West Seattle Junction Segment

West Seattle Link Extension



The Ldn noise levels near noise-sensitive uses in the project study area typically range from 53 dBA to 75 dBA, with a few locations not near any major roadways with noise levels below this range. Daytime average hourly Leq sound levels range from 47 dBA to 74 dBA, and average nighttime Leq levels range between 42 dBA and 67 dBA. Median daytime Leq sound levels in the project study area are 62 dBA and median nighttime sound levels are 53 dBA. Complete data summaries and tables, along with photographs of the noise monitoring sites, are provided in Attachment N.3A to Appendix N.3.

4.7.2.3 Vibration Testing and Measurements

As shown on Figures 4.7-2 through 4.7-4, Sound Transit performed vibration propagation tests at five at-grade sites and two below-grade sites to determine how vibration levels would change as vibration travels through the ground.

Data from the propagation tests were used in the vibration prediction model. An existing vibration measurement was completed at Harbor Island Machine Works, which is a Category 1 vibration-sensitive building with precision manufacturing equipment that could be affected by high vibration levels. Detailed results of testing and measurements are provided in Attachment N.3H to Appendix N.3.

4.7.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, there would be no light rail constructed. Noise along the project corridor would continue to be dominated by traffic and various industrial, commercial, and construction activities; therefore, no light rail-related noise or vibration impacts would occur.

4.7.4 Environmental Impacts of the Build Alternatives during Operation

4.7.4.1 SODO Segment

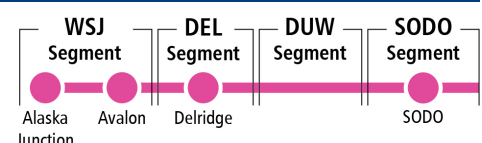
Land uses in the SODO Segment are predominantly industrial and commercial. No FTA noise- or vibration-sensitive properties were identified in this segment.

How are Noise Impacts Identified: An Example

Given the complex nature of the FTA criteria, the following example is provided to clarify how impacts are identified.

Consider a residential land use (FTA Category 2) with an existing Ldn of 65 dBA. If the noise from light rail operations is below 61 dBA, there is no noise impact. A moderate impact would occur if light rail noise levels were between 61 and 66 dBA, and a severe noise impact would occur if light rail noise were above 66 dBA. If noise from the light rail is 62 dBA Ldn (a moderate impact), the total future noise would be rounded up to 67 dBA Ldn, for a 2-decibel increase in the overall noise (adding the existing 65 dBA Ldn with the light rail noise of 62 dBA Ldn = 66.8 dBA Ldn). Typically, for transportation noise sources, an increase of less than 3 dBA is not perceptible to an average person. More importantly, although the 2 dBA increase may not be perceptible, it would still be identified as an impact under FTA criteria and mitigation would be considered.

This example shows how the light rail noise level could be lower than the existing noise levels, and still result in a noise impact. It also shows how the FTA criteria help to prevent increasing noise levels in areas that already have high levels of background noise. Section 2.1.2 in Appendix N.3, Noise and Vibration Technical Report, provides information on how total sound level with the project and ambient noise is calculated.



4.7.4.2 Duwamish Segment

4.7.4.2.1 Noise

Preferred Alternative DUW-1a and Option DUW-1b would have the most noise impacts because of their proximity to residences on the north end of the Pigeon Point community (Table 4.7-4). Under Preferred Alternative DUW-1a, connections with Preferred Option DEL-6b, Alternative DEL-3, Alternative DEL-4, and Alternative DEL-5 would have the most noise impacts. Alternative DUW-2 would have the fewest noise impacts of all the Duwamish Segment Build Alternatives. The alignment for Alternative DUW-2 would be along the north side of the West Seattle Bridge, farther away from the Pigeon Point residences.

A severe noise impact was identified at Fire Station 14 on 4th Avenue South under Preferred Alternative DUW-1a and Option DUW-1b and a moderate impact under Alternative DUW-2. There would be no impacts at Fire Station 36 off Chelan Avenue Southwest under any of the Duwamish Alternatives.

Table 4.7-4. Light Rail Noise Impacts – Duwamish Segment

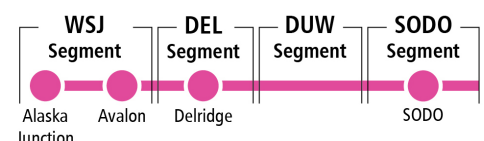
Alternatives and Design Options	Noise Impacts				Total Noise Impacts
	Category 1	Category 2 Moderate Impacts	Category 2 Severe Impacts	Category 3	
Preferred South Crossing Alternative (DUW-1a)	0	25 to 45	1 to 6	0	29 to 47
South Crossing South Edge Crossing Alignment Option (DUW-1b)	0	34	1	0	35
North Crossing Alternative (DUW-2)	0	1	0	0	1

Notes:

The numbers presented are the number of units, counted by individual residences, including individual units of multi-family structures, and number of structures for other uses, like schools, places of worship, and parks. Category 2 parcels are evaluated with the 24-hour Ldn, and Category 1 and 3 are evaluated with the peak hour Leq.

Ranges reflect differences from connecting to different alternatives in adjacent segments. The total impacts are based on individual alternatives and connection options and not the high and low of each impact type shown in the table.

There are curves with potential for wheel squeal and crossovers in the Duwamish Segment for access to the Operations and Maintenance Facility Central, just north of Fire Station 14, that could increase light rail noise near this noise-sensitive land use for all Duwamish Segment alternatives. There is also a crossover in the Pigeon Point area near Fire Station 36 under Preferred Alternative DUW-1a with connections to Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 but it would not result in impacts at Fire Station 36. In addition, Preferred Alternative DUW-1a and Option DUW-1b each have a curve with potential for wheel squeal near the Pigeon Point community. Alternative DUW-2 would have a similar curve in the same general area. There are no crossovers in the Pigeon Point area under Option DUW-1b. Alternative DUW-2 has a crossover near 1st Avenue South, east of the West Seattle Bridge, but it would not be near any noise-sensitive land uses. Bus operations in the Duwamish Segment would remain on existing roadways; therefore, no noise analysis for buses was required. Figure 4.7-5 shows the locations of the project noise impacts in the Duwamish Segment before mitigation.



4.7.4.2.2 Vibration

Preferred Alternative DUW-1a is the only alternative with predicted vibration impacts in the Duwamish Segment, and the projected impacts are near special trackwork (Table 4.7-5). An impact is projected at Fire Station 14 near the turnout at the entrance to the Operations and Maintenance Facility Central. When connecting to Preferred Option DEL-6b or Alternative DEL-7, an impact is also projected at a single-family residence near the crossover that is east of Delridge Way Southwest near the West Seattle Bridge on-ramp. When connecting to Alternative DEL-5 or Alternative DEL-6a, the crossover near Delridge Way Southwest is further from sensitive receivers and no impact is projected at that crossover location.

Option DUW-1b and Alternative DUW-2 in the Duwamish Segment are not projected to have impacts because they do not have special trackwork as close to sensitive receivers in this segment as Preferred Alternative DUW-1a. All alternatives and options in this segment would be mostly elevated, which reduces vibration levels by about 10 decibels compared with at-grade or below-grade track. As a result, there are few impacts in this segment compared to the Delridge and West Seattle Junction segments.

Figure 4.7-5 shows the locations of the project vibration impacts in the Duwamish Segment before mitigation.

Table 4.7-5. Groundborne Noise and Vibration Impacts – Duwamish Segment

Alternatives and Design Options	Number of Predicted Vibration or Groundborne Noise Impacts ^a			Total Predicted Vibration or Groundborne Noise Impacts
	Category 1	Category 2	Category 3	
Preferred South Crossing Alternative (DUW-1a)	0	1 to 2	0	1 to 2
South Crossing South Edge Crossing Alignment Option (DUW-1b)	0	0	0	0
North Crossing Alternative (DUW-2)	0	0	0	0

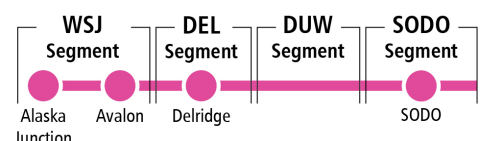
^a See Appendix N.3 for a more detailed information on groundborne noise and vibration impacts.

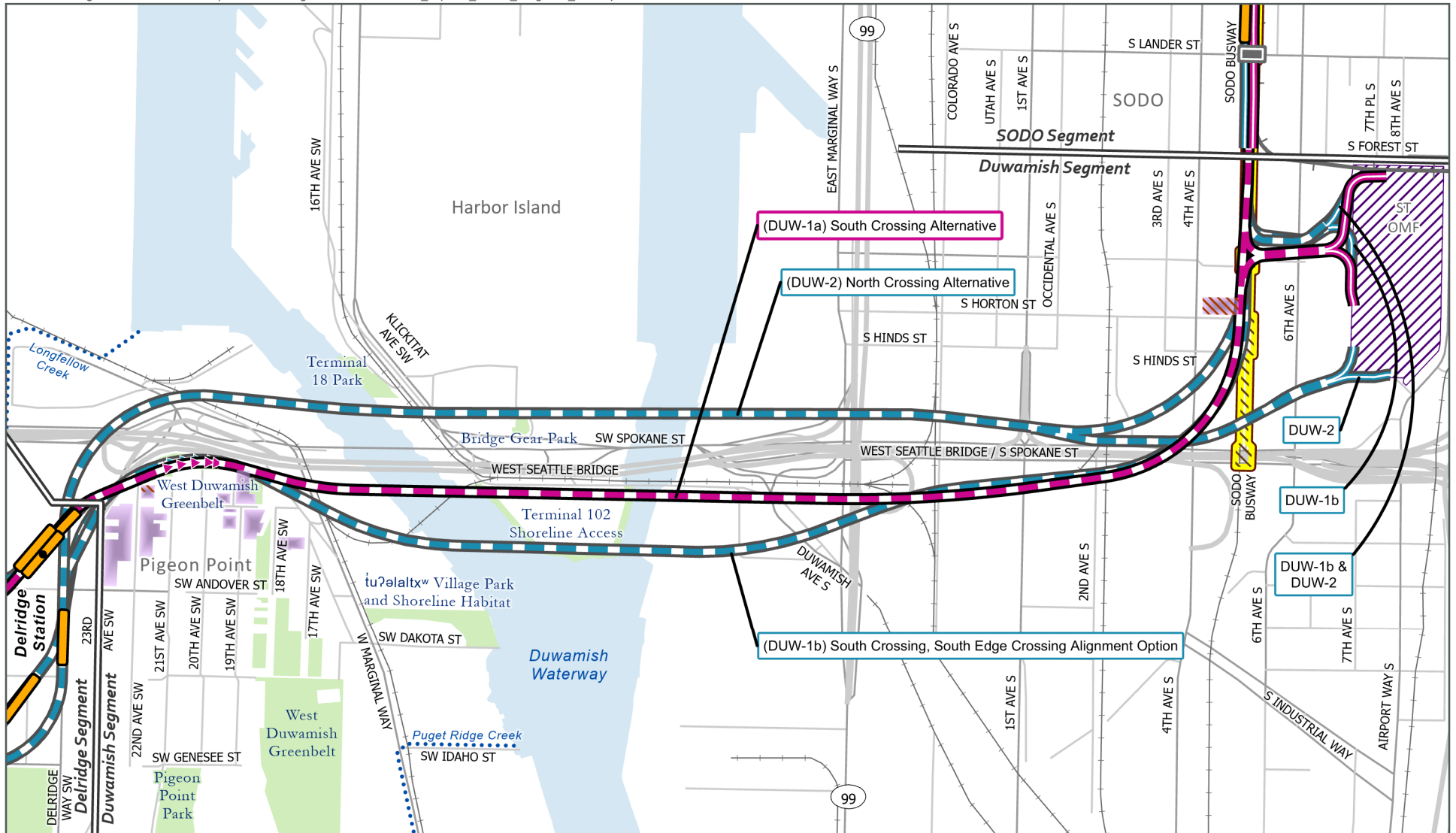
4.7.4.3 Delridge Segment

4.7.4.3.1 Noise

Under Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4, there would be a moderate noise impact at the Category 1 land use, Secret Studio Records/Studio 1208, which specializes in music recording. The least number of overall impacts would occur under Alternative DEL-6a, followed by Preferred Option DEL-6b. Alternatives DEL-1a, DEL-3, DEL-4, and DEL-5 would have the greatest number of overall impacts due to their proximity to single- and multi-family residences. Impacts shown in Table 4.7-6 assume a connection to Preferred Alternative DUW-1a in the Duwamish Segment. Figure 4.7-6 shows the locations of the project noise impacts in the Delridge Segment before mitigation under the same conditions.

Sound Transit evaluated traffic noise impacts for residences west of Southwest Avalon Way with Preferred Option DEL-6b and Alternative DEL-6a, because several residential structures between 32nd Avenue Southwest and the West Seattle Bridge would be removed, thereby exposing the other residences to traffic noise from Fauntleroy Way Southwest. Although there would be slight increases of 3 to 6 dB, no traffic noise impacts were identified due to the removal of the existing residential structures.





Source: City of Seattle, King County (2023).

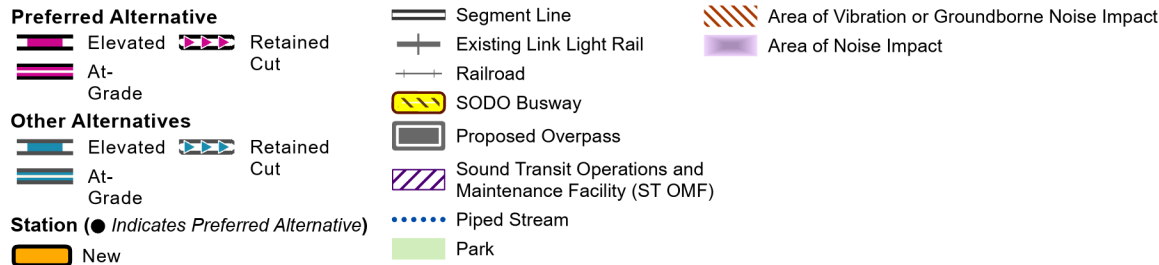
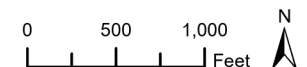
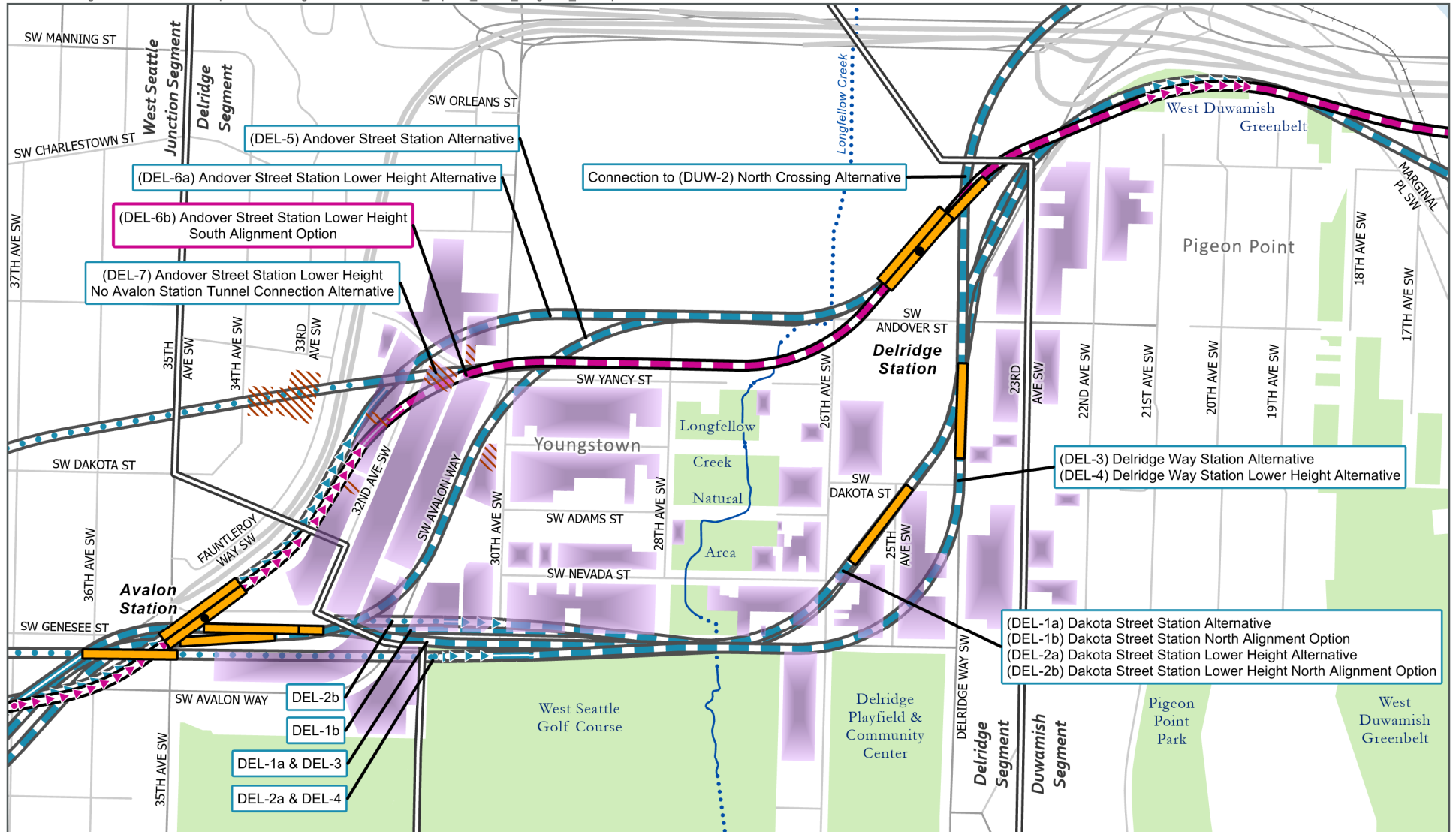


FIGURE 4.7-5
Noise and Vibration Impacts
(before mitigation)
 Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

FIGURE 4.7-6
Noise and Vibration Impacts
(before mitigation)
Delridge Segment

West Seattle Link Extension

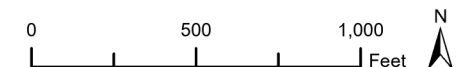


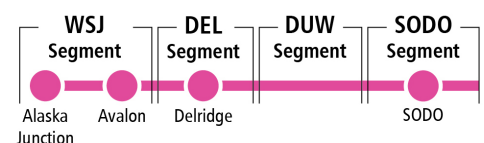
Table 4.7-6. Light Rail Noise Impacts – Delridge Segment

Alternatives and Design Options	Noise Impacts				Total Noise Impacts
	Category 1	Category 2 Moderate Impacts	Category 2 Severe Impacts	Category 3	
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	0	156	5	0	161
Dakota Street Station Alternative (DEL-1a)	1	228 to 240	5 to 6	0	234 to 247
Dakota Street Station North Alignment Option (DEL-1b)	1	203	14	0	218
Dakota Street Station Lower Height Alternative (DEL-2a)	1	218	22	0	241
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	1	154	23	0	178
Delridge Way Station Alternative (DEL-3)	1	242	2	0	245
Delridge Way Station Lower Height Alternative (DEL-4)	1	217	28	0	246
Andover Street Station Alternative (DEL-5)	0	208	43	0	251
Andover Street Station Lower Height Alternative (DEL-6a)	0	55	13	0	68
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	0	186	42	0	228

Note: The numbers presented are the number of units, counted by individual residences, including individual units of multi-family structures, and number of structures for other uses, like schools, places of worship, and parks. Category 2 parcels are evaluated with the 24-hour Ldn, and Category 1 and 3 are evaluated with the peak hour Leq.

Preferred Option DEL-6b and Alternative DEL-7 would have several curves with potential for wheel squeal north of Delridge Station on Delridge Way Southwest near the intersection with Southwest Charlestown Street and two curves south of Delridge Station near the intersection of Southwest Andover Street and 26th Avenue Southwest. Preferred Option DEL-6b would have an additional curve south of the intersection of Southwest Andover Street and 32nd Avenue Southwest. All curves would be equipped with or prepared for track lubricators to reduce wheel squeal. Additional information on lubrication is provided in Section 4.7.7.1, Light Rail Noise Mitigation and in Appendix N.3.

Alternative DEL-1a would have curves with potential for wheel squeal along Delridge Way Southwest north of Southwest Dakota Street, at Southwest Genesee Street and 26th Avenue Southwest, and at Southwest Genesee Street and Southwest Avalon Way. It would also have a crossover near the intersection of Delridge Way Southwest and Southwest Andover Street. Curves and crossovers for Option DEL-1b, Alternative DEL-2a, and Option DEL-2b would be the same as described under Alternative DEL-1a with the exception of the curve at Southwest Genesee Street and Southwest Avalon Way, where Alternative DEL-1a would be on the south side of the Southwest Genesee Street right-of-way while Option DEL-1b shifts to the north side of Southwest Genesee Street.



Alternative DEL-3 and Alternative DEL-4 would have curves with potential for wheel squeal at Delridge Way Southwest near Southwest Andover Street, at 25th Avenue Southwest and Southwest Genesee Street, and along Delridge Way Southwest between Southwest Dakota and Southwest Genesee Street. These alternatives would also have a crossover for each alternative at 23rd Avenue Southwest and Delridge Way Southwest. Alternative DEL-5 and Alternative DEL-6a would both have curves with potential for wheel squeal near Southwest Charlestown Street and Southwest Andover Street. Alternative DEL-5 would also have curves with potential for wheel squeal at Southwest Avalon Way and Southwest Yancy Street, and east of Southwest Avalon Way at Southwest Genesee Street. Alternative DEL-6a would have additional curves with potential for wheel squeal at the intersection of Southwest Yancy Street and 32nd Avenue Southwest and at the Delridge-West Seattle Junction border east of the West Seattle Bridge and a crossover between Southwest Andover Street and Southwest Genesee Street, west of 32nd Avenue Southwest. All curves would be equipped with or prepared for track lubricators to reduce wheel squeal. Crossovers for Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 are in a retained cut along the west part of Pigeon Point in the Duwamish Segment. Bus operations were reviewed for potential noise impacts. Bus operations under Alternatives DEL-1a, DEL-1b, DEL-2a, DEL-2b, DEL-3, DEL-4, DEL-5, and DEL-6a would occur on existing roadways, including Delridge Way Southwest, Southwest Andover Street, 25th Avenue Southwest and 26th Avenue Southwest, and no analysis was required. For Preferred Option DEL-6b and Alternative DEL-7, southbound buses would connect to the Delridge Station through a commercial area near Southwest Charlestown Street, with no noise sensitive land uses, and therefore no impacts were identified.

4.7.4.3.2 Vibration

Preferred Option DEL-6b would impact one single-family residence the near the intersection of Southwest Andover Street and Southwest Avalon Way. Alternative DEL-1a and Alternative DEL-3 would impact the most residences in the Delridge Segment (Table 4.7-7). The impacts would be at the same multi-family building near the intersection of Southwest Genesee Street and Southwest Avalon Way. Alternative DEL-5 would impact a multi-family building with many dwelling units, while Alternative DEL-6a would impact single-family residences. Alternative DEL-7 would have groundborne noise impacts at the residences near the tunnel portal.

Figure 4.7-6 shows the locations of the project vibration impacts in the Delridge Segment before mitigation.

4.7.4.4 West Seattle Junction Segment

4.7.4.4.1 Noise

Alternative WSJ-3a, Option WSJ-3b, and Alternative WSJ-6 would be entirely in tunnels and would not have any airborne noise impacts; therefore, they are not discussed further in this section. Preferred Option WSJ-5b and Alternative WSJ-5a are primarily within a tunnel and would have no severe noise impacts and the fewest moderate noise impacts. Alternative WSJ-1 and Alternative WSJ-2 would have the most overall and most severe noise impacts. Severe noise impacts for Alternative WSJ-1 and Alternative WSJ-2 when connecting to Alternative DEL-5 in the Delridge Segment would be a result of the elevated guideway's proximity to several large, multi-story, multi-family buildings. There would also be a Category 3 moderate noise impact at the Eastridge Church under Alternative WSJ-1 (Table 4.7-8).

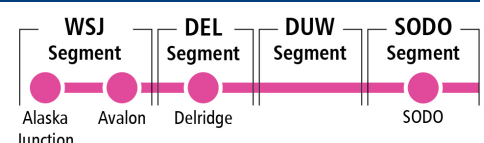


Table 4.7-7. Groundborne Noise and Vibration Impacts – Delridge Segment

Alternatives and Design Options	Number of Predicted Vibration or Groundborne Noise Impacts ^a			Total Predicted Vibration or Groundborne Noise Impacts
	Category 1	Category 2 ^b	Category 3	
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	0	1	0	1
Dakota Street Station Alternative (DEL-1a)	0	12	0	12
Dakota Street Station North Alignment Option (DEL-1b)	0	0	0	0
Dakota Street Station Lower Height Alternative (DEL-2a)	0	0	0	0
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	0	0	0	0
Delridge Way Station Alternative (DEL-3)	0	12	0	12
Delridge Way Station Lower Height Alternative (DEL-4)	0	0	0	0
Andover Street Station Alternative (DEL-5)	0	9	0	9
Andover Street Station Lower Height Alternative (DEL-6a)	0	3	0	3
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	0	9	0	9

^a See Appendix N.3 for a more detailed information on groundborne noise and vibration impacts.

^b Number of predicted impacts for Category 2 land uses is the number of dwelling units, not the number of buildings.

Preferred Option WSJ-5b and Alternative WSJ-5a would have one curve at the boundary with the Delridge Segment and West Seattle Junction Segment and would have no crossovers. Alternative WSJ-1 would have three curves with potential for wheel squeal noise: at Fauntleroy Way Southwest between Southwest Avalon Way and 35th Avenue Southwest, Southwest Alaska Street and 41st Avenue Southwest, and Southwest Edmunds Street and 42nd Avenue Southwest. There would also be a double crossover near 40th Avenue Southwest between Southwest Oregon Street and Southwest Alaska Street. Alternative WSJ-2 would have three curves with potential for wheel squeal, all along Fauntleroy Way Southwest. Alternative WSJ-4 would have two curves with potential for wheel squeal: one at Fauntleroy Way Southwest and Southwest Genesee Street and another at 38th Avenue Southwest and Southwest Oregon Street. All curves would be equipped with or prepared for track lubricators to reduce wheel squeal. All buses serving the station alternatives in the West Seattle Junction Segment would be along existing roadways, including Southwest Avalon Way, 35th Avenue Southwest, Southwest Alaska Street, and Fauntleroy Way Southwest; therefore, no noise analysis for buses was required.

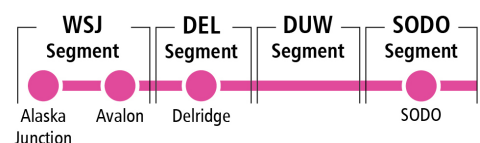


Table 4.7-8. Light Rail Noise Impacts – West Seattle Junction Segment

Alternatives and Design Options	Noise Impacts				Total Noise Impacts
	Category 1	Category 2 Moderate Impacts	Category 2 Severe Impacts	Category 3	
Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	0	5	0	0	5
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	0	359	54	1	414
Elevated Fauntleroy Way Station Alternative (WSJ-2)	0	275 to 332	15 to 81	0	312 to 356
Tunnel 41st Avenue Station Alternative (WSJ-3a)	0	0	0	0	0
Tunnel 42nd Avenue Station Option (WSJ-3b)	0	0	0	0	0
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	0	140	0	0	140
Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	0	5	0	0	5
No Avalon Station Tunnel Alternative (WSJ-6)	0	0	0	0	0

Note: The numbers presented are the number of units, counted by individual residences, including individual units of multi-family structures, and number of structures for other uses, like schools, places of worship, and parks. Category 2 parcels were evaluated with the 24-hour Ldn, and Category 1 and 3 were evaluated with the peak hour Leq.

4.7.4.4.2 Vibration

In the West Seattle Junction Segment, the tunnel alternatives (Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6) would have more vibration or groundborne noise impacts than Alternative WSJ-1 and Alternative WSJ-2 because elevated guideways reduce vibration levels by about 10 decibels (Table 4.7-9).

The tunnel alternatives, including Preferred Option WSJ-5b, would have impacts near the crossover south of Alaska Junction Station and where the tunnel is shallowest near the tunnel portal and along the curve. Alternative WSJ-2 would have no impacts because of the vibration reduction provided by the elevated structure and no sensitive receivers are close to the structure. Option WSJ-3b would have the most vibration or groundborne noise impacts in this segment, which would be concentrated in large multi-family buildings along 42nd Avenue Southwest near Southwest Alaska Street and east of Avalon Station along Southwest Avalon Way.

Figure 4.7-7 shows the locations of the project vibration impacts in the West Seattle Junction Segment before mitigation.

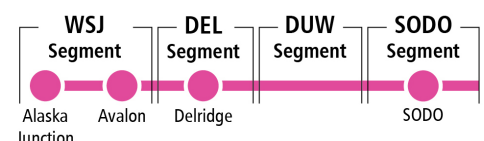


Table 4.7-9. Groundborne Noise and Vibration Impacts – West Seattle Junction Segment

Alternatives and Design Options	Number of Predicted Vibration or Groundborne Noise Impacts ^a			Total Predicted Vibration or Groundborne Noise Impacts
	Category 1	Category 2 ^b	Category 3	
Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	0	158	0	158
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	0	7	0	7
Elevated Fauntleroy Way Station Alternative (WSJ-2)	0	0	0	0
Tunnel 41st Avenue Station Alternative (WSJ-3a)	0	24 to 199	0	24 to 199
Tunnel 42nd Avenue Station Option (WSJ-3b)	0	269 to 430	0	269 to 430
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	0	153	0	153
Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	0	79	0	79
No Avalon Station Tunnel Alternative (WSJ-6)	0	144	0	144

Note: Ranges reflect differences from connecting to different alternatives in adjacent segments. The total impacts are based on individual alternatives and connection options and not the high and low of each impact type shown in the table.

^a See Appendix N.3 for a more detailed information on groundborne noise and vibration impacts.

^b Number of predicted impacts for Category 2 land uses is the number of dwelling units, not the number of buildings.

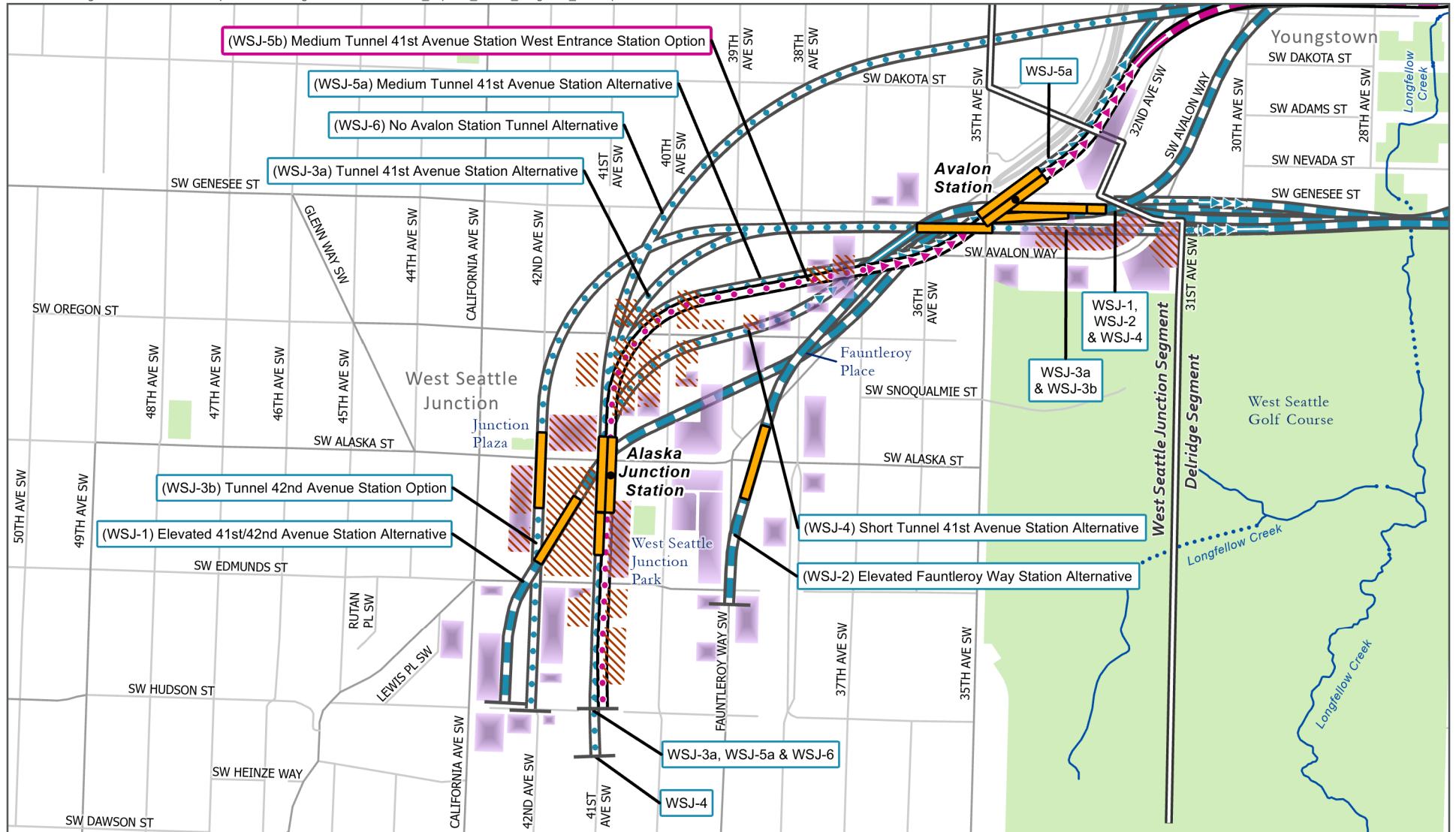
4.7.5 Environmental Impacts of the Build Alternatives during Construction

4.7.5.1 Noise

Except for underground tunnel construction, Sound Transit estimates that most general project construction noise levels, such as elevated guideway and station construction, would be between 84 and 89 dBA (hourly Leq) at a distance of 50 feet.

Construction noise is subject to City of Seattle code requirements, and noise levels for construction would be required to stay within those requirements unless the project obtained a variance from the Seattle Department of Construction and Inspections. Types of construction activities that may require a variance include nightwork and daytime construction that is anticipated to produce substantial noise levels, such as impact pile-driving. See Section 3.1.3, Construction Noise Criteria of Appendix N.3 for more information on construction noise criteria and applications for noise variances for major public projects.

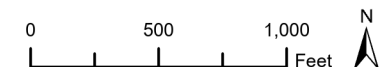
During construction of elevated structures such as guideways and stations, the loudest sources of noise would be cranes, excavators, concrete pumps, and pneumatic tools. Construction of elevated structures might result in sound levels of up to 87 dBA at a distance of 50 feet. Impact pile-driving, which is not normally included in general construction noise, would generate substantial noise levels that would likely exceed 101 dBA at 50 feet.



Source: City of Seattle, King County (2023).

FIGURE 4.7-7
Noise and Vibration Impacts
(before mitigation)
West Seattle Junction Segment

West Seattle Link Extension



Above-grade activities at tunnel portals would mainly consist of material deliveries and hauling materials. Ventilation fans might run 24 hours a day at tunnel portals and access shafts to supply fresh air into the tunnel. Sound levels from tunnel construction at tunnel portals are anticipated to be approximately 86 dBA at a distance of 50 feet. Nighttime construction near tunnel portals would likely be necessary throughout tunnel construction and would require a noise variance.

Cut-and-cover tunnel and station construction would likely occur during the daytime and might result in sound levels of approximately 88 dBA at a distance of 50 feet during the loudest phases of construction.

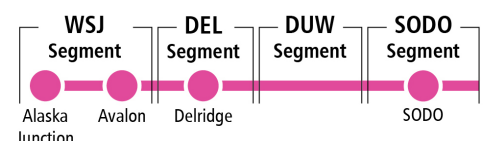
During retained-cut construction, the loudest pieces of construction equipment would be cranes, backhoes, jackhammers, excavators, pneumatic tools, concrete pump trucks, and concrete mixers. Retained-cut construction may result in sound levels of up to 89 dBA at a distance of 50 feet.

At-grade construction is anticipated to occur primarily within the SODO Segment. Construction equipment that could be used for at-grade construction includes excavators, backhoes, concrete mixers, concrete pumps, and haul trucks. Construction noise from at-grade construction could result in sound levels up to 87 dBA at a distance of 50 feet.

Nighttime construction work required for tunneling and elevated guideway construction, would require a noise variance. Sound Transit would ensure that the construction contractor minimize noise impacts from nighttime construction as described in Section 4.7.7, Mitigation Measures, and noise levels would meet requirements set forth in any variances that would be required for project construction. For detailed information on construction noise impacts, refer to Section 6, Impact Assessment of Appendix N.3.

The SODO Segment and eastern portion of the Duwamish Segment are mostly industrial and commercial properties, which are less sensitive to construction noise; therefore, there would be low potential for noise impacts. In the Duwamish Segment, bridge construction would mostly take place in industrial areas on the shore of the Duwamish Waterway (also known as Duwamish River) and Harbor Island, and possibly in the water, depending on the type of bridge constructed. There are two fire stations with sleeping quarters in the Duwamish Segment, Fire Station 14 and Fire Station 36. The Bootstrap Music Company is a noise-sensitive music rehearsal and recording space in an industrial area southeast of the West Seattle Bridge. Although the Bootstrap Music Company is not considered a FTA Category 1 land use, it has a potential for construction noise impacts during construction activities within the Duwamish Segment and, due to the use of the building, it was considered in the construction noise analysis. Residents with lines of sight to construction near the Duwamish Waterway, such as in the Riverside community, would likely experience more construction noise impacts than other nearby residential properties. Because Alternative DUW-2 would be farther from residential areas than the other alternatives and would not require retained-cut construction, it is expected to result in fewer construction noise impacts at noise-sensitive properties.

In the Delridge Segment, there is potential for construction noise impacts to noise-sensitive properties along all the Build Alternative alignments. Preferred Option DEL-6b, Alternative DEL-5, and Alternative DEL-6a would have lower potential for construction noise impacts at noise-sensitive properties because a portion of these alternatives would be closer to industrial and commercial areas and farther away from some noise-sensitive properties than the other Delridge Segment alternatives. Alternative DEL-7 has more potential noise impacts than Preferred Option DEL-6b, Alternative DEL-5, and Alternative DEL-6a because it would have a tunnel portal within a residential area, and night work at the tunnel portal could last several years. The Secret Studio Records/Studio 1208 recording studio is within the Duwamish Segment and is anticipated to



experience the highest construction noise levels from construction within the Delridge Segment under Alternative DEL-1a, Alternative DEL-2a, and Alternative DEL-4. Because of the distance between Secret Studio Records/Studio 1208 and construction activities from other alternatives, noise impacts from the other alternatives are not anticipated at the studio.

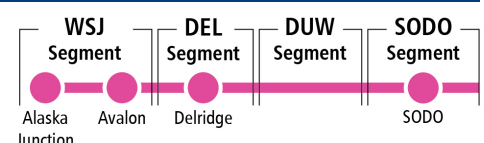
In the West Seattle Junction Segment, construction of Alternative WSJ-1 and Alternative WSJ-2 are anticipated to have lower potential for noise impacts at noise-sensitive properties than other alternatives that would require tunneling. Although tunneling would take place underground, construction at the tunnel portals would include night work, could last several years, and would be within residential areas. The tunnel portal for Alternative WSJ-6 would be within a residential area in the Delridge Segment. Construction at this tunnel portal would likely result in impacts at noise-sensitive properties within the Delridge Segment but could generate minimal noise impacts within the West Seattle Junction Segment. The overall construction duration of Alternative WSJ-1 and Alternative WSJ-2 might also be less than construction of a below-grade station and tunnel.

4.7.5.2 Vibration

Vibration caused by construction activities could potentially cause cosmetic damage to nearby structures and annoy occupants. The construction activity most likely to generate high levels of vibration is pile-driving. Pile-driving could potentially result in cosmetic damage to structures within 100 feet of pile locations if an impact pile driver is used. The number and severity of vibration impacts would depend on the location of the piles and the method of installation. Pile-driving is likely to be used in the construction of the new light rail bridge over the Duwamish Waterway and could be used in the construction of elevated guideways or retained cut guideways. Alternatives with elevated guideway are Alternative SODO-2 in the SODO Segment, all Build Alternatives in the Duwamish Segment, all Build Alternatives in the Delridge Segment, and Alternative WSJ-1 and Alternative WSJ-2 in the West Seattle Junction Segment. Alternatives with retained cut guideway include sections north of South Walker Street for Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b in the SODO segment; the retained cut section along the Pigeon Point neighborhood and sections near the tunnel portals for some alternatives in the Delridge segment; and sections near the tunnel portals for Preferred Option WSJ-5b, Alternative WSJ-4, and Alternative WSJ-5a in the West Seattle Junction segment.

When operating at distances greater than 20 feet, most other construction equipment has a low risk of causing even minor cosmetic damage from vibration. No buildings were identified within 20 feet of construction activities. Vibration from the tunnel boring machine cutterhead and supply train would likely remain below the cosmetic damage and annoyance thresholds for residential and institutional land uses, and there are no Category 1 or special buildings close to the tunnel alternatives.

Alternative DUW-2 in the Duwamish Segment would have an impact from pile-driving at Harbor Island Machine Works, a Category 1 land use. Detailed vibration predictions and mitigation measures would be included in a Vibration Control Plan for this property because of its vibration sensitivity. The Bootstrap Music Company, a music rehearsal space, is near the east end of the West Seattle Bridge and is likely to be within 100 feet of pile-driving locations for Preferred Alternative DUW-1a. The Bootstrap Music Company is not considered a Category 1 land use because it is compatible with noise and vibration levels generated by operational light rail; however, higher levels of vibration and groundborne noise generated by construction might be noticeable in the building. No other vibration impacts are expected to Category 1 land uses or special buildings during project construction.



4.7.6 Indirect Impacts of the Build Alternatives

Indirect noise and vibration impacts could be associated with transit-oriented development. Although noise associated with future development could increase noise in the project corridor, any increase would likely be minimal, and any new developments would be required to meet the City of Seattle noise regulations.

4.7.7 Mitigation Measures

4.7.7.1 Light Rail Noise Mitigation

Sound Transit is committed to minimizing project noise levels at their source for all of its light rail corridors. When noise would exceed FTA moderate or severe impact criteria, Sound Transit would consider noise mitigation measures consistent with its Link Noise and Vibration Policy (Resolution No. R2023-15; Sound Transit 2023), the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018), and the Sound Transit *Design Criteria Manual* (2021).

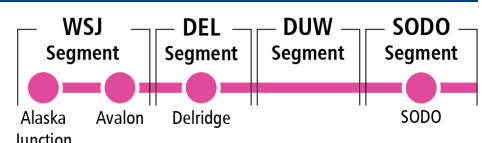
The Link Noise and Vibration Policy provides the hierarchy for implementation of mitigation measures. It prioritizes reduction at the noise source, followed by measures to disrupt the noise path, such as sound walls. Lastly, it considers residential sound insulation. The policy also guides coordination with the affected property owners and reconsideration of noise impacts and mitigation during final design.

Sound walls are the primary noise mitigation option for project operations because they are effective at reducing noise near the source. Sound walls for elevated profiles would be along the side of the top of the guideway; for other profiles, they would be next to the guideway on the ground or retaining structures. Sound walls are proposed for all areas with residential land uses in all segments. They are also proposed adjacent to Fire Station 14 in the Duwamish Segment.

Wheel squeal reduction measures, including non-oil-based lubrication and friction modifiers, would be included in the project design following the Sound Transit policy in the *Design Criteria Manual*. Under Sound Transit policy, curves with a radius of less than 600 feet near noise-sensitive properties must have track lubricators installed as part of the project. Curves with a radius of 600 feet to 1,250 feet must be built to allow for subsequent lubrication if needed.

For noise from crossovers, recommended mitigation would include special trackwork, such as moveable-point or spring-rail “frogs” (a mechanical installation enabling trains to be guided from one track to another, such as at a junction or where a spur or siding branches off), to eliminate the noise- and vibration-causing gap between tracks.

When source mitigation measures or sound barriers are infeasible or not entirely effective at reducing exterior noise levels below the FTA impact criteria, and where the affected building does not already achieve a sufficient exterior-to-interior reduction of noise levels, Sound Transit would consider residential sound insulation. Sound insulation is normally only used on older dwellings with single-paned windows or in buildings with double-paned windows that are no longer effective because of leakage. Most newer buildings have effective exterior-to-interior noise reduction, and additional sound insulation might not be necessary. For this analysis, however, any location not mitigated to within the FTA criteria with sound walls would be considered for sound insulation. Sound insulation would be designed to reduce the interior noise levels in sleeping and living quarters in residential land uses to within the 45-dBA Ldn guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, fresh air exchange must be maintained within the units. Sound insulation would not reduce exterior noise levels.



The project would mitigate the majority of noise impacts with sound walls along the guideway and with special trackwork at track crossover locations. A summary of the recommended sound walls and alternatives with locations considered for sound insulation are provided in Table 4.7-10.

The modeling process is conservative, and proposed mitigation is based on the current project design. During final design, the detailed noise analysis would be updated based on a more advanced design. All predicted noise levels and mitigation measures would be reviewed. Mitigation would be modified as needed to reduce noise levels to below the FTA impact criteria. If equivalent mitigation could be achieved by a less costly means or if the final design analysis shows no impact, then the mitigation measure may be modified or eliminated. After light rail operations begin, if the resulting noise were to exceed FTA criteria, Sound Transit would evaluate the need for additional mitigation. More details on light rail noise mitigation are available in Appendix N.3. Attachment N.3D shows detailed maps of noise impacts with proposed mitigation, and Attachment N.3F shows tables of noise predictions and includes predicted levels with mitigation.

Table 4.7-10. Recommended Noise Mitigation

Segment	Alternatives and Design Options	Mitigation Recommendation
Duwamish	Preferred South Crossing Alternative (DUW-1a)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	South Crossing South Edge Crossing Alignment Option (DUW-1b)	Sound Walls: 4 to 8 feet
	North Crossing Alternative (DUW-2)	Sound Walls: 4 feet
Delridge	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Sound Walls: 4 to 8 feet
	Dakota Street Station Alternative (DEL-1a)	Sound Walls: 4 to 6 feet
	Dakota Street Station North Alignment Option (DEL-1b)	Sound Walls: 4 to 6 feet
	Dakota Street Station Lower Height Alternative (DEL-2a)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Delridge Way Station Alternative (DEL-3)	Sound Walls: 4 to 6 feet
	Delridge Way Station Lower Height Alternative (DEL-4)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Andover Street Station Alternative (DEL-5)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Andover Street Station Lower Height Alternative (DEL-6a)	Sound Walls: 4 to 8 feet
	Andover Street Station Lower Height No Avalon Tunnel Connection Alternative (DEL-7)	Sound Walls: 4 to 6 feet, and review locations for potential sound insulation

Segment	Alternatives and Design Options	Mitigation Recommendation
West Seattle Junction	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Sound Walls: 4 to 10 feet
	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Sound Walls: 4 to 8 feet, and review locations for potential sound insulation
	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Sound Walls: 4 to 6 feet
	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	Sound Walls: 4 to 8 feet

Note: Sound wall height is determined by assessing the degree of noise impact and the height needed to mitigate the impact.

4.7.7.2 Construction Noise Mitigation

Through compliance with applicable construction permits and management plans along with incorporating best management practices such as using broadband backup alarms during nighttime hours, minimizing the use of public address systems, ensuring internal combustion equipment are fitted with mufflers, and locating equipment away from noise-sensitive properties to the extent feasible, no additional mitigation for noise impacts would be needed. Sound Transit would obtain a noise variance from the Seattle Department of Construction and Inspections to complete work during nighttime hours. For the construction staging areas near tunnel portals, mitigation measures could include construction of temporary noise barriers adjacent to the staging area. Detailed information on construction noise mitigation can be found in Appendix N.3.

4.7.7.3 Operational Vibration Mitigation

Sound Transit would mitigate vibration and groundborne noise impacts that exceed FTA criteria. Vibration impacts are projected at several special trackwork locations as the wheels travel through the gap between tracks at these locations. Sound Transit would use low-vibration designs for special trackwork, referred to as low-impact frogs, to mitigate these impacts.

For vibration impacts not caused by special trackwork, high-resilience direct-fixation fasteners would be used to reduce vibration levels. Fasteners are used to attach the rail to the concrete track slab. Alternative vibration mitigation approaches that may be applied under specific circumstances include increasing the thickness of the concrete under the track, specifying straighter rails, and building the track on top of pile foundation systems where the track would traverse very soft sections of soil.

With the potential mitigation, project vibration and groundborne noise levels are expected to be below FTA criteria. In addition, the modeling process is conservative, and additional measurement information at affected buildings might show no or reduced impact. As project design advances, some impacts may be eliminated or the type of mitigation needed may change. During final design, the detailed vibration analysis would be updated based on more advanced design and would evaluate the specific buildings, and alternative mitigation measures might be warranted. All predicted vibration levels and mitigation measures would be reviewed. Mitigation would be modified as needed to reduce vibration levels to below the FTA impact criteria. Recommended mitigation measures for each alternative with impacts are shown in Table 4.7-11. Additional information on light rail vibration mitigation can be found in Appendix N.3. Attachment N.3E shows detailed maps of vibration impacts with proposed mitigation, and Attachment N.3G shows tables of vibration predictions and includes predicted levels with mitigation.

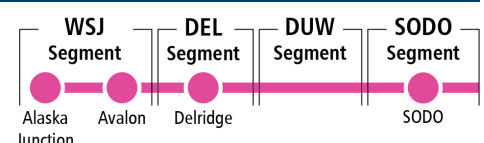
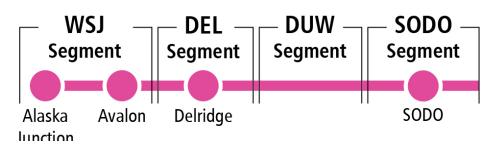


Table 4.7-11. Recommended Groundborne Noise and Vibration Mitigation

Segment	Alternatives and Design Options	Mitigation Recommendation
Duwamish	Preferred South Crossing Alternative (DUW-1a)	Low-impact frog
Delridge	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	High-resilience direct-fixation fastener
	Dakota Street Station Alternative (DEL-1a)	High-resilience direct-fixation fastener
	Delridge Way Station Alternative (DEL-3)	High-resilience direct-fixation fastener
	Andover Street Station Alternative (DEL-5)	High-resilience direct-fixation fastener
	Andover Street Station Lower Height Alternative (DEL-6a)	High-resilience direct-fixation fastener
	Andover Street Station Lower Height No Avalon Tunnel Connection Alternative (DEL-7)	High-resilience direct-fixation fastener
West Seattle Junction	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	High-resilience direct-fixation fastener and low-impact frog
	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Low-impact frog
	Tunnel 41st Avenue Station Alternative (WSJ-3a)	High-resilience direct-fixation fastener and low-impact frog
	Tunnel 42nd Avenue Station Option (WSJ-3b)	High-resilience direct-fixation fastener and low-impact frog
	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	High-resilience direct-fixation fastener and low-impact frog
	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	High-resilience direct-fixation fastener and low-impact frog
	No Avalon Station Tunnel Alternative (WSJ-6)	High-resilience direct-fixation fastener and low-impact frog

4.7.7.4 Construction Vibration Mitigation

The primary means of mitigating vibration from construction activities are to conduct pre-construction surveys, locate equipment as far as possible from vibration-sensitive sites, use alternative low-vibration methods where practical, and conduct vibration monitoring. The contractor, when selected, would prepare and implement a detailed Construction Vibration Control Plan that provides more detail on the construction vibration mitigation measures. Appendix N.3 provides more information on the potential mitigation measures that may be included in this plan. The Construction Vibration Control Plan would include Category 1 land uses and any other structures where predicted construction vibration would exceed the applicable thresholds. If pile-driving is planned within 100 feet of structures, alternative methods of pile installation or vibration monitoring would be considered. Predicted vibration levels from the tunnel boring machine are below impact thresholds. If needed, options for reducing vibration from the supply train during tunneling are reducing the operation speed of the supply train, smoothing the running surface, or using rubber-tire supply train vehicles. Pre-construction surveys would be conducted to document the existing conditions of buildings, and the contractor would be responsible for repairing damage resulting from the project. During final design, all impacts and potential mitigation measures would be reviewed for verification.



4.8 Water Resources

4.8.1 Introduction to Resource and Regulatory Requirements

This section discusses how the West Seattle Link Extension Project (the project) would affect surface water, including streams, rivers and bays, shorelines, floodplains and floodways, and groundwater (including critical aquifer recharge areas, sole-source aquifers, and wellhead protection areas that may be present). It also describes the affected water resources, the potential for flooding, and potential water quality impacts associated with the project.

Appendix L4.8, Water Resources, contains the following supporting information:

- A list of relevant laws, statutes, local ordinances, and guidelines
- A table of designated water uses for the waterbodies in the study area
- Maps and explanation of hydrologic soil groups in the study area
- Discussion of estimated changes in impervious surfaces
- Maps of floodplains, drainage basins, and outfalls in the study area, by segment
- Discussion of best management practices for stormwater impacts

Section 4.9, Ecosystems, includes discussions of wetlands, stream habitat, and stream and wetland buffers.

4.8.2 Affected Environment

The study area for water resources consists of the Longfellow Creek basin, Duwamish Waterway (also known as Duwamish River), Elliott Bay, and the City of Seattle combined sewer basins along the project corridor. The project is in the city of Seattle in King County, Washington, within Water Resource Inventory Area 9, the Green-Duwamish Basin (Ecology 2022). The study area is just inland of Puget Sound's Elliott Bay and includes the Duwamish Waterway and Longfellow Creek. The potential area of effect encompasses locations where water resources would be altered by construction and operation of the project and where resources would likely receive direct runoff from the project during construction and in long-term operation. The study area is generally highly developed, aside from the West Duwamish Greenbelt, which is a vegetated slope stretching 4 miles south from the West Seattle Bridge along the western side of the Duwamish Waterway. The study area is served by combined and separated storm sewer systems. The waterbodies, outfalls, drainage basins, and associated floodplains in the study area are shown on Figure 4.8-1.

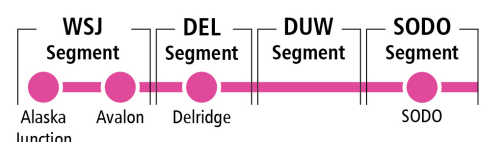
Stormwater Drainage in the Study Area

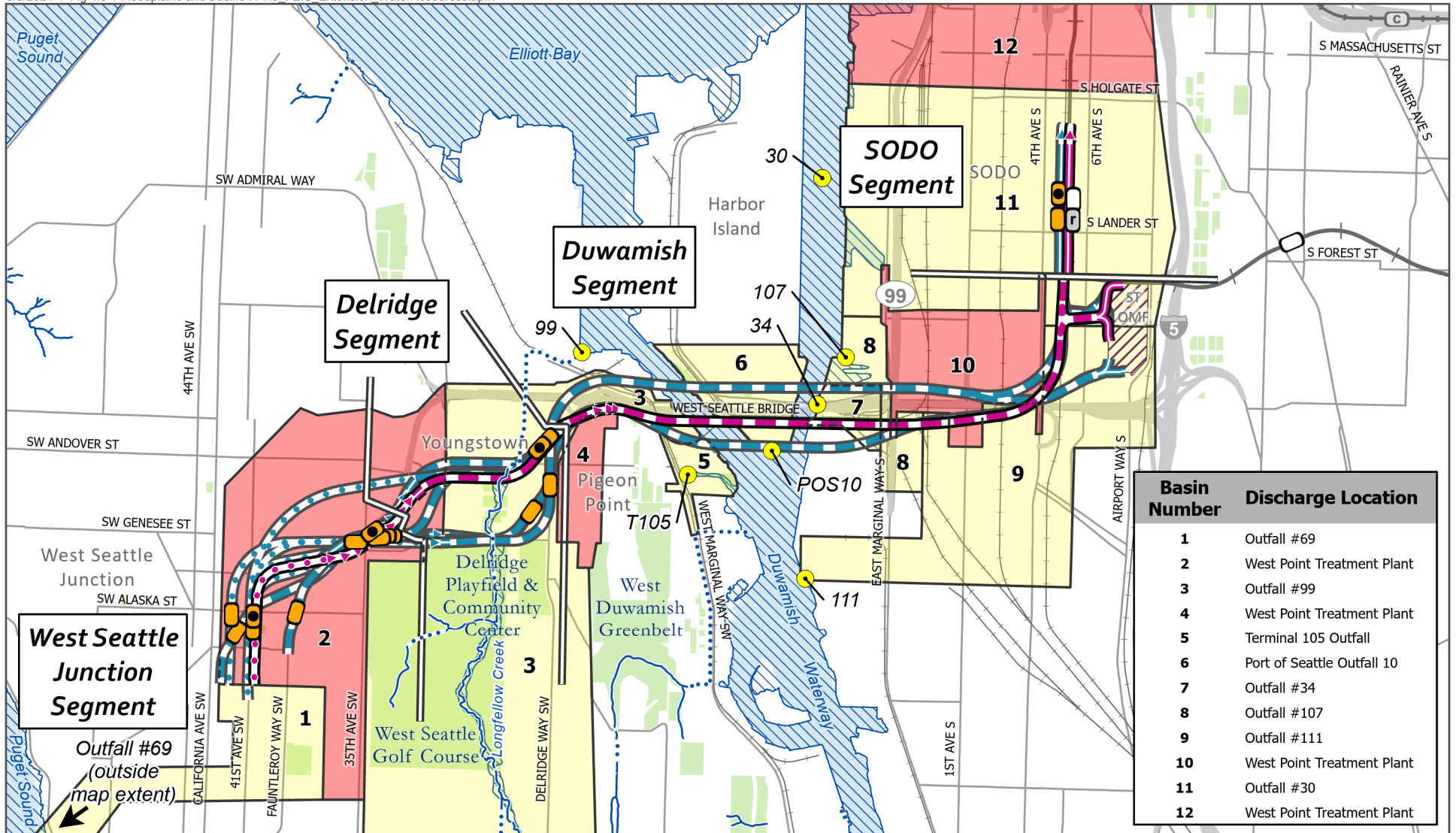
Combined Sewer System

Wastewater and stormwater travel in the same pipe to treatment plants. In the study area, there are both County and City combined sewer systems.

Separated Sewer System

Wastewater and stormwater travel in separate pipes: the wastewater is conveyed to treatment plants and stormwater is conveyed to drainage outlets.





Source: City of Seattle (2022, 2023), King County (2023).

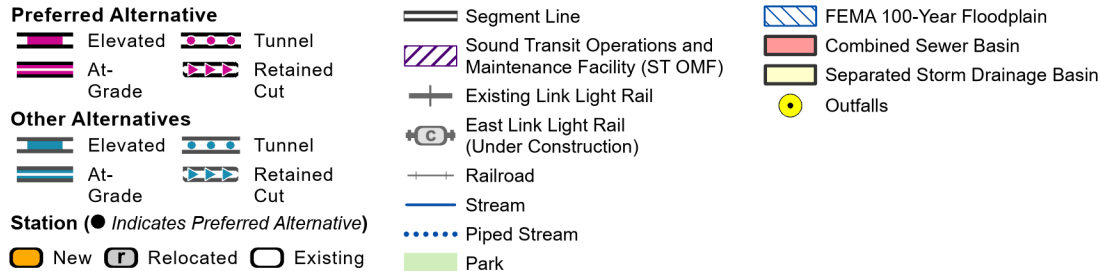
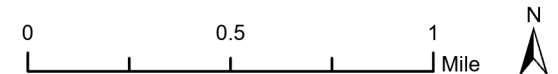


FIGURE 4.8-1
Floodplains, Drainage
Basins, and Outfalls

West Seattle Link Extension



4.8.2.1 Surface Water

Surface water, including stormwater runoff, in the study area drains into either a combined sewer system (City or County) (Figure 4.8-1, basin numbers 2, 4, 10, and 12) or to stormwater drains in separated sewer systems (Figure 4.8-1, basin numbers 1, 3, 5 through 9, and 11). Surface water also flows to Longfellow Creek, a tributary to the Duwamish Waterway. Stormwater runoff that drains to a combined sewer system is treated at the West Point Wastewater Treatment Plant, adjacent to Discovery Park in the City of Seattle's Magnolia neighborhood, before being discharged into Puget Sound. Figure 4.8-1 shows the major creeks and waterbodies in the study area, as well as the drainage basins and discharge (i.e., outfall) locations.

The Washington State Department of Ecology (Ecology) has designated water uses to each of the study area waterbodies (see Table L4.8-1 in Appendix L4.8). These uses define applicable water quality standards for each waterbody. Elliott Bay, Longfellow Creek, and the Duwamish Waterway have designated uses of aquatic life, recreation, and non-domestic water supply. More information on fish habitat is provided in Section 4.9.

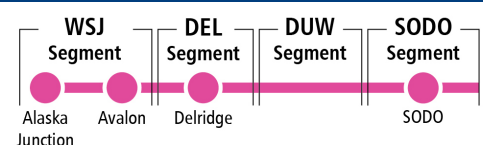
4.8.2.1.1 Duwamish Waterway

The lowermost 11 miles of the Duwamish River are a tidally influenced estuary where salt water from Puget Sound mixes with fresh water from the Duwamish River. The Duwamish River in the study area includes the Duwamish Waterway (East Waterway and West Waterway), separated by Harbor Island and referred to collectively as the Duwamish Waterway. It supports commercial and recreational navigation and salmon fishing, most especially in the estuarine area. The Duwamish River is categorized as "Salmonid Rearing and Migration Only Habitat" for aquatic life use (King County 2016a, Washington Administrative Code 173-201A-602).

The Duwamish Waterway receives flows from numerous combined sewer overflow outfalls and separate storm drain outfalls within the study area. As shown on Figure 4.8-1, most of the study area that does not drain to the West Point Wastewater Treatment Plant discharges to the Duwamish Waterway.

There are two Superfund sites in the study area that are crossed by project alternatives. The United States Environmental Protection Agency listed Harbor Island and its associated sediments as a Superfund site in 1983, and the Lower Duwamish Waterway as a Superfund site in 2001 (United States Environmental Protection Agency 2023a, 2023b). The Lower Duwamish Superfund site is 5 miles long, stretching from the southern tip of Harbor Island to the end of the straightened waterway in Tukwila. The Lockheed West Seattle Superfund site is about a mile north from the project alternatives at the mouth of the Duwamish Waterway, and is noted here because it does contribute to water quality impairments in the study area. Section 4.12, Hazardous Materials, provides more information on the status of the two Superfund sites in the study area.

Ecology classifies the Lower Duwamish Waterway as a Category 5 waterbody, and it was included in the Ecology 303(d) list of impaired waterbodies in 2022 because of exceedances of more than 40 water quality criteria. Ecology maintains the 303(d) list in compliance with Section 303(d) of the Clean Water Act to track impaired waterbodies and to prioritize cleanup needs. A Category 5 waterbody means that Ecology has data showing that the water quality standards have been violated for one or more pollutants and that there is no pollution-control program in place (Ecology 2023). Of special concern are dissolved oxygen and fecal coliform, which frequently exceed the state standard. The Duwamish Waterway has also seen an increasing trend of water temperatures since the 1970s (King County 2016a).



4.8.2.1.2 Longfellow Creek

Longfellow Creek flows for more than 4 miles from its origin near Southwest Thistle Street into the West Waterway (City of Seattle 2012). North of Southwest Yancy Street, the downstream 3,260 feet of the creek flows through an underground 60-inch storm drain beneath a business park, roads, Nucor Steel, and Port of Seattle properties until it discharges into the West Waterway, and during overflow events is also redirected through an underground 42-inch storm drain beneath Port of Seattle property until it discharges into Elliott Bay (City of Seattle 2023a). Land use along the creek is almost entirely developed (King County 2016b). The creek is categorized as “Salmonid Spawning, Rearing and Migration Habitat” for aquatic life use (King County 2016b). Portions of the creek have been assigned “Supplemental Spawning and Incubation Protection” temperature criteria of 13 degrees Celsius, applicable from September 15 to May 15.

Water quality testing completed by King County since the 1970s in the northernmost point of the creek has identified this area as Moderate Concern (King County 2021). Ecology classifies Longfellow Creek as a Category 5 waterbody, and it was included on the Ecology 303(d) list in 2014 because of exceedances of criteria for water temperature, dissolved oxygen, and fecal coliform bacteria (Ecology 2023).

4.8.2.1.3 Elliott Bay

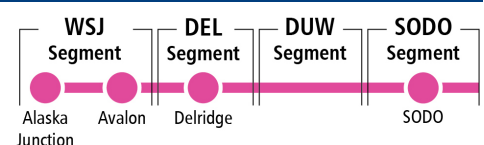
Elliott Bay is part of Puget Sound and is adjacent to the Seattle downtown waterfront. The Duwamish Waterway flows into Elliott Bay. Some runoff from the West Seattle Junction Segment of the project corridor drains untreated into Puget Sound through existing stormwater system infrastructure. Elliott Bay is categorized as “Salmonid Rearing and Migration Only” for aquatic life use (Ecology 2023) and is included in 303(d) listings for exceedances in bacteria levels.

4.8.2.1.4 Combined Sewer Service Areas

The combined sewer system is a network of city pipelines collecting both storm and sanitary sewer flows that are conveyed to King County interceptor pipes. In these areas of the city (Figure 4.8-1, basin numbers 2, 4, 10, and 12), pipes lead to diversion structures and the West Point Wastewater Treatment Plant, where the flows are treated and released to Puget Sound. During overflow events, untreated water in combined sewer systems is discharged to Puget Sound or the Duwamish Waterway at combined sewer overflow outfalls.

4.8.2.2 Shorelines

The Duwamish Waterway shorelines are designated as Urban Industrial in the City of Seattle’s Shoreline Master Program (City of Seattle 2023b) and are heavily developed with Port of Seattle and related industrial waterfront uses. The Shoreline Master Program regulates designated shorelines of the state within the city and 200 feet from the ordinary high-water mark along the shoreline. The only other shorelines that are included in the study area are associated with the mouth of Longfellow Creek. Although Longfellow Creek itself is not a designated shoreline of the state, the mouth of the creek lies within the shoreline jurisdiction of the West Waterway. Information on shoreline habitat is provided in Section 4.9.



4.8.2.3 Floodplains

The Federal Emergency Management Agency (FEMA) classifies the Duwamish Waterway as a Special Flood Hazard Area Inundated by the 100-Year Flood as Zone AE, meaning that base flood elevations have been determined (FEMA 2020). The study area is heavily industrialized and nearly 100 percent of the Duwamish Waterway shoreline in the study area has been modified by placing fill and associated structure protection on industrial properties adjacent to the waterway. Only a few small areas outside of the Duwamish Waterway itself are within the FEMA-designated 100-year floodplain. The Duwamish Waterway is regulated for flood control on the upper Green River (near Rivermile 64.5) by the Howard A. Hanson dam, which is operated by the United States Army Corps of Engineers. Figure 4.8-1 illustrates the Duwamish Waterway floodplain limits.

The portion of Longfellow Creek in the study area lies within a floodplain mapped by FEMA. The floodplain is classified as a Special Flood Hazard Area Inundated by the 100-Year Flood as Zone A, meaning that no base flood elevations nor floodways have been determined (FEMA 2020). FEMA-designated 100-year floodplains are areas with a 1 percent or greater chance of flooding each year. Flooding is known to occur at numerous locations along Longfellow Creek due to restricted channel and culvert capacities as well as debris accumulations causing partial obstruction of the natural channel (FEMA 2020). During a field visit in March 2023, it was found that the creek is conveyed under Southwest Genesee Street through a siphoned culvert with a trash rack at the outlet (Figure 4.8-2). The structure was partially blocked by debris, which suggests that the structure may be non-functional and Southwest Genesee Street may flood during large flow events. Seattle Public Utilities owns and maintains the Southwest Genesee Street Detention Dam, a flood control and stormwater detention dam on Longfellow Creek on the south side of Southwest Genesee Street. The north slope of the roadway is armored with concrete blocks and is designed to function as an emergency spillway when needed. In normal conditions, the dam does not retain any water and all flows are conveyed within Longfellow Creek (City of Seattle 2020). This dam is regulated and permitted by Ecology and is considered a high-hazard dam if the dam were to fail (Ecology 2020).

Figure 4.8-2 Siphoned Culvert at Southwest Genesee Street Dam Outlet



4.8.2.4 Groundwater

There are no designated sole-source aquifer areas, critical aquifer recharge, or wellhead protection areas that occur within the study area. The hydrogeologic regime and groundwater flow in the Puget Sound area are highly variable. Groundwater recharge typically occurs in the upland areas of the city and predominantly flows downward to the discharge areas and eventually to major surface waterbodies. On the steep slopes on Pigeon Point, groundwater seeps were observed during a project site visit (HNTB 2021), meaning that groundwater reached the surface.

Impervious Surfaces

Impervious surfaces are hard surfaces that do not allow rainwater to seep through and enter groundwater beneath the surface. Impervious surfaces increase runoff volumes that can also increase pollutant runoff, flooding, and stream erosion. New impervious surfaces are areas that would replace existing pervious surfaces, where rainwater can seep through the surface and enter groundwater. Existing pervious surface areas are generally vegetated or bare ground.

Section 4.11, Geology and Soils, provides more information on groundwater and aquifers. More information on potential for groundwater contamination is provided in Section 4.12.

4.8.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, light rail would not be extended to West Seattle and the potential impacts on water resources identified for the Build Alternatives would be avoided. The No Build Alternative would have no direct impacts on any waterbodies, stormwater flow in combined sewer service areas, shorelines, or floodplains and floodways. There would also be no construction impacts. However, the potential water quality benefits associated with the project would also not be realized, such as reduced pollution from motor vehicles and the addition of water quality treatment for pollution-generating impervious surfaces that are currently not treated.

4.8.4 Environmental Impacts of the Build Alternatives during Operation

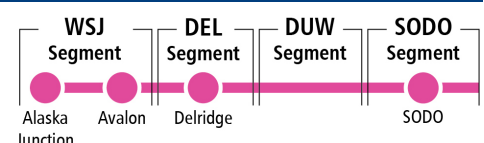
4.8.4.1 Impacts Common to All Alternatives

As design advances, Sound Transit would continue to coordinate with the City of Seattle and King County on issues related to water resources, including the following:

- Approved points of discharge and discharge basins
- Flow-control and water quality requirements
- Opportunities for infiltration
- Extension of utility mainlines
- Temporary and permanent dewatering
- Potential for onsite stormwater management when outside of the public right-of-way

4.8.4.1.1 Water Quality

All alternatives would increase impervious surfaces. In the project, pollution-generating impervious surfaces are the pavement areas of road improvements needed to accommodate the project. The pollutants from vehicular traffic on these surfaces accumulate on the road surface and are transported to waterbodies by stormwater runoff that, if not treated, can degrade water quality in receiving waters. The potential impacts of added pollution-generating impervious surfaces are greater in drainage basins that drain directly to surface water resources than in basins draining to combined sewers, which are treated before discharging to surface water resources.



Stormwater runoff from the project would drain to the locations described in Section 4.8.2.1, Surface Water. Sound Transit would provide water quality treatment for all runoff from new and replaced pollution-generating impervious surfaces outside of public right-of-way and new pollution-generating impervious surfaces within public right-of-way. Water quality treatment for replaced pollution-generating impervious surface in public right-of-way is not required based on current code requirements, but would be provided in some areas as agreed to with the City of Seattle. All impervious areas would be reviewed for necessary flow control implementation in each basin, per City of Seattle minimum requirements. This would prevent the additional runoff from the project from overloading and affecting the city and county pipe networks and other combined sewer system infrastructure.

Non-pollution-generating impervious surfaces in the project are guideways,¹ station buildings, and sidewalks. In general, runoff from non-pollution-generating impervious surfaces would not generate pollutants and would not degrade water quality, additional impervious surface area could increase stormwater volumes and flow rates to affected waterbodies and decrease groundwater infiltration. Table 4.8-1 summarizes the estimated total new impervious surface added with each alternative (these totals combine both pollution-generating and non-pollution-generating impervious surfaces). For further details, refer to Appendix L4.8, which quantifies the types of impervious surfaces added to areas not served by combined sewer systems.

Best management practices included as part of the project would minimize the effects of increased impervious surface. Flow-control vaults would be added in areas of added impervious surfaces, such as roadway improvements, guideways, and at stations. The vaults would control the volume, rate, frequency, and flow duration of stormwater runoff. Stormwater vaults consist of concrete boxes sited below ground level, with access covers or grates at the surface. Water quality treatment would be provided when pollutant-generating impervious surface (roadway) runoff discharges into surface waters (Figure 4.8-1, basin numbers 1, 3, 5 through 9, and 11). In addition, at intersections that would be improved, additional oil control treatment would be provided where required. This provides supplemental removal of pollutants from areas with higher vehicle use. As noted, if areas discharge to a combined sewer system, water quality treatment is not required as the runoff collected in these systems is directed to a wastewater treatment plant.

In addition, there are areas in all project segments where some older, existing impervious surfaces on the streets would be replaced with newer surfaces as part of roadway improvements associated with the project and/or to improve their strength and durability.

Runoff from replaced surfaces may also receive water quality treatment in addition to flow control prior to discharging to surface waters. Some of these replaced surfaces are pollution-generating but currently do not receive treatment, because such treatment was not required when they were constructed. Adding treatment for these surfaces would result in additional reductions of pollutants, providing additional benefits to surface waters. These areas would be identified during subsequent design of the project, based on pavement condition data to be collected.

A City of Seattle requirement to direct stormwater from the project to storm drains that are within 300 feet of the project's long-term footprint will be incorporated where opportunities exist. This would reduce flows to the combined sewer system, increasing available capacity. These opportunities will be identified as the project develops; one specific example is described in Section 4.8.4.4, Delridge Segment.

¹ Sound Transit and Ecology entered into a Memorandum of Understanding dated December 9, 2019, in which Sound Transit agreed to conduct a study to characterize the quality of the stormwater discharged from light rail guideways. The data and analysis from the study will be used to inform the design of light rail projects that are scheduled in the Sound Transit 3 Plan to be completed between 2030 and 2041, and Sound Transit will identify all known, available, and reasonable methods of prevention, control, and treatment to define light-rail specific best management practices.

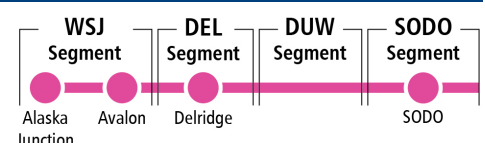
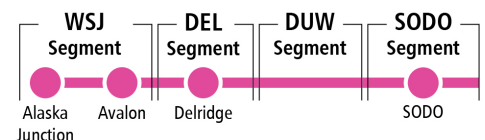


Table 4.8-1. Summary of New Impervious Areas for West Seattle Link Extension Alternatives

Segment	Alternatives and Design Options	Total New Impervious Surface (square feet)
SODO	Preferred At-Grade Lander Access Station Option (SODO-1c)	5,400
SODO	At-Grade Alternative (SODO-1a)	5,400
SODO	At-Grade South Station Option (SODO-1b)	7,100
SODO	Mixed Profile Alternative (SODO-2)	3,700
Duwamish	Preferred South Crossing Alternative (DUW-1a)	47,700
Duwamish	South Crossing South Edge Crossing Alignment Option (DUW-1b)	60,100
Duwamish	North Crossing Alternative (DUW-2)	4,800
Delridge	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	56,700
Delridge	Dakota Street Station Alternative (DEL-1a)	53,400
Delridge	Dakota Street Station North Alignment Option (DEL-1b)	44,600
Delridge	Dakota Street Station Lower Height Alternative (DEL-2a)	51,300
Delridge	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	21,900
Delridge	Delridge Way Station Alternative (DEL-3)	48,300
Delridge	Delridge Way Station Lower Height Alternative (DEL-4)	31,700
Delridge	Andover Street Station Alternative (DEL-5)	27,300
Delridge	Andover Street Station Lower Height Alternative (DEL-6a)	29,400
Delridge	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	48,400
West Seattle Junction	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	98,300
West Seattle Junction	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	35,900
West Seattle Junction	Elevated Fauntleroy Way Station Alternative (WSJ-2)	30,700
West Seattle Junction	Tunnel 41st Avenue Station Alternative (WSJ-3a)	64,000
West Seattle Junction	Tunnel 42nd Avenue Station Option (WSJ-3b)	30,700
West Seattle Junction	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	81,700
West Seattle Junction	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	98,300
West Seattle Junction	No Avalon Station Tunnel Alternative (WSJ-6)	63,600



4.8.4.1.2 Groundwater

Increases in impervious area from the project could reduce the amount of groundwater recharge because there would be less pervious area available for precipitation to directly infiltrate into the ground. Low-impact design (also referred to as onsite stormwater management), which encourages natural processes of managing stormwater such as infiltration, evaporation, and dispersion, would be used where possible based on available property and soil infiltration, which could offset the effects of decreases in pervious area by increasing infiltration in some locations. As a result, the project is not expected to substantially impact groundwater levels.

Subsurface drainage systems would be required in certain locations where groundwater would be present behind foundations and retaining walls. The subsurface drainage systems would be designed to protect the project and manage the groundwater. In addition, stormwater runoff from pollution-generating impervious surfaces resulting from the project would be treated as required before release, such that groundwater quality would not be adversely impacted. The following segment-specific sections mention locations where subsurface drainage systems are currently expected to be needed; other locations may be identified during design after additional subsurface data are collected.

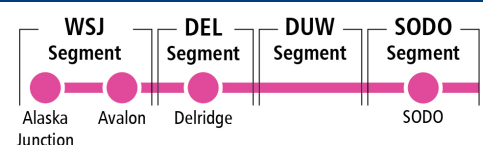
4.8.4.2 SODO Segment

There would be no additional impacts to water resources in the SODO Segment beyond the applicable impacts common to all alternatives. Most of the SODO Segment would discharge to the Duwamish Waterway and would receive flow-control and water quality treatment (Figure 4.8-1, basin number 11). In other areas of the segment, stormwater would be collected in flow-control vaults and discharged to systems that connect to the West Point Wastewater Treatment Plant (Figure 4.8-1, basin number 12).

4.8.4.3 Duwamish Segment

Groundwater seeps along the West Duwamish Greenbelt would require a subsurface drainage system beneath the slope and elevated guideway of Preferred Alternative DUW-1a and Option DUW-1b to manage seepage and provide slope stability. The system would collect the groundwater flows upslope of the project and discharge flows downslope of the project, and negative impacts to groundwater are not anticipated. Most areas of the Duwamish Segment would discharge to the Duwamish Waterway and would receive flow-control and water quality treatment (Figure 4.8-1, basin numbers 5, 6, 7, 8, and 9). In other areas of the segment, stormwater would be collected in flow-control vaults and discharged to systems that connect to the West Point Wastewater Treatment Plant (Figure 4.8-1, basin numbers 4 and 10). Due to this, negative impacts to the Duwamish Waterway are not anticipated.

All of the Duwamish Segment alternatives would be on elevated guideway and would cross the Duwamish Waterway on a high-level fixed bridge. Sound Transit evaluated the feasibility of several bridge types to cross the Duwamish Waterway. The bridge over the East Waterway would be a balanced cantilever segmental box girder for all alternatives. Preferred Alternative DUW-1a would be cable-stayed or truss bridge over the West Waterway to avoid guideway columns in the Duwamish Waterway. For Option DUW-1b and Alternative DUW-2, the bridge type over the West Waterway has not been selected and guideway columns could be placed in the Duwamish Waterway.



As shown in Table 4.8-2, Alternative DUW-2 could have the greatest amount of water displacement from the guideway columns below the mean high-water mark of the Duwamish Waterway, depending on bridge type. Alternative DUW-2 has the potential to avoid displacing water below the mean high-water mark, depending on bridge type. All work below the mean high-water mark would be within the mapped floodplain for the Duwamish Waterway.

Preferred Alternative DUW-1a would not have permanent structures within the FEMA-designated 100-year floodplain and would not have the potential to change the flow behavior of the Duwamish Waterway. Option DUW-1b and Alternative DUW-2 could have guideway columns in the floodplain, depending on bridge type. Potential changes to the mapped floodplain would be analyzed during final design if a bridge type is selected that results in impacts within the mapped floodplain, and Sound Transit would work to minimize impacts consistent with Executive Order 11988, Floodplain Management, Federal Flood Risk Management Standard, and Executive Order 14030, Climate-Related Financial Risk.

Option DUW-1b would require relocation of two Port of Seattle stormwater outfalls (one 8-inch and one 18-inch) that discharge to the West Waterway, as well as one 18-inch stormwater outfall that discharges to the East Waterway. The permanent impact area for the three relocated stormwater outfalls would be less than 0.1 acre total and would be below the mean high-water mark of the Duwamish Waterway. Preferred Alternative DUW-1a and Alternative DUW-2 would not require relocation of any stormwater outfalls. All stormwater outfall relocations are related to conflicts with bridge guideway column foundation locations. Impacts to surface habitat and water quality impacts on aquatic species in the Duwamish Waterway from the guideway column footprint and outfall relocations are discussed in Section 4.9.

Table 4.8-2. Summary of Bridge Guideway Column Volumes in the Duwamish Waterway

Alternatives and Design Options	Approximate Volume of Guideway Columns below Mean High-water Mark (cubic yards)
Preferred South Crossing Alternative (DUW-1a)	0
South Crossing South Edge Crossing Alignment Option (DUW-1b)	6,560 to 9,840
North Crossing Alternative (DUW-2)	0 to 10,450

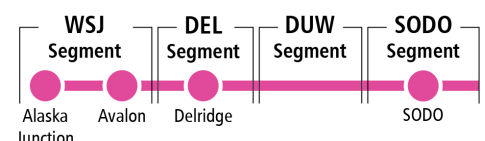
Notes:

Range reflects impacts from different possible bridge types.

In-water guideway column volumes include the volume of the guideway columns (including pier caps) that are fully or partially below the mean high-water mark of the Duwamish Waterway.

4.8.4.4 Delridge Segment

All Delridge Segment alternatives would drain to the storm drainage system (which drains into the Duwamish Waterway) (Figure 4.8-1, basin number 3), or to a combined sewer system (Figure 4.8-1, basin numbers 2 and 4) that would be conveyed to the West Point Wastewater Treatment Plant. During combined sewer overflow events, drainage would discharge to the Duwamish Waterway. The retained cut guideway approaching Avalon Station for Preferred Option DEL-6b and Alternative DEL-6a would intercept groundwater flows from groundwater, but the retained cut guideway would be sealed and allow for groundwater to flow below and around it. These small collections would be pumped into the nearest combined sewer system for disposal and are not expected to substantially affect the groundwater level around the tunnel alternatives.



As shown on Figure 4.8-1, all alternatives would cross the Longfellow Creek 100-year floodplain. The elevated guideway for Preferred Option DEL-6b and Alternative DEL-7 would cross the floodplain and would have four guideway columns in the FEMA-designated 100-year floodplain. Sound Transit has established the base flood elevation for Preferred Option DEL-6b and determined the project would result in an increase in the base flood water surface elevation of 0.01 foot. As design advances, Sound Transit would evaluate whether guideway columns could be shifted to avoid impacts to the floodplain (consistent with Executive Order 11988, Floodplain Management) or coordinate with the City of Seattle regarding modifications to the floodplain to increase storage capacity. If modifications to the floodplain occur, Sound Transit would submit a Conditional Letter of Map Revision to FEMA. The design analyzed in this Final EIS minimizes impacts to the extent practicable for the height and location of the preferred alternative elevated guideway. Longfellow Creek has no defined floodway; therefore, no floodway analysis could be performed.

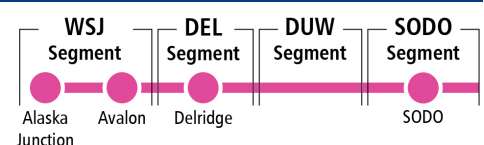
The Dakota Street station alternatives (DEL-1a, DEL-1b, DEL-2a, and DEL-2b) and Delridge Way station alternatives (DEL-3 and DEL-4) all would cross Longfellow Creek at Southwest Genesee Street, but on different sides and distances from the street. The creek has a FEMA-designated 100-year floodplain on each side of Southwest Genesee Street, and all of these alternatives would have one or more elevated guideway columns in the FEMA-designated 100-year floodplain. Alternative DEL-5 and Alternative DEL-6a would cross the creek where it is piped underground and there is no FEMA-designated 100-year floodplain and therefore would not have guideway columns in the FEMA-designated 100-year floodplain. Executive Order 13690, Federal Flood Risk Management Standard, and Executive Order 14030, Climate-Related Financial Risk, were established to encourage climate resiliency of federally funded projects and provide guidelines for what to evaluate in project siting, design, and construction. Appendix L4.8 provides more information on potential floodplain impacts and compliance with floodplain executive orders.

The Dakota Street station alternatives and Delridge Way station alternatives could also have guideway column foundations in close proximity to the Southwest Genesee Street Detention Dam or may require widening of the roadway to the north, affecting the emergency spillway. The placement of guideway column foundations within the dam fill is not expected based on the current level of design. Option DEL-1b and Option DEL-2b would require widening of Southwest Genesee Street to the north. Sound Transit would coordinate with Seattle Public Utilities and Ecology to determine if any modifications to the dam or emergency spillway would be needed to maintain the dam's integrity or function. Modifications, if needed, could require a permit from Ecology's Dam Safety Office.

4.8.4.5 West Seattle Junction Segment

All West Seattle Junction Segment alternatives would drain to a combined sewer system (Figure 4.8-1, basin number 2) that would be conveyed to the West Point Wastewater Treatment Plant. A small portion of Alternative WSJ-1 and Alternative WSJ-3a would discharge to Puget Sound and would receive flow-control and water quality treatment (Figure 4.8-1, basin number 1).

Although tunnels would be watertight, all tunnel alternatives in the West Seattle Junction Segment would have a drainpipe to convey groundwater that may seep into the tunnel. The Sound Transit tunnel design criteria assume 0.2 gallon per minute of seepage per 250 feet of tunnel. These small flows would be pumped into the nearest storm or combined sewer system for disposal and are not expected to substantially affect the groundwater level around the tunnel alternatives.



4.8.5 Environmental Impacts of the Build Alternatives during Construction

4.8.5.1 Impacts Common to All Alternatives

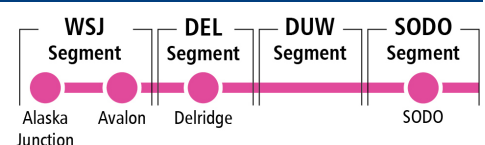
Construction-related impacts to water resources would be similar for all Build Alternatives because construction equipment and techniques would be similar. Alternatives with more at-grade or cut-and-cover portions would disturb more ground area and require more water pollution protective measures.

The following construction activities could affect water resources:

- **Earthwork, stockpiling, and material transport:** Soil exposed in sloped excavations or fills is especially susceptible to local erosion until vegetation is established. Wind can erode dry, exposed soil. Water or wind can carry loose soil into adjacent stormwater drains. Construction vehicle tires can carry soil onto roadways, where the soil could wash into ditches and storm drains during storms.
- **Concrete work and paving:** Runoff that encounters process water or slurry from concrete work or curing concrete can increase the pH in surface water to levels harmful to fish and wildlife.
- **Construction machinery:** Equipment leaks or spills can affect water quality in nearby water resources. Construction-related pollutants can increase turbidity and affect other water quality parameters, such as oils and grease, pH levels, and/or the amount of available oxygen in the water.
- **Construction below the groundwater table:** In locations along the project corridor where construction of tunnels and underground stations would be at or below the groundwater table, groundwater dewatering would occur to keep construction excavations free of water to provide safe and workable spaces. This is a temporary impact to groundwater levels and flow. If the groundwater meets King County pollutant criteria, it would be discharged to an existing separated storm drain system, where available, or to the existing combined sewer system if there is capacity. Discussion of hazardous materials and procedures may be found in Section 4.12. This has the potential to temporarily increase flow to existing infrastructure. Construction below the groundwater table also has the potential to impact the water quality of groundwater because of the construction machinery itself. In upland areas, where groundwater flows downward to surface waterbodies, and the Pigeon Point neighborhood, where seeps have been observed, this potential water quality impact would also apply to the nearby surface waterbodies.

Sound Transit would develop and implement a Construction Stormwater Pollution Prevention Plan with the following plans (for further details, refer to Appendix L4.8, Section L4.8.6, Best Management Practices):

- Temporary Erosion and Sediment Control Plan
- Spill Prevention, Control, and Countermeasures Plan
- Concrete Containment and Disposal Plan
- Dewatering Plan
- Fugitive Dust Plan



Sound Transit would use a variety of best management practices to avoid or minimize impacts during construction, such as erosion, sedimentation, dust, and other water quality impacts. Best management practices could include, but are not limited to, stabilized construction site entrances, silt fencing, and the mulching or covering of stockpiles and other disturbed sites.

In upland areas, conventional best management practices, such as construction limit fencing and mulching or other temporary covering of exposed soils as with plastic, would reduce the erosion during construction. For example, in areas with steep slopes, workers would minimize disturbance and place erosion blankets over reseeded areas at the conclusion of construction. More information on best management practices can be found in Appendix L4.8.

Construction impacts specific to working in or near waterbodies are outlined in the subsections of the project containing waterbodies and/or where the project would affect groundwater.

4.8.5.2 SODO Segment

There are no additional impacts to the water resources in the SODO Segment beyond the applicable impacts common to all alternatives.

4.8.5.3 Duwamish Segment

Construction at waterbody crossings, such as the Duwamish Waterway, can pose a direct risk to water quality from pollutant spills, sediment runoff and transport, or wind deposition of stockpiled materials. Soil exposed in sloped excavations or fills during construction is especially susceptible to local erosion until vegetation is established. Water or wind can carry loose soil into adjacent waterbodies. Construction activities within the Duwamish Waterway for the bridge structures, including coffer dams and work trestle foundations, would disturb sediments, potentially impacting water quality. Stormwater outfall relocations would also disturb sediments, but to a lesser degree than bridge guideway columns because the area disturbed would be smaller and the construction duration would be less. Work barges used during construction to transport supplies or provide work cranes could also stir up sediments.

Sound Transit would use the best management practices described in Section 4.8.5.1, Impacts Common to All Alternatives, and follow regulatory requirements to minimize these impacts.

All Duwamish Segment alternatives would cross the Duwamish Waterway and its shoreline on high-level bridges. As shown in Table 4.8-3, Option DUW-1b would have the largest in-water construction area on the Duwamish Waterway and Preferred Alternative DUW-1a would have the smallest. Sound Transit considered several different types of high-level fixed bridges for crossing the Duwamish Waterway. The bridge over the East Waterway would be a balanced cantilever segmental box girder for all alternatives. Preferred Alternative DUW-1a would have either a cable-stayed or steel truss bridge over the West Waterway to avoid permanent in-water structures. A bridge type has not been selected for Option DUW-1b and Alternative DUW-2, which still consider bridge types with in-water guideway columns and depending on the bridge type, the in-water footprint could potentially be reduced. All work below the mean high-water mark would be in the mapped floodplain for the Duwamish Waterway. Temporary construction work within the mapped floodplain could occur for all alternatives.

Groundwater pump stations would be needed to control groundwater for alternatives near Pigeon Point. It is assumed that the groundwater in this area would be routed to detention facilities where necessary and discharged to storm drains where available.

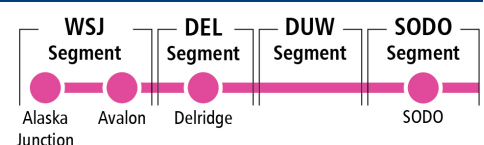


Table 4.8-3. Summary of Construction Impacts to the Duwamish Waterway

Alternatives and Design Options	Approximate Area of Construction Impacts in Waterbody (acres)
Preferred South Crossing Alternative (DUW-1a)	<0.1
South Crossing South Edge Alignment Option (DUW-1b)	0.2 to 1 ^a
North Crossing Alternative (DUW-2)	0 to 0.9

Note: Range reflects impacts from different possible bridge types.

^a Less than 0.1 acre of impact is associated with storm drain outfalls.

4.8.5.4 Delridge Segment

Though there are no guideway columns in Longfellow Creek, construction activities could still impact the creek. The potential impacts associated with construction near waterbody crossings are as described for the Duwamish Segment and would be managed with the same best management practices. Longfellow Creek also requires protection from pollutants and streambed erosion during construction activities. Construction discharges to Longfellow Creek would be controlled to meet city, state, and federal permit requirements for water quality and flow rates.

4.8.5.5 West Seattle Junction Segment

There are no additional impacts to water resources in the West Seattle Junction Segment beyond the applicable impacts common to all alternatives.

4.8.6 Indirect Impacts of the Build Alternatives

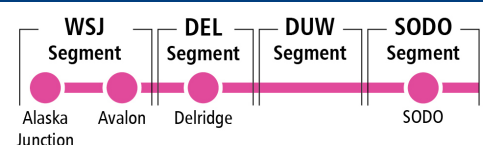
Population in Washington state is expected to increase, which would increase demand for development and vehicular traffic in many parts of the state. The project would convert some future vehicle traffic to light rail and reduce vehicle-related stormwater pollutants. This would be a benefit to water quality in the region.

The project could also indirectly attract residents and increase density near the new stations, reducing development pressure and associated increases in stormwater runoff in undeveloped areas in other portions of the watershed. The project would also support redevelopment around station areas, which could lead to associated infrastructure improvement. These redevelopment projects would be required to provide stormwater treatment for any new or changed pollution-generating impervious surface, which would improve water quality.

4.8.7 Mitigation Measures

Operation and construction of the project would comply with federal, state, and regional regulations related to water quality. Potential impacts to water quality would be minimized or avoided through project planning, design, and implementing best management practices. Additional floodplain storage may be needed for a change in the base flood elevation for Longfellow Creek.

Mitigation for unavoidable impacts in the Duwamish Waterway and Longfellow Creek would be approved by the appropriate permitting agencies and jurisdictions before construction. Section 4.9 provides additional information on compensatory mitigation. As plans for wetland mitigation adjacent to Longfellow Creek advance, the floodplain analysis will be updated to reflect modified grading plans and determine if a rise in the base flood elevation would still occur and to confirm if additional storage capacity would be needed.



4.9 Ecosystems

4.9.1 Introduction to Resource and Regulatory Requirements

This section addresses the ecosystems (aquatic and terrestrial) present in the vicinity of the West Seattle Link Extension Project (the project), including streams and aquatic habitat, vegetation, terrestrial wildlife and wildlife habitat, wetlands, and threatened and endangered species. It also describes the potential impacts to these resources associated with the project. These resources are regulated by laws and guidelines at the City of Seattle, state, and federal levels.

Appendix N.4, Ecosystem Resources Technical Report, contains the following supporting information:

- A list of relevant laws, local ordinances, and guidelines
- Maps and details of individual wetlands and streams in the study area
- An in-depth explanation of impacts on ecosystems resources and the avoidance, minimization, and mitigation measures planned for each resource
- Details on the species of concern within the study area, including an explanation of the protections around the great blue heron rookery at Pigeon Point

Additional information on water quality and hydrology is provided in Section 4.8, Water Resources.

4.9.2 Affected Environment

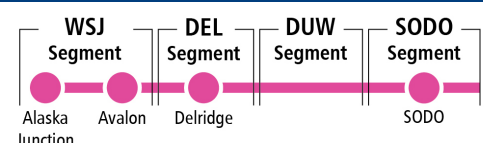
The study area for ecosystem resources varies according to the type of resource. Each area was measured from the edge of the project footprint and area used for construction (the project limits). The ecosystem study area includes all species and habitat within 200 feet of the project limits. Wetlands were inventoried within 300 feet of the project limits. At water crossings, the in-water analysis focused on areas 300 feet downstream and 100 feet upstream of the project limits, and to the extent that sound could travel underwater (e.g., to where sound reaches the nearest land mass). The analysis also considered potential impacts on sensitive federal or state-listed species documented within 0.25 mile of the project limits and in Elliott Bay.

Sound Transit evaluated ecosystem components by using:




- Scientific literature
- Federal and state resource agency websites
- Consultation with Muckleshoot Indian Tribe, the Suquamish Tribe, the Confederated Tribes and Bands of the Yakama Nation, the Snoqualmie Indian Tribe, the Stillaguamish Tribe of Indians of Washington, the Tulalip Tribes of Washington, and federal, state, and local resource agencies
- Field investigations
- Aerial maps, GIS maps, and aerial images

4.9.2.1 Aquatic Species and Habitat




The West Seattle Link Extension would cross two waterbodies: the Duwamish Waterway (also known as the Duwamish River) and Longfellow Creek (Figures 4.9-1 and 4.9-2).




Preferred Alternative

-  Elevated
-  At-Grade
-  Retained Cut

Other Alternatives

-  Elevated
-  At-Grade
-  Retained Cut

Station (● Indicates Preferred Alternative)

-  New

Legend










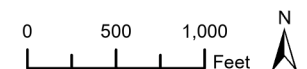
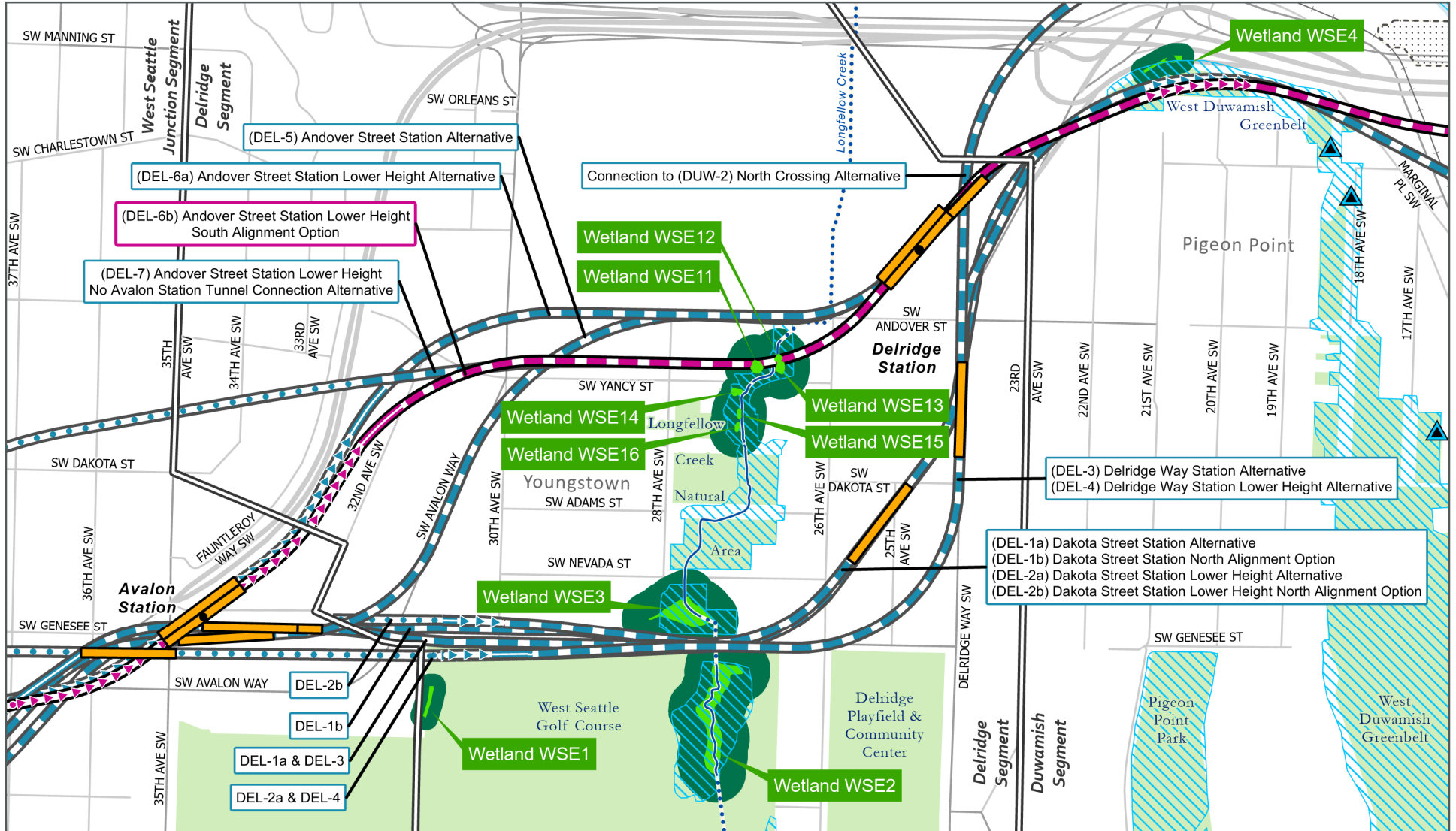
-  Segment Line
-  Existing Link Light Rail
-  Railroad
-  SODO Busway
-  Proposed Overpass
-  Sound Transit Operations and Maintenance Facility (ST OMF)
-  Park
-  Existing Mitigation Site (not related to this project)
-  Proposed Mitigation Site (not related to this project)

FIGURE 4.9-1
Ecosystems Resources
Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County, Washington Department of Fish and Wildlife (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

- New

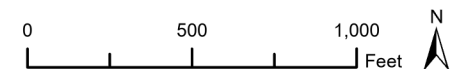
- Segment Line
- Railroad
- Park
- Existing Mitigation Site (not related to this project)

- Great Blue Heron Nest
- Stream
- Piped Stream
- WDFW Priority Habitat
- Wetland
- Wetland Buffer

Notes: 1) The steelhead trout critical habitat follows the streams.
2) The WDFW Salmon Stock Inventory maps wild populations of salmon in Longfellow Creek. 3) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

FIGURE 4.9-2
Ecosystems Resources
Delridge Segment

West Seattle Link Extension



The Duwamish Waterway splits into two channels around Harbor Island (the West Waterway and East Waterway) before flowing into Elliott Bay, a large estuary system that provides habitat for a wide variety of fish species and marine mammals. Sensitive species in Elliott Bay are included in this analysis because in-water construction of some alternatives at the Duwamish Waterway crossing could create underwater noise detectable in Elliott Bay.

The Duwamish Waterway is regulated by the City of Seattle's Shoreline Master Program as a Shoreline of the State. The waterway provides open water habitat, pockets of shoreline habitat in between industrial uses, and pockets of estuary habitat. The waterway is tidally influenced, and limited portions of the Duwamish Waterway contain intertidal mudflats. The waterway supports many species of native and introduced fish, including natural and hatchery runs of coho, Chinook, and chum salmon and steelhead and cutthroat trout. The waterway provides the single point of entry for these salmon species to access the Duwamish River/Green River system from Puget Sound and travel up to 60 miles inland.

Marine mammals such as killer whales, humpback whales, and harbor porpoise occasionally occur in Elliott Bay. Seals and sea lions also occur in the bay and travel up the waterway from Elliott Bay into the study area. Osprey, bald eagle, great blue heron, and waterfowl use the waterway for foraging. A purple martin breeding site is present south of Harbor Island.

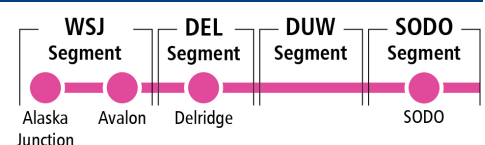
The waterway's benthic habitat, which is the area along the bottom of a waterbody, is also key for nutrient cycling and for macroinvertebrates. Macroinvertebrates are prey for many of the above species.

The Duwamish Waterway flows through a heavily developed industrial area. Very little natural estuarine habitat or intertidal shoreline habitat remains within the study area. More than 92 percent of the shoreline in the study area lacks riparian vegetation (Kerwin and Nelson 2000), and benthic habitat quality is affected by regular dredging used to maintain the navigation channel. Conditions include bulkheads and steep shorelines comprised of rock, gravel, or a combination of rock with silty areas. Some of the shoreline is covered by over-water structures, and little vegetation is present. Below-water substrates include sand/mud, gravel, or rock, with limited aquatic vegetation. Some habitat for shorebirds is present among rocks or where silty sediment is exposed during low tides, such as along the shorelines of Harbor Island south of and underneath the West Seattle Bridge. Upland habitat within 200 feet of the Duwamish Waterway is almost entirely developed.

Limited restoration work has occurred along the waterway within the study area: about 1 acre of industrial property has been restored to tidal marsh, mudflat, and riparian buffer at the Duwamish Village Park and Shoreline Habitat along the west side of the West Duwamish Waterway, south of the West Seattle Bridge. Additionally, the Port of Seattle is planning a 9-acre wildlife habitat restoration project at Terminal 25 on the east side of the East Duwamish Waterway.

Washington State Department of Ecology (Ecology) lists numerous water quality concerns in the waterway, including fecal coliform, Ammonia-N, and temperature (Ecology 2022). The river also provides a discharge point for many storm drains and combined sewer overflows, which route contaminants from the urban environment into the waterway. Three active Superfund sites along the river are undergoing remediation; two are within the study area (see Section 4.12, Hazardous Materials, for the status of these Superfund sites).

Longfellow Creek is a perennial stream that drains into the Duwamish Waterway. In the study area, the creek is an open channel running through the West Seattle Golf Course, within a culvert under Southwest Genesee Street. The creek then flows in an open channel through the Longfellow Creek Natural Area. This section of the creek contains large, deep pools that can support fish (City of Seattle 2007). Downstream of the Longfellow Creek Natural Area and



adjacent greenbelt, just south of Southwest Andover Street, the creek flows about 0.5 mile through a series of culverts to an outlet near Terminal 5 (City of Seattle 2012). The City of Seattle regulates the creek and its surrounding vegetation as a fish and wildlife habitat conservation area. The City of Seattle regulates any development in or over the creek and within 100 feet of the creek (which is defined by the City of Seattle as the riparian management area).

Adult steelhead trout and Chinook, chum, and coho salmon have been observed in Longfellow Creek up to the West Seattle Golf Course. Fish-passage barriers block anadromous salmon from reaching the segments of the creek upstream of the West Seattle Golf Course. Rainbow trout have also been documented in Longfellow Creek, and numerous releases of coho fry have occurred in the creek (King County 2016a; Puget Soundkeeper 2022; Kerwin and Nelson 2000).

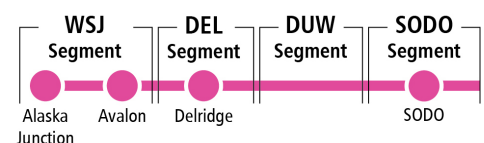
Water quality in the creek is of high concern, as rated by Ecology's water quality index. Longfellow Creek has periodic exceedances of dissolved oxygen, temperature, and fecal coliform bacteria beyond levels suitable for aquatic life (King County 2016b; Ecology 2022). Stormwater runoff from urban areas can also bring elevated concentrations of nutrients, bacteria, metals, pesticides, or other organic pollutants into the creek (City of Seattle 2007). Recent surveys of coho salmon in urban streams in Puget Sound, including Longfellow Creek, have documented abnormally high levels of pre-spawn mortality. Contaminants from urban stormwater runoff are being investigated as the likely cause, and stormwater treatment may be critical to the health of the coho run in Longfellow Creek (King County 2016a). Starting in the 1990s, ongoing physical and biological restoration efforts in the creek and in upland areas draining to the creek aim to improve the creek's water quality and habitat quality.

4.9.2.2 Vegetation, Terrestrial Wildlife, and Wildlife Habitat

The West Seattle Link Extension runs through densely developed city and suburban properties that have been greatly altered from historical conditions. In the study area, land cover is primarily urban, with about 80 percent developed with high-density buildings, industrial areas, and high- to moderate-density residential areas (National Land Cover Database 2016). These types of developed areas, with 50 to 100 percent impervious surfaces, support primarily urban-adapted wildlife species. Invasive plant species are prevalent throughout the highly modified environment of the study area. Ornamental vegetation is also present around residential and commercial buildings.

There are about 38 acres of forested habitat in the study area, making up only 5 percent of the overall study area. Wildlife habitat is limited to community parks (see Section 4.17, Parks and Recreational Resources), the West Seattle Golf Course, and two larger forested corridors: the West Duwamish Greenbelt and the Longfellow Creek greenbelt (which includes the Longfellow Creek Natural Area). Ornamental vegetation present around residential and commercial buildings provides habitat to urban-adapted wildlife species.

The West Duwamish Greenbelt is within the Duwamish Segment. The greenbelt stretches 4 miles south from the West Seattle Bridge along the western side of the Duwamish Waterway. The Washington Department of Fish and Wildlife designates the greenbelt as a Biodiversity Area and Corridor (a priority habitat). It is primarily deciduous forest composed mostly of bigleaf maples and red alders, and habitat elements such as mixed forest snags, downed woody debris, and areas with multi-layered canopy. The Delridge Segment includes the Longfellow Creek greenbelt (which is also a Washington Department of Fish and Wildlife-designated Biodiversity Area and Corridor), as well as developed open space in the West Seattle Golf Course and the Delridge Playfield and Community Center Park. The golf course contains mowed fairways bordered with rows of trees and a few patches of forest. Delridge Playfield has lines of trees, and the groundcover is primarily mowed lawn. Riparian habitat along Longfellow



Creek is fragmented, with patches of non-native species such as Himalayan blackberry, field bindweed, and reed canarygrass. However, stream and riparian restoration projects, including native plantings and placement of large woody debris in the creek, have increased habitat quality within the study area.

These greenbelts, as well as the forested patches within the golf course, provide shelter for wildlife tolerant of urban areas, including deer, coyote, raccoon, squirrel, opossum, bats, and many species of birds. Voles and other small mammals might also occur in the greenbelts and in portions of the small parks and the golf course that have shrubs or herbaceous groundcover. Great blue herons have established nesting colonies (rookeries) within the West Duwamish Greenbelt in the study area, specifically at Pigeon Point just south of the West Seattle Bridge. A wetland along about 800 feet of Longfellow Creek (within the golf course) and several small wetlands along the creek in and adjacent to the Longfellow Creek Natural Area store sediment deposited during high flows and provide riparian habitat for wildlife including waterfowl, herons, songbirds, small and large mammals, and amphibians.

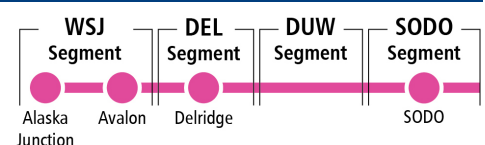
Several raptor species are known to use these greenbelts for nesting, roosting, and foraging. The City of Seattle has historically mapped bald eagle nesting in the West Duwamish Greenbelt. Peregrine falcons nest on the West Seattle Bridge on a nest platform placed under the bridge (Urban Raptor Conservancy 2022). Osprey forage in the Duwamish Waterway and use trees or utility poles near the waterway for nesting. The greenbelt trees and golf course trees also provide roosting and nesting habitat for raptors such as red-tailed hawk, merlin, and barred owl, and roosting opportunities for bald eagles. An artificial platform for nesting osprey is adjacent to Sound Transit's existing Operations and Maintenance Facility Central on the eastern edge of the Duwamish Segment.

Outside of small parks and the forested corridors described above, vegetation in the study area predominantly consists of street trees (ornamental and native), native and non-native shrubs along roadsides, and landscaping in residential yards. Street trees throughout Seattle can be nominated as a "heritage tree" based on their size, form, rarity, or historic contribution. No heritage trees are mapped within the project limits. However, project limits include other trees regulated by the City of Seattle's tree protection code. This code covers trees including street trees in the City right-of-way and trees on private property, as described further in Appendix N.4, Ecosystem Resources Technical Report. Trees that are within critical areas would require protection or mitigation under the City of Seattle's critical areas regulations.

4.9.2.3 Wetlands

Ten wetlands were identified in the project study area; one wetland in the Duwamish Segment and nine wetlands in the Delridge Segment (see Figures 4.9-1 and 4.9-2). No wetlands were identified in the SODO or West Seattle Junction segments. All the wetlands are in areas altered by human development, and are rated as follows:

- Three wetlands (less than 0.1 acre in size) are rated as Category IV (the lowest quality), and they have low habitat scores based on limited vegetation, limited habitat complexity and contributions to water quality, and their location adjacent to paved roads and other human disturbance. These wetlands receive water from groundwater and precipitation, as well as from stormwater runoff.
- Five wetlands near Southwest Andover Street are rated as Category III. These wetlands provide moderate habitat and water quality functions within the Longfellow Creek greenbelt and two of them provide flood control functions when the creek water levels are high. Some have shrub or tree layers that provide wildlife habitat.



- Two wetlands (between 0.4 and 0.5 acre in size) are higher-quality (Category II) as they border the fish-bearing Longfellow Creek, to the north and south of Southwest Genesee Street, and provide multiple water quality, flood control, and habitat functions. Beaver activity is evident, shrub and tree layers provide shelter for wetland-associated mammals and birds, and areas with seasonal inundation provide amphibian habitat.

Additional details on individual wetlands are described in the Ecosystem Resources Technical Report, Appendix N.4.

4.9.2.4 Threatened and Endangered Fish and Wildlife Species, Species of Concern, Essential Fish Habitat, and Washington Department of Fish and Wildlife Priority Species and Habitat

Table 4.9-1 summarizes federally-listed species and species of concern that are known to occur or potentially occur in the West Seattle Link Extension study area. The United States Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries have adopted final recovery plans for Chinook salmon, steelhead, and bull trout that guide recovery efforts throughout Puget Sound, including within the study area. The Chinook salmon plan includes recommendations to improve water quality in the lower 5 miles of the Duwamish River, and to restore intertidal habitat within the river where fresh water and salt water mix. The steelhead plan also recommends improvements to habitat complexity in the lower reaches of rivers.

The Magnuson-Stevens Fishery Conservation and Management Act protects essential fish habitat for federally managed species. In addition to the essential fish habitat listed in Table 4.9-1, the Duwamish Waterway is also mapped as essential fish habitat for all life stages of groundfish, finfish, coastal pelagic species, and salmonids. Longfellow Creek is in a watershed mapped as essential fish habitat for pink salmon.

The Washington Department of Fish and Wildlife data show the following priority species of salmonids using the Duwamish Waterway: sockeye, coho, odd-year pink, fall chum salmon, and resident cutthroat trout. Coho and chum salmon have also been documented in Longfellow Creek (King County 2016a). Elliott Bay contains priority species including harbor porpoise, harbor seal, and California and Steller sea lions, and contains priority estuary habitat. Seals and sea lions are also protected by the Marine Mammal Protection Act.

Washington Department of Fish and Wildlife has identified the Longfellow Creek Natural Area and West Duwamish Greenbelt as priority biodiversity areas and wildlife corridors. Terrestrial priority species that could occur in the greenbelts include Townsend's big-eared bat, pileated woodpecker, band-tailed pigeon, and Vaux's swift. The great blue heron is also a Washington Department of Fish and Wildlife priority species, and the City of Seattle has designated it as a species of local importance (Seattle Municipal Code 25.09.200).

4.9.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would not have any direct impacts on ecosystem resources.

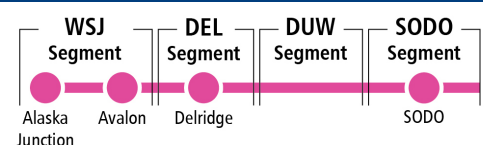


Table 4.9-1. Listed Species and Species of Concern Potentially Occurring in the Study Area

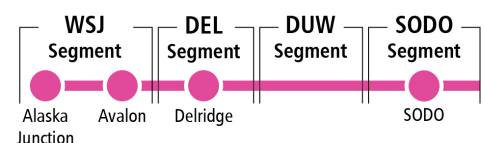
Common Name	Status	Occurrence in Study Area
Bull trout	Federal Threatened; State Candidate	Documented in Duwamish Waterway; critical habitat in Elliott Bay and Duwamish Waterway.
Chinook salmon	Federal Threatened; State Candidate	Documented in Elliott Bay, Duwamish Waterway, and Longfellow Creek; critical habitat in Elliott Bay, Duwamish Waterway; essential fish habitat in Duwamish Waterway and Longfellow Creek.
Steelhead trout	Federal Threatened	Documented in Elliott Bay, Duwamish Waterway, and Longfellow Creek; critical habitat in the Duwamish Waterway and Longfellow Creek.
Bocaccio	Federal Endangered; State Candidate	Likely in Elliott Bay, potential in Duwamish Waterway; critical habitat in Elliott Bay.
Yelloweye rockfish	Federal Threatened; State Candidate	Likely in Elliott Bay, potential in Duwamish Waterway; critical habitat in Elliott Bay.
Southern resident killer whale ^a	Federal Endangered	Documented in Elliott Bay; critical habitat in Elliott Bay.
Humpback whale ^a	Federal Endangered, State Endangered	Documented in Puget Sound, potential in Elliott Bay.
Green sturgeon ^a	Federal Threatened	Unlikely; could occur in Elliott Bay but no spawning occurs in Puget Sound rivers.
Pacific eulachon ^a	Federal Threatened	Unlikely; closest documented spawning is in southern British Columbia.
Marbled murrelet	Federal Threatened; State Threatened	Marbled murrelets occur in Elliott Bay and occasionally access the Duwamish Waterway for foraging.
Steller sea lion ^a	Federal Species of Concern	Documented in Elliott Bay; potential in Duwamish Waterway.
Pacific cod ^a	Federal Species of Concern; State Candidate	Documented in Elliott Bay and Duwamish Waterway.
River lamprey	Federal Species of Concern	Documented in Elliott Bay; potential in Duwamish Waterway.
Coho salmon	Federal Species of Concern	Documented in Duwamish Waterway and Longfellow Creek; essential fish habitat in Duwamish Waterway and Longfellow Creek.

Sources: United States Fish and Wildlife Service 2023; National Oceanographic and Atmospheric Administration 2023; Washington Department of Fish and Wildlife 2018.

^a Listed marine species found in Elliott Bay but not the Duwamish Waterway are included here because in-water construction noise could reach the bay.

4.9.4 Environmental Impacts of the Build Alternatives during Operation

Sound Transit analyzed the potential long-term impacts of operation of the West Seattle Link Extension Build Alternatives on ecosystem resources in the study area. These impacts would include permanent loss of habitat that is replaced with light rail facilities. Permanent changes in habitat adjacent or nearby the light rail facilities are also considered.



4.9.4.1 Impacts Common to All Alternatives

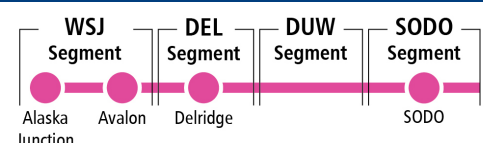
Operation of the West Seattle Link Extension would have long-term impacts on ecosystem resources in the study area except in the SODO Segment, where no ecosystem resources are present. In some areas, the guideway would be within or near existing forested habitat. Vegetation and wildlife habitat within and 15 feet beyond the guideway would be permanently converted from forested or scrub/shrub vegetation to light rail project elements. After construction is complete and during operation, Sound Transit would continue to remove “hazard trees” (trees that might cause a hazard to light rail operations) throughout project operations as needed. Removing trees such as street trees, heritage trees, or trees in critical areas during maintenance activities would require coordination, approvals, and permitting with the City of Seattle.

Based on the existing urban environment of the study area, the operation of any alternatives has a low potential to affect the viability of local wildlife populations. Directly impacted land cover is highly modified and dominated in many areas by impervious surface, ornamental vegetation, or invasive species. The alternatives would primarily be along existing roads and railroad corridors (existing barriers to wildlife movement) or would be elevated track over areas that currently serve as connective corridors to wildlife. For short portions of the alignment (in the Duwamish and Delridge segments), retained-cut track would be parallel to roadways that already create barriers and are not anticipated to further affect wildlife populations. Although the potential for adverse effects would be low, operations would impact vegetation and wildlife over the long term. For example, maintenance activities that involve the removal of vegetation during the breeding season could require removal of nests, eggs, or birds protected under the Migratory Bird Treaty Act. At-grade guideways would reduce the amount of habitat for small mammal species and potentially impact animal movement in the corridor. A change in distribution of the prey species could change wildlife movement patterns. Vegetated areas would be changed to impervious surfaces, which increases runoff volumes. However, as described in Section 4.8, Water Resources, stormwater from project-related impervious surfaces would receive flow control as required by the City of Seattle and, where appropriate, water quality treatment.

Some of the guideway and other features would be elevated. This may reduce the amount of light and rainfall reaching vegetation. Based on the existing high levels of noise and vehicle traffic throughout the study area, as well as human activity associated with residential, commercial, and industrial development in the study area, wildlife that use habitats adjacent to the light rail alternatives are likely accustomed to noise and human activity. Therefore, the potential is low for disturbance from increased human access, noise, and light. Some species may move farther into greenbelt habitat to avoid the immediate area of the light rail, but these minor localized movements are not anticipated to affect these species’ viability. As described in Section 4.7, Noise and Vibration, operation of the light rail would have limited increases over ambient noise, and mitigating features such as sound walls would further limit noise effects.

4.9.4.2 SODO Segment

The SODO Segment travels through a primarily industrial district. Ecosystem resources are not present in this segment; therefore, there would be no impacts to ecosystems. Long-term effects would be limited to updates to stormwater systems (see Section 4.8), and tree canopy removal. Preferred Option SODO-1c and Alternative SODO-1a would have 0.4 acre of tree canopy removal; while Option SODO-1b or Alternative SODO-2 would have 0.3 and 0.2 acre of tree removal, respectively. Some trees may be replaced in the same area, others may be mitigated elsewhere as agreed to with the City of Seattle.



4.9.4.3 Duwamish Segment

Table 4.9-2 lists the estimated long-term ecosystem impacts from converting wildlife habitat to light rail structures. All the Duwamish Segment alternatives would be on elevated guideway through industrial areas and would cross the Duwamish Waterway. Sound Transit is evaluating multiple high-level fixed bridge types to cross the waterway. The bridge over the East Waterway would be a balanced cantilever segmental box girder for all alternatives. Preferred Alternative DUW-1a would be a cable-stayed or truss bridge over the West Waterway to avoid guideway columns in the Duwamish Waterway. For Option DUW-1b and Alternative DUW-2, the bridge type over the West Waterway has not been selected. Alternative DUW-2 could have guideway columns in the Duwamish Waterway, while Option DUW-1b would have guideway columns in the Duwamish Waterway regardless of bridge type. In-water guideway columns may also include a pier-protection system when sited adjacent to the navigation channel.

Regardless of bridge type or alternative, navigation lights on the bridge structure could alter the nighttime swimming behavior of juvenile salmonids, which may avoid these areas to avoid potential predation or seek these areas to feed on prey. Over-water shading from the guideway is not likely to change fish behavior or impact benthic productivity or temperature in the waterway, as the bottom of the bridge would have a clearance of approximately 100 feet to 140 feet above the water.

Table 4.9-2. Long-term Impacts to Ecosystems – Duwamish Segment

Alternatives	Wetland (acres) ^{a, b}	Wetland Buffers (acres) ^a	Shoreline (linear feet)	Biodiversity Area (acres) ^{b, c}	Over-water Structures (acres) ^{b, d}	In-water (Benthic Surface) Impacts (acres) ^{b, e}	Tree Canopy (acres) ^f
Preferred South Crossing Alternative (DUW-1a)	0 to <0.1	<0.1 to 0.3	400	1.6 to 2.1	0.8 to 0.9	0	3.8 to 4.4 ^{b, g}
South Crossing South Edge Crossing Alignment Option (DUW-1b)	0	<0.1	500	1.9	0.7 to 0.9	<0.1 to 0.4 ^h	3.8 to 4.4 ^{b, g}
North Crossing Alternative (DUW-2)	0	0	500	0	0.7 to 0.9	0 to 0.5	1.8

^a To estimate wetland impacts, the impact analyses for all alternatives assumed areas under elevated guideways as impacted during operation.

^b Ranges shown for impacts reflect differences from connecting to different alternatives in adjacent segments.

^c Biodiversity areas are forested corridors mapped by the City of Seattle and identified by Washington Department of Fish and Wildlife as priority habitats.

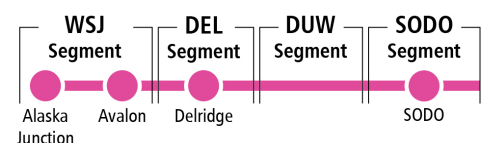
^d This area represents the total area of elevated bridge features over the Duwamish Waterway; this does not include bridge guideway columns and pile caps in the water; these are shown in the long-term in-water (benthic surface) impacts column.

^e The range of impacts shown represent impacts from different bridge types; pile cap locations would vary by bridge type, and some bridge types would avoid in-water work. In-water benthic surface impacts include columns and pile caps that are either fully or partially in-water.

^f Assumes permanent removal of trees within both the operation (long-term) and construction (temporary) footprints. Some trees may be replaced in the same area; others may be mitigated elsewhere as agreed to with the City of Seattle.

^g Includes forested area in the West Duwamish Greenbelt, which is also counted in the Biodiversity Area impact column.

^h Less than 0.1 acre of impact is associated with storm drain outfalls.

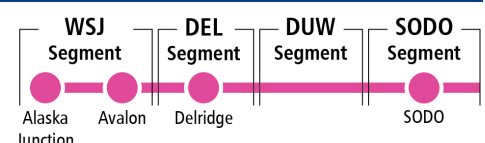


Option DUW-1b would require relocation of three Port of Seattle stormwater outfalls: one 8 inches in diameter and one 18 inches in diameter that discharge to the West Duwamish Waterway and one 18 inches in diameter that discharges to the East Duwamish Waterway. Preferred Alternative DUW-1a and Alternative DUW-2 would not require relocation of any outfalls. All proposed outfall relocations are related to conflicts with bridge column foundation locations.

For Option DUW-1b and some bridge types for Alternative DUW-2, in-water columns and pier-protection systems would permanently change shoreline, benthic habitat, and in-water habitat within waters that are essential fish habitat and critical habitat for federally-listed salmon species. The columns would not directly conflict with current projects to restore intertidal habitat under Chinook or steelhead salmon recovery plans. However, the columns would increase the steepness of some shoreline patches where they are not currently armored. Recovery plans for federally-listed salmon identify shallow areas of shoreline as important to migrating salmonids. Guideway columns and pier-protection systems along the shoreline could change the movement patterns of migrating salmon. Bridge guideway columns could cover up to about 18,370 square feet (about 0.5 acre) of benthic habitat that is currently accessible to fish and benthic invertebrates. The covered area of benthic habitat would reduce the amount of productivity in these benthic locations. Lower productivity could in turn affect the availability of prey species for salmonids and marine mammals using the waterway. Some bridge types would require pile cap structures close to the waterline that would prevent daylight from reaching the waters and benthic surface below them. This could further reduce productivity, affect movement patterns of fish and marine mammals, and increase areas for predator fish to shelter that may prey upon young migrating salmonids.

Preferred Alternative DUW-1a and Option DUW-1b would cross the north end of the West Duwamish Greenbelt on a mix of elevated and retained-cut guideway. Trees (primarily big leaf maple, alder, and non-native laurel trees) and understory vegetation (primarily non-native Himalayan blackberry and English ivy) would be removed. Low-growing vegetation may be used to stabilize this slope, but large trees would not be allowed near the guideway for safety reasons. Some of the trees that would be removed in the West Duwamish Greenbelt are within the year-round buffer of a management area for a great blue heron colony. The City of Seattle regulates construction within 200 feet of heron colonies year-round and within 500 feet during the nesting season. The guideway would also pass close to a known peregrine falcon nesting site on the West Seattle Bridge. Preferred Alternative DUW-1a would pass closer to the falcon nest site and Option DUW-1b would pass closer to the heron colony. Although falcons in the area are already habituated to an urban environment and traffic on nearby roads and bridges, under either Preferred Alternative DUW-1a or Option DUW-1b the light rail trains moving close to the nest could affect their use of this artificial nest location. Both alternatives would affect the buffer of a Category IV wetland.

Alternative DUW-2 would cross the Duwamish Waterway on the north side of the West Seattle Bridge, avoiding impacts to the greenbelt, the Category IV wetland, and the heron colony. Alternative DUW-2 may require relocation of the artificial nesting platform for osprey on the eastern edge of the Duwamish Segment; the platform would be relocated in the vicinity to ensure continued use. This alternative could also impact about 600 square feet of the Port of Seattle's planned wildlife habitat restoration project at Terminal 25. The guideway would be at least 90 feet above the site such that no impacts on vegetation from shading are expected.



4.9.4.4 Delridge Segment

Table 4.9-3 compares the ecosystem impacts of the alternatives in the Delridge Segment. Preferred Option DEL-6b and Alternative DEL-7 would pass through the Longfellow Creek greenbelt, just south of Southwest Andover Street. While avoiding the creek, guideway columns would need to be placed in small wetlands and in the wetland and stream buffer, and tree removal would be required within the greenbelt. An elevated guideway would cross over an open-channel portion of Longfellow Creek approximately 80 feet above the creek and would be about 40 to 70 feet above vegetated portions of the greenbelt. Due to its height, the elevated guideway is not expected to negatively affect the functions of the creek or vegetation below the guideway when the restoration plantings have matured, though tree and shrub heights would be limited beneath the guideway. While the vegetation and habitat would change because native conifer and deciduous trees that typically grow higher than 80 feet cannot be replanted under the guideway, wildlife moving through this area would be able to continue their movements under the elevated guideway. Wildlife seeking such trees for foraging or nesting would need to use adjacent areas of the greenbelt.

Alternatives DEL-5 and DEL-6a along Southwest Andover Street would avoid these long-term impacts to wetlands and would also avoid impacts to Longfellow Creek, because the creek is in a culvert under Southwest Andover Street. Guideway columns for these alternatives would require removing some Douglas-fir, spruce, or red alder trees in the Longfellow Creek greenbelt.

The remaining alternatives (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4) would parallel the north end of the West Seattle Golf Course along Southwest Genesee Street and have similar impacts to the stream and wetlands adjacent to Southwest Genesee Street. These alternatives cross over a culverted portion of Longfellow Creek on an elevated guideway and would avoid direct impacts to the creek; guideway columns would be placed on existing impervious surface or vegetated street rights-of-way outside of creek boundaries. Guideway columns would also be placed outside of the boundary of the wetlands along Longfellow Creek; however, they would impact the wetland buffer that consists of mowed grass along the roadside and provides low buffer functions, or on paved roadway where wetland buffer function is currently not provided.

All of the alternatives following Southwest Genesee Street would require some vegetation removal along the southern side of the street at the north boundary of the West Seattle Golf Course. The vegetation here consists of mowed grass areas and small to moderate-height trees, including small ornamental trees, Douglas-fir, and western hemlock trees. Options DEL-1b and DEL-2b would also impact roadside vegetation on the northern side of Southwest Genesee Street. Option DEL-1b is farther north at the Longfellow Creek biodiversity area and therefore would have the greatest impact to this resource (Table 4.9-3). Alternative DEL-1a and Alternative DEL-3 would remain elevated over Southwest Genesee Street but would require column foundations where trees are currently growing along the golf course edge. Alternative DEL-2a and Alternative DEL-4 descend to retained-cut guideway in the northwestern corner of the golf course. This would remove some trees and grassy areas, but these alternatives would avoid impacts to the biodiversity area along Longfellow Creek.

The elevated crossings over Longfellow Creek for all alternatives would not preclude future projects to daylight portions of the creek currently flowing through culverts. No stormwater from the project would be discharged into Longfellow Creek except for potential drainage to one outfall directly upstream of the Longfellow Creek outlet to the Duwamish Waterway.

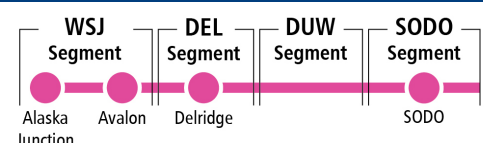


Table 4.9-3. Long-term Impacts to Ecosystems – Delridge Segment

Alternatives	Wetlands (acres) ^a	Wetland Buffers (acres) ^{a, b}	Biodiversity Corridor (acres) ^c	Over- water Structures (acres) ^d	Tree Canopy (acres) ^{e, f}
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	<0.1	0.2	0.2	<0.1	3.9
Dakota Street Station Alternative (DEL-1a)	0	0.5	0	0	4.1
Dakota Street Station North Alignment Option (DEL-1b)	0	0.8	0.1	0	4.3
Dakota Street Station Lower Height Alternative (DEL-2a)	0	0.4	0	0	3.9
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	0	0.6	<0.1	0	4.1
Delridge Way Station Alternative (DEL-3)	0	0.6	0	0	3.5
Delridge Way Station Lower Height Alternative (DEL-4)	0	0.4	0	0	4.3
Andover Street Station Alternative (DEL-5) ^c	0	0	<0.1	0	4.0
Andover Street Station Lower Height Alternative (DEL-6a)	0	0	0	0	3.6
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	<0.1	0.2	0.2	<0.1	3.4

^a To estimate wetland or critical areas impacts, the impact analyses for all alternatives assumed areas under elevated guideways as impacted during operation.

^b Wetland buffer metrics may include paved areas within wetland buffer; these may be removed from impact totals following coordination with the City of Seattle.

^c Biodiversity areas are forested corridors mapped by the City of Seattle and identified by Washington Department of Fish and Wildlife as priority habitats.

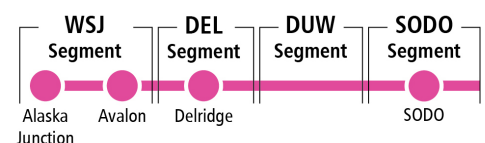
^d Represents guideway that is 70 feet over Longfellow Creek.

^e Assumes permanent removal of trees within both the operation (long-term) and construction (temporary) footprint. Some trees may be replaced in the same area; others may be mitigated elsewhere as agreed to with the City of Seattle.

^f Includes tree area in the greenbelt along Longfellow Creek, which is also counted in the biodiversity column.

4.9.4.5 West Seattle Junction Segment

None of the Build Alternatives would have direct long-term impacts to wetlands, aquatic habitat, critical habitat for any species, or biodiversity areas in the West Seattle Junction Segment. Long-term effects related to vegetation and wildlife would be limited to permanent removal of tree canopy. The amount of canopy removed varies by alternative, as described in Appendix N.4, Ecosystem Resources Technical Report. The amounts range from 1.8 acres (Alternative WSJ-6) to 4.2 acres (Alternative WSJ-4). Preferred Option WSJ-5b would remove 3.5 acres of tree canopy. Some trees may be replaced in the same area, others may be mitigated elsewhere as agreed to with the City of Seattle.



4.9.5 Environmental Impacts of the Build Alternatives during Construction

4.9.5.1 Impacts Common to All Alternatives

Construction would last 3 to 5 years for bridge construction, 2 to 4 years for elevated or at-grade guideway construction, and 2 years for tunnel portions of the alternatives, although active construction would be intermittent during these timeframes. For the tunnel alternatives, ground disturbance would happen at tunnel portals. For surface alternatives, ground-disturbing activities would include clearing existing vegetation, soil fill, excavation and grading, drainage system relocation, ground improvement activities, and dewatering. Ground-disturbing activities could introduce sediment and contaminants (e.g., runoff from stockpiled soils, spilled fuels from construction equipment) to aquatic habitat or stormwater features. Temporarily disturbed sites that are currently vegetated would be replanted immediately following construction in each project segment to restore or improve upon pre-construction conditions (e.g., replacing non-native weeds with native plants), and low-growing vegetation would likely become reestablished within a year or two. Some areas of currently forested greenbelt would be restored with herbaceous or shrub species close to the guideway.

All alternatives would require removal of or disturbance to street trees. Several alternatives would also require removal of native trees and other existing vegetation within biodiversity areas. Wildlife movements may be altered by these tree removals and the noise and activity of construction. During construction, removing trees such as street trees or any trees in critical areas would require coordination, associated approvals, and permitting with the City of Seattle. Some of these trees would be removed entirely; others would be replaced with the same or similar trees.

4.9.5.2 SODO Segment

Construction in the SODO Segment would have no impacts to ecosystems other than street trees.

4.9.5.3 Duwamish Segment

Estimated construction impacts are summarized in Table 4.9-4. Preferred Alternative DUW-1a could require temporary riprap removal below the mean high water line near each guideway column to facilitate cofferdam construction; riprap would be replaced after construction. Barges may be used adjacent to the shoreline during construction. Barges may be periodically required to transport construction materials, and crane barges may be required to lift bridge segments into place. Movement of construction barges could disturb benthic habitat and sediments and create temporary turbidity in the vicinity of critical fish habitat. Temporary work trestles would not be needed.

Some bridge types of Alternative DUW-2 would span the waterway and would not require in-water guideway columns. These bridge types would have similar construction impacts to Preferred Alternative DUW-1a.

Option DUW-1b and some bridge types of Alternative DUW-2 could require constructing bridge guideway column foundations in or partially in the Duwamish Waterway. Bridge designs with in-water guideway columns would require an in-water temporary cofferdam system to be built around each bridge guideway column location. These are described in Chapter 2, Alternatives Considered, including how a temporary cofferdam system would be installed.

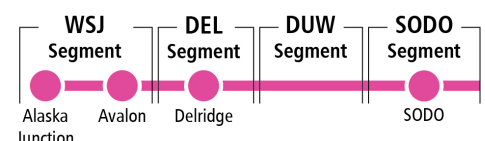


Table 4.9-4. Construction Impacts to Ecosystems – Duwamish Segment

Alternatives	Wetlands (acres) ^a	Wetland Buffers (acres) ^{a, b}	Shoreline (linear feet)	Biodiversity Area (acres) ^{b, c}	Approximate Area of Impacts in Waterbody (acres) ^{d, e}
Preferred South Crossing Alternative (DUW-1a)	<0.1	0 to 0.1	100	0.5 to 0.9	0 to <0.1 ^f
South Crossing South Edge Crossing Alignment Option (DUW-1b)	0	0.1	1,000	0.6	0.6 to 1.0 ^g
North Crossing Alternative (DUW-2)	0	0	800	0	0 to 0.9

Note: Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

^a To estimate wetland impacts, the impact analyses for all alternatives assumed a complete loss of wetland or buffer within the construction footprint.

^b Ranges shown for wetlands and biodiversity areas reflect differences from connecting to different alternatives in adjacent segments.

^c Biodiversity areas are forested corridors mapped by the City of Seattle and identified by Washington Department of Fish and Wildlife as priority habitats.

^d These construction in-water impacts represent the total area of the cofferdam footprints, piles, and work trestle column support footprints that would be placed on the benthic surface, minus the area of guideway columns and pile caps that would remain permanently within that same footprint. All this in-water work would occur in salmonid critical habitat and essential fish habitat.

^e Ranges shown for in-water impacts represent different bridge types; the number and position of cofferdams, piles, and work trestles would vary by bridge type. Preferred Alternative DUW-1a and some bridge types for Alternative DUW-2 could avoid in-water work.

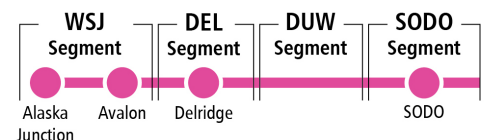
^f Impact is associated with up to 2,000 square feet of shoreline below mean high water disturbed during riprap removal and replacement.

^g Less than 0.1 acre of impact is associated with storm drain outfall relocations.

Temporary work trestles on in-water support pilings and construction barges would also be used during construction of these in-water features. Cofferdam placement and removal, pile-driving, and trestle-support construction (and eventual removal) would disturb benthic habitat and sediments and create temporary turbidity in the vicinity of critical fish habitat. Barges would also be required throughout the construction, and could disturb benthic habitat and sediments.

Preferred Alternative DUW-1a and Alternative DUW-2 would not require relocation of any stormwater outfalls. Option DUW-1b would require relocation of two existing stormwater outfalls (an 8-inch-diameter outfall and an 18-inch diameter outfall in the West Waterway and an 18-inch-diameter outfall in the East Waterway), to accommodate placement of bridge support columns. They would be relocated as close to their existing locations as possible. Outfall relocations would disturb sediments, but to a lesser degree than constructing in-water bridge columns because the area disturbed would be smaller and the construction duration would be less.

Suspended sediments from construction in the Duwamish Waterway might contain contaminants because this excavation would be occurring in the Harbor Island Superfund Site and potentially in the Lower Duwamish Waterway Superfund Site. Construction methods and activities in the Superfund sites would be coordinated with the United States Environmental Protection Agency and Ecology to avoid conflicts with existing and future cleanup actions at the Superfund site. For project elements within the Harbor Island Superfund Site or the Lower Duwamish Waterway Superfund Site, Sound Transit would coordinate with the United States Environmental Protection Agency and Ecology on any potential protective measures or restrictions that might be required for the project.



The barges and work trestles would also temporarily shade benthic habitat; this shade could affect fish movements through the waterway. During construction, temporary lighting close to the water would be used on the temporary cofferdams, work trestles, and associated barges. Changes in underwater light regimes at night can alter fish movements and can affect predator/prey interactions in a way that could be harmful to fish.

For bridge types requiring in-water guideway columns or cofferdams, cofferdam installation and pile-driving could create noise loud enough to potentially injure fish or marine mammal species or change their movements through the area. Underwater sound could travel unimpeded down the East Duwamish Waterway and would therefore be audible to sensitive species within Elliott Bay. While the cofferdam is in place, the dewatered areas would exclude habitat from use by aquatic species, including federally-listed fish species and benthic invertebrates. Dewatering the cofferdam would cause mortality of benthic organisms present in the cofferdam area. Placement of and construction on barges and trestles would also create construction noise. Best management practices would be used during all over-water construction to contain any spills of fuel, oil, or other contaminants from construction equipment.

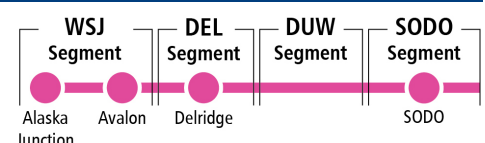
If Alternative DUW-2 requires relocation of the osprey nesting platform near the Operations and Maintenance Facility Central, this would be performed outside the nesting season using standard permits and protocols for osprey nest relocation.

Construction of Preferred Alternative DUW-1a or Option DUW-1b would impact the West Duwamish Greenbelt and a small Category IV wetland (Table 4.9-4). Construction noise could disturb wildlife in the greenbelt and would occur within the great blue heron management area regulated by the City of Seattle and adjacent to a peregrine falcon nesting platform. A portion of the steep slope at Pigeon Point (at the north end of the greenbelt) could be stabilized using slope drains, soil nails, and other reinforcement that would require ground disturbance and noise. A temporary work trestle may be required. Vegetation would be cleared within the construction footprint near known great blue heron nest trees, though not any actual nest trees would be removed. In addition, hazard trees would be evaluated and removed in and adjacent to the construction zone as necessary for safety. The amount of greenbelt impact would vary depending on the design option or the specific connection to the Delridge Segment, but all would require some tree removal within the great blue heron management area. Alternative DUW-2 would avoid construction impacts to the greenbelt, the great blue heron colony's year-round buffer, and the small wetland. The construction footprint of Alternative DUW-2 does overlap the edge of the heron's seasonal buffer. Pile-driving strike noise from Preferred Alternative DUW-1a or Option DUW-1b could temporarily exceed existing ambient noise levels at the colony (which include traffic and industrial noise, and frequent train horns). Strike noise from Alternative DUW-2 could also be audible at the colony but is not expected to exceed ambient noise levels. If the Port of Seattle's habitat restoration site at Terminal 25 is constructed prior to the West Seattle Link Extension, Alternative DUW-2 would temporarily impact about 0.4 acre of the site.

4.9.5.4 Delridge Segment

Table 4.9-5 summarizes construction impacts to ecosystems in the Delridge Segment.

Preferred Option DEL-6b and Alternative DEL-7 would have construction impacts to vegetated portions of the Longfellow Creek greenbelt. Areas of vegetation would be cleared for construction access to erect guideway columns and guideway and would remain cleared for up to 3 years. These impacts occur in wetland, wetland buffer, and stream buffer; however, impacts to the creek would be avoided. Alternatives DEL-5 and DEL-6a would avoid these impacts as work would be restricted to paved portions of wetland and stream buffer, though some minor



tree or vegetation clearing may be required. Some construction access may also be required in paved portions of stream and wetland buffer.

The alternatives following Southwest Genesee Street (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4) would have similar impacts to wetland buffers and the Longfellow Creek Natural Area during construction. Option DEL-2b would have a small impact to the western corner of the wetland north of Southwest Genesee Street.

Wetland buffer areas disturbed during construction would be revegetated using native vegetation and would replace current non-native vegetation; this would lead to long-term improvements in riparian habitat along the creek and wetlands.

Table 4.9-5. Construction Impacts to Ecosystems – Delridge Segment

Alternatives	Wetlands (acres)	Wetland Buffers (acres) ^a	Biodiversity Area (acres) ^b	Over-water Structures (acres)
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	<0.1	0.4	0.2	0
Dakota Street Station Alternative (DEL-1a)	0	0.4	0.1	0
Dakota Street Station North Alignment Option (DEL-1b)	0	0.4	<0.1	0
Dakota Street Station Lower Height Alternative (DEL-2a)	0	0.4	<0.1	0
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	<0.1	0.4	<0.1	0
Delridge Way Station Alternative (DEL-3)	0	0.4	<0.1	0
Delridge Way Station Lower Height Alternative (DEL-4)	0	0.3	<0.1	0
Andover Street Station Alternative (DEL-5)	0	0.4	<0.1	0
Andover Street Station Lower Height Alternative (DEL-6a)	<0.1	0.4	<0.1	0
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	<0.1	0.4	0.2	0

Notes:

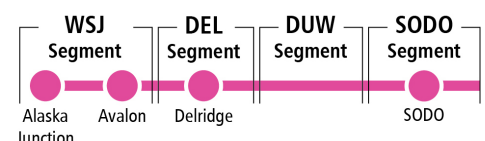
Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

^a Wetland buffer metrics may include paved areas within wetland buffer; these may be removed from impact totals following coordination with the City of Seattle.

^b Biodiversity areas are forested corridors mapped by the City of Seattle and identified by Washington Department of Fish and Wildlife as priority habitats.

4.9.5.5 West Seattle Junction Segment

Alternative WSJ-3a and Option WSJ-3b would include construction staging at the edge of a wetland buffer on existing paved surfaces that do not provide buffer functions or would occur in unpaved areas separated from the wetland by a paved road. These tunnel alternatives would also require removal and replacement of some street trees and other ground vegetation in cut and cover locations, but these areas would be revegetated and restored after construction. No other temporary impacts to ecosystems would occur in the West Seattle Junction Segment



because this segment has no natural vegetation or critical areas; vegetation is limited to residential landscaping and street trees.

4.9.6 Indirect Impacts of the Build Alternatives

Indirect impacts to ecosystem resources would be limited as the project would be in areas that are already densely developed. The West Seattle Link Extension would not interfere with future habitat improvement projects such as culvert replacements along Longfellow Creek. The project would also not interfere with future habitat restoration efforts along the creek, except in the specific locations on Preferred Option DEL--6b and Alternative DEL-7 where guideway columns would overlap wetland or wetland and stream buffer. Along the Duwamish Waterway, if guideway columns are placed along the Harbor Island shoreline, they also would prevent future restoration at those specific locations (see the impacted length of shoreline in Table 4.9-2). However, the area directly adjacent to the guideway columns at Longfellow Creek or the Duwamish Waterway shoreline would retain opportunities for habitat enhancement.

Where the guideway would cross the Duwamish Waterway, bridge guideway columns could remove small patches of intertidal silt, rock, or gravel shoreline from an area with already-degraded baseline conditions. The guideway columns would prevent these patches from being considered for future restoration efforts under the Chinook and steelhead salmon recovery plans.

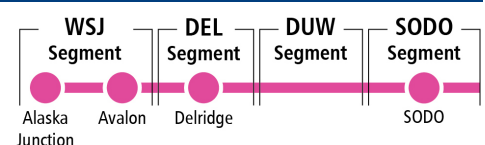
Elevated guideways would add impervious surfaces and guideway columns that have the potential to change hydrology at the wetland at the north end of the West Duwamish Greenbelt and Longfellow Creek and the associated wetlands. The guideway columns have the potential to intercept and reroute water flow. These effects are expected to be limited at the West Duwamish Greenbelt wetland, which receives most water from groundwater seepage, and at Longfellow Creek because these wetlands receive most of their water from the creek itself and from upstream sources. Therefore, intercepted rainwater would not alter the majority of the water sources of these wetlands. The wetland in the West Duwamish Greenbelt could be affected by groundwater changes, as a subsurface drainage system may be required to manage seepage and provide slope stability around guideway columns for Preferred Alternative DUW-1a and Option DUW-1b. Improved stormwater detention could minimize these effects to the West Duwamish Greenbelt wetland. See Section 4.8, Water Resources, for more information on groundwater and stormwater management.

Construction could contribute to the spread of invasive plant species by transporting them to or from the construction site when moving soil, or by creating bare soil areas that weeds might colonize quickly; however, weeds are already common in the study area. Sound Transit would minimize this risk by restoring temporarily disturbed areas with native plant species, which may improve existing conditions in greenbelts and buffers.

Indirect impacts would include increased human activity and train traffic near wildlife habitat and adjacent to biodiversity areas. The introduction of light rail transit to the area could also create a slight reduction in vehicle traffic compared to current levels. This effect, in turn, would slightly decrease (in the short term) or slow the increase (in the long term) of the expected automotive emissions and pollutant-laden stormwater runoff associated with increased traffic under the No Build Alternative.

4.9.7 Mitigation Measures

Sound Transit's policy on ecosystem mitigation is to avoid impacts on environmentally sensitive resources where practicable and to compensate for unavoidable impacts to ensure no net loss



of ecosystem function and acreage because of agency projects. Mitigation for ecosystem impacts is based on a hierarchy of avoiding, minimizing, and compensating for unavoidable adverse impacts. Sound Transit would comply with all applicable laws associated with ecosystem mitigation.

4.9.7.1 Avoidance and Minimization Measures

The design of the West Seattle Link Extension already incorporates avoidance and minimization techniques noted below, although further avoidance and minimization measures would continue to be pursued as the project enters final design and permitting stages. Attachment N.4F, Best Management Practices for Ecosystems Resources, in Appendix N.4, Ecosystems Technical Report, provides a compilation of best management practices that could be used to avoid or minimize project construction and operational impacts on sensitive ecosystem resources, including state and federal protected species and their habitats, wetlands, and aquatic resources.

4.9.7.1.1 Wetlands

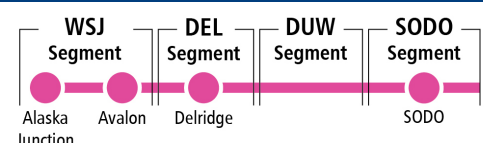
Avoidance and minimization measures specific to wetlands could include the following design features and construction actions:

- Siting guideway columns to avoid direct placement in wetlands, where possible.
- Minimizing the placement of construction staging areas in buffers, where possible. The construction contractor would work within construction limits marked with fencing and signage to prevent unintended impacts on riparian vegetation, wetlands, and wetland buffers.
- Taking all practical steps to minimize harm to wetlands, and analyze relevant factors of the project's effect on the survival and quality of the wetlands, per Executive Order 11990.
- Applying a monitoring plan for restoration areas to ensure success of the restoration.

4.9.7.1.2 Aquatic Resources

Avoidance and minimization measures specific to aquatic resources could include the following design features and construction actions:

- Avoiding direct impacts to Longfellow Creek by routing the elevated guideway over culverted areas of the creek or spanning the width of the creek where it is in an open channel.
- Siting guideway columns to avoid direct impacts to shorelines, where practical.
- Pursuing bridge design options that avoid or minimize permanent impacts to the waterways.
- Designing stormwater treatment facilities and flow-control measures to minimize impacts on stream water quality and flow or flow to larger waterways (see Appendix L4.8, Water Resources Technical Report). Stormwater flow control might use detention or infiltration facilities such as vaults, or water quality treatment using bioretention or media filter vaults.
- Avoiding in-water construction work at Longfellow Creek.
- Protecting Longfellow Creek from falling debris during over-water bridge construction.
- Minimizing construction staging areas in stream buffers or shorelines.
- Directing nighttime construction lighting away from Longfellow Creek or other waterways to avoid possibly altering the migratory behavior of fish or predation rates of juveniles.



- Ensuring the project is consistent with and receives Washington State concurrence with the Coastal Zone Management Act.

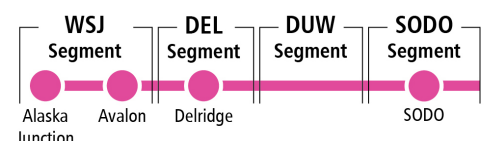
Potential in-water construction activities under Preferred Alternative DUW-1a would be restricted to riprap removal on the shoreline and is expected to occur above water. Should this work touch the water, it would be scheduled to occur during the work windows established by the U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife in the Duwamish Waterway. These work windows would also be employed if in-water columns are constructed for Option DUW-1b or for bridge types of Alternative DUW-2 that require such columns. Use of these windows would minimize the effects on salmonids, especially during the construction and operation of cofferdams. In-water work in the Duwamish Waterway would also include complying with the Marine Mammal Protection Act; this may entail monitoring for these animals during construction to avoid harassment or injury, using equipment such as bubble curtains around pile-driving to reduce noise by several decibels, and monitoring underwater sound levels. Specialized construction techniques would be required during any sediment disturbance in the Duwamish Waterway, such as allowing water discharged from dewatering activities to reduce sediments before their release to an approved outlet or facility, which would avoid resuspending contaminants from the Harbor Island Superfund Site.

4.9.7.1.3 Upland Vegetation and Wildlife Resources

Avoidance and minimization measures specific to upland resources could include the following design features and construction actions:

- Avoiding impacts to greenbelts where possible.
- Minimizing the placement of construction staging areas in forested areas where possible.
- Replanting cleared areas and implementing best management practices to minimize the risk of introducing or spreading invasive species.
- Reducing use of herbicides and fertilizers when restoring disturbed areas by using mulching, ground cover, and other planting strategies that discourage growth of undesirable species.
- Restricting clearing activities to outside the active bird nesting period, to the extent possible, to comply with the Migratory Bird Treaty Act, administered by the U.S. Fish and Wildlife Service. If avoidance scheduling is infeasible, Sound Transit would work with staff at the U.S. Fish and Wildlife Service to conduct pre-construction surveys to determine presence or absence of nesting migratory birds and assist Sound Transit in complying with the Migratory Bird Treaty Act.
- Minimizing tree removal along the corridor, where practical, and coordinating with the City of Seattle to minimize tree removal while also minimizing impacts on safety.
- Using a landscape design that prioritizes native plants and adaptable, low-maintenance plants suitable for the local climate, per the Sound Transit design manual. These plantings may improve upon existing conditions where non-native plants are currently present. Using native plants that do not require extensive irrigation would also allow restored areas to reestablish robust vegetated cover quickly and effectively after construction.

Work within the great blue heron management zone would require development of and adherence to a habitat management plan in coordination with the City of Seattle, Washington Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. The City of Seattle requires a management plan that normally includes a year-round, 197-foot-radius buffer around nesting colonies, with an additional 300-foot buffer during the nesting season (February 1 through August 31). These metrics are similar to Washington Department of Fish and Wildlife recommendations. The City-



required management plan may include a variety of measures such as retaining trees to screen the colony, work sequencing in the buffers, preventing specific loud activities during the nesting season, monitoring during nesting season, or other measures as developed in coordination with Washington Department of Fish and Wildlife and the City of Seattle.

Data collection is in process to identify the precise number of street trees potentially impacted by the project. Within the Duwamish Shoreline jurisdiction, additional data are being gathered, including height, diameter at breast height, species, drip line, and health rating. All trees within the project footprint are being surveyed via desktop analysis, including light detection and ranging data, and confirmed during field investigations.

4.9.7.1.4 Federally-listed Species, Species of Concern, Priority Species, and Species of Local Importance

Avoidance and minimization measures for listed and sensitive species are covered in Sections 4.9.7.1.2, Aquatic Resources, and 4.9.7.1.3, Upland Vegetation and Wildlife Resources. These measures would fulfill key elements of recovery plans for Chinook salmon and steelhead (such as preserving water quality through stormwater control, preventing changes to water quality during construction in the Duwamish Waterway, and preserving salmon habitat in Longfellow Creek through avoiding in-water impacts).

4.9.7.2 Compensatory Mitigation

4.9.7.2.1 Wetlands

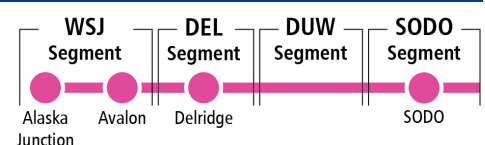
To the extent that permanent impacts could not be avoided to wetlands or wetland buffers (as would occur under Preferred Alternative DUW-1a, Option DUW-1b, and all Delridge alternatives), Sound Transit would provide compensatory mitigation to achieve no net loss of wetland function. For instance, enhancing areas currently covered in invasive plants with native vegetation would improve the ability for these wetland buffers to support wildlife. All compensatory mitigation would include a monitoring period to ensure success of the mitigation.

Preferred Alternative DUW-1a and Option DUW-1b

These alternatives would have permanent impacts to wetlands and its buffer. Onsite wetland buffer mitigation could be provided through native plantings or weed control in the West Duwamish Greenbelt. These mitigation actions could improve wetland buffer habitat where buffers are dominated by non-native plants or where ground cover is sparse. Mitigation for wetland impacts could occur on property adjacent to Longfellow Creek in the Delridge Segment, between Southwest Andover Street and Southwest Yancy Street, if this property is acquired for project construction for Preferred Option DEL-6b or Alternative DEL-7. The property provides opportunity for habitat creation and enhancement adjacent to a stream, wetlands and greenbelt. Sound Transit would plan this mitigation area using applicable policies and regulations and coordination with the City of Seattle.

If additional mitigation is needed (or if the property between Southwest Andover Street and Southwest Yancy Street is not acquired), Sound Transit plans to use one or more of the following methods. The mitigation planning would follow the mitigation sequencing priorities outlined in U.S. Army Corps of Engineers guidance or as agreed to with regulatory agencies:

- Approved In-Lieu Fee program such as the King County Mitigation Reserves Program or mitigation bank such as the Port of Seattle mitigation bank (currently in review), if available. The Port's Wetland Mitigation and Habitat Conservation Umbrella Bank Prospectus lists two new mitigation sites within about 0.5 mile of all Duwamish Segment alternatives' bridge



impacts (Terminal 25 and Terminal 105), and two additional sites about 0.5 mile south of Option DUW-1b, Terminal 107 and Terminal 108 (Port of Seattle and Anchor QEA 2021).

- Compensatory mitigation at an advance mitigation site.
- Project-specific mitigation developed by Sound Transit and approved by appropriate regulatory agencies.

Sound Transit would implement compensatory mitigation in accordance with applicable federal, state, and local requirements and guidelines. To the extent practical, wetland mitigation sites would be identified close to impacts and compensated in-kind for lost values.

Preferred Option DEL-6b and Alternative DEL-7

These alternatives would have permanent impacts to wetland and wetland buffer. Onsite mitigation could occur on property adjacent to Longfellow Creek that would be acquired for project construction of these alternatives, between Southwest Andover Street and Southwest Yancy Street. The existing wetlands and wetland buffers along Longfellow Creek could also provide opportunities for mitigation where native plantings could improve existing wetland or buffer habitat. If additional mitigation area is needed, one of the mitigation options previously described would be applied. Sound Transit would determine final mitigation actions during final design and permitting.

Alternatives DEL-1a, DEL-1b, DEL-2a, DEL-2b, DEL-3, DEL-4, DEL-5, and DEL-6a

These alternatives would have long-term impacts to wetland buffers. Mitigation for these impacts would use one or more of the methods listed within Section 5.1.2.3 in Appendix N.4, Ecosystems Technical Report. Sound Transit would determine final mitigation actions during final design and permitting.

4.9.7.2.2 Aquatic Resources

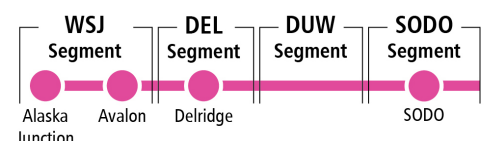
Sound Transit would provide mitigation for unavoidable impacts to benthic habitat, streams, and stream buffers protected under federal, state, and local regulations. This mitigation would address permanent impacts, as well as temporary impacts as required.

Preferred Alternative DUW-1a

Preferred Alternative DUW-1a avoids permanent in-water impacts, but would have permanent impacts to regulated shoreline along the Duwamish Waterway. Shoreline impacts could receive mitigation in the form of replanting near shorelines, which could improve conditions for juvenile salmonids in the Duwamish Waterway. The appropriate permitting agencies and jurisdictions would approve mitigation for impacts on shorelines prior to construction.

Option DUW-1b and Alternative DUW-2

These alternatives would impact regulated shoreline along the Duwamish Waterway, and mitigation for impacts on benthic habitat and fisheries would be required for some bridge types crossing the waterway that would have permanent and/or temporary in-water impacts. Compensatory mitigation within the watershed may be available via a mitigation bank being established by the Port of Seattle (the Umbrella Wetland Mitigation and Habitat Conservation Bank). This mitigation bank would allow mitigation credits to be purchased that would offset environmental impacts within Water Resources Inventory Area 9 (Port of Seattle and Anchor QEA 2019). Potential mitigation sites the Port may establish for the bank are listed in Section 4.9.7.2.1, Wetlands. Shoreline impacts could receive mitigation in the form of replanting



near shorelines, which could improve conditions for juvenile salmonids in the Duwamish Waterway. The appropriate permitting agencies and jurisdictions would approve mitigation for impacts on shorelines and benthic habitat prior to construction.

All Delridge Alternatives

All Delridge alternatives would avoid stream impacts, but would have permanent impacts to regulated riparian management area along Longfellow Creek. Preferred Option DEL-6b and Alternative DEL-7 could affect up to 0.2 acre of vegetation with the riparian management area. The other alternatives would impact less area.

Onsite mitigation could occur on property adjacent to Longfellow Creek between Southwest Andover Street and Southwest Yancy Street (as described in Section 4.9.7.2.1). At this location, currently paved portions of stream buffer could be changed to vegetated areas of native plants. The existing stream buffers along Longfellow Creek could also provide opportunities for mitigation where enhancement with native plantings could improve the ability of these areas to support wildlife. Plantings could also improve over-water shade to the creek, thus improving fish habitat.

If additional mitigation is needed (or if the property between Southwest Andover Street and Southwest Yancy Street is not acquired), Sound Transit would use one or more of the other mitigation methods listed within Section 4.9.7.2.1. Sound Transit would determine final mitigation actions during final design and permitting.

4.9.7.2.3 Upland Vegetation and Wildlife Resources

Mitigation would be required under all alternatives for impacts on trees. Sound Transit would coordinate with the City of Seattle on tree replacement requirements. For trees permanently removed, Sound Transit will replace them or provide payment in-lieu fees (1) in compliance with governing City regulations, Seattle Department of Construction and Inspections Director's Rules, and Executive Orders or (2) as agreed upon in the West Seattle Link Extension Tree and Vegetation Management Plan. Tree replacement regulations include Seattle's Executive Order 2023-03. Current Seattle Department of Transportation replacement ratios are 3:1 for any tree removed in the Seattle right-of-way and in Seattle parks. Seattle Department of Construction and Inspections would require appropriate replacement for trees meeting the Tier 1, 2, or 3 definitions on private property. It is expected that some of the area between Southwest Andover Street and Southwest Yancy Street could be used for tree replacement.

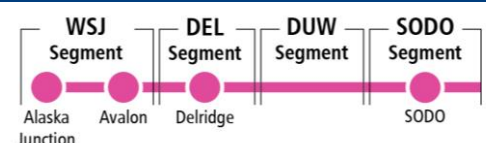
Additional mitigation would be needed under some Duwamish and Delridge alternatives where greenbelt habitat would be affected, as described below.

Preferred Alternative DUW-1a and Option DUW-1b

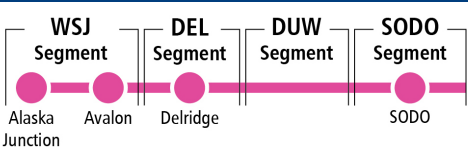
To the extent that impacts cannot be avoided to acreage in the West Duwamish Greenbelt, Sound Transit would provide compensatory mitigation to achieve no net loss of ecosystem function. Sound Transit would mitigate for impacts on forested vegetation using applicable policy and regulations and would coordinate with the City of Seattle on tree replacement requirements as noted above. The onsite mitigation area proposed in Section 4.9.7.2.1, on currently paved area between Southwest Andover Street and Southwest Yancy Street, could be used for upland habitat replacement.

All Delridge Alternatives

Similar to West Duwamish Greenbelt impacts, Sound Transit would mitigate for unavoidable impacts to greenbelt acreage along Longfellow Creek using applicable policy and regulations. As noted above, tree replacements would be coordinated with the City of Seattle. It is expected



that some of the area proposed for riparian area mitigation between Southwest Andover Street and Southwest Yancy Street could be used for upland habitat replacement within the same contiguous greenbelt where the impacts would occur.



4.10 Energy Impacts

4.10.1 Introduction to Resource and Regulatory Requirements

This section presents the energy estimates for the West Seattle Link Extension Project (the project) operation and construction activities, including:

- Vehicles operating within the study area, including project light rail, automobile, and other transit use
- Construction of the project

There are no federal, state, or local laws that specifically and quantitatively regulate energy consumption in the transportation sector. Many state, local, and regional transportation plans and policies identify goals for the efficient use of energy, and energy conservation and use reduction goals occur at all levels of government. Sound Transit has a Sustainability Plan and Program that is described in further detail in Section 2.8, Environmental Practices and Commitments, in Chapter 2, Alternatives Considered. Sound Transit monitors its environmental impacts with an internationally certified (ISO 140001) Environmental and Sustainability Management System. In addition, City of Seattle Resolution 31447, which adopted the 2013 Seattle Climate Action Plan, calls for carbon neutrality and equity in environmental programs (City of Seattle 2022), and the City's Executive Order 2021-09 Driving Accelerated Climate Action calls for incentivizing transit to meet their greenhouse gas reduction goals.

4.10.2 Affected Environment

The energy use study area for the project covers the Puget Sound Regional Council four-county region of King, Pierce, Kitsap, and Snohomish counties. Consistent with the Council's regional travel demand model, the analysis includes vehicular travel on all facilities, including freeways, ramps, collector-distributors, arterials, and collector streets. This scale of analysis is the most comprehensive and accounts for mode shifts between private vehicles and public transit; that is, this scale primarily illustrates the effects of travel demand. According to the Energy Information Administration, Washington state consumed over 1,779 trillion British thermal units of energy in 2020 (Energy Information Administration 2022), which is enough energy to meet the needs of approximately 20 million households (United States Department of Energy 2015). Approximately 28 percent of total energy use was consumed for transportation purposes.

Table 4.10-1 presents daily vehicle miles traveled and energy consumption by mode for the region. According to the Puget Sound Regional Council traffic model and the Sound Transit ridership model, the existing daily total for the region is approximately 88.8 million vehicle miles traveled. The daily energy use by the different transportation modes is approximately 621,000 million British thermal units.

Seattle City Light is a municipally owned utility that provides electricity to Seattle and other nearby King County communities. Its electricity is generated using a number of different resources, including utility-owned hydro facilities and purchased power. In 2022, hydroelectric power accounted for 90 percent of the utility's power portfolio (City of Seattle 2022). The remaining power sources include nuclear, natural gas, wind, and other sources. Seattle City Light has been providing its service area, which includes the study area, with carbon neutral power since 2005 using utility-owned and purchased clean power sources.

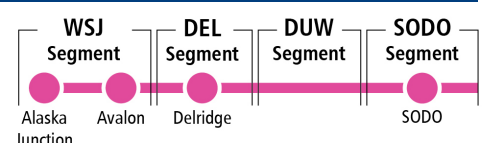


Table 4.10-1. Energy Consumption by Surface Transportation Mode for the No Build and Build Alternatives

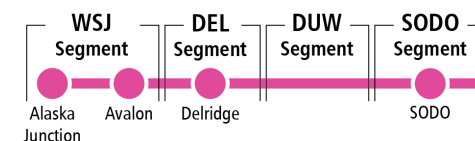
Vehicle Type	Consumption Rate in British Thermal Units per mile ^a	Existing Conditions Daily Vehicle Miles Traveled ^b	Existing Conditions in Million British Thermal Units	2042 No Build Daily Vehicle Miles Traveled ^b	2042 No Build Million British Thermal Units	2042 Build Daily Vehicle Miles Traveled	2042 Build Million British Thermal Units	Percent Change in Million British Thermal Units for Build from No Build
Cars and Light Trucks	5,277	79,532,300	419,706	85,366,700	450,496	85,351,300	450,414	0.0%
Heavy Trucks	21,335	9,011,700	192,265	11,269,700	240,439	11,269,700	240,439	0.0%
Transit Buses	37,404	188,800	7,062	238,200	8,910	237,000	8,865	-0.5%
Streetcar	29,333	600	18	3,100	91	3,100	91	0.0%
Light Rail	25,129	16,000	402	129,000	3,242	133,300	3,350	3.3%
Commuter Rail	108,252	11,400	1,234	17,500	1,894	17,500	1,894	0.0%
Total	Not Applicable	88,760,800	620,687	97,024,200	705,071	97,011,900	705,053	0.0%^c

Sources: Oak Ridge National Laboratory 2022, Sound Transit 2023, Roos 2019, Puget Sound Regional Council 2023.

^a Consumption rate is for all vehicles in that classification including electric and hybrid vehicles.

^b Vehicle miles traveled are for the four-county region: King, Snohomish, Pierce, and Kitsap counties.

^c The total percentage change represents the change from the 2042 No Build Alternative to the 2042 Build Alternative total and includes all vehicle types.



4.10.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, energy would be consumed by operation of cars, trucks, and existing transit services (including buses, streetcar, light rail, and commuter rail), within the four-county region. The No Build Alternative would result in slightly more surface transportation energy use during operations when compared to the Build Alternatives. There would be no construction-related energy consumption under the No Build Alternative. Energy consumption by surface transportation mode in British thermal units is shown in Table 4.10-1 for the No Build Alternative.

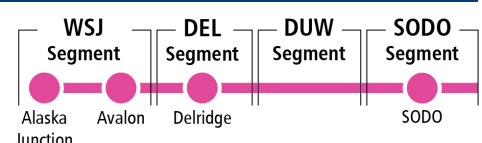
4.10.4 Environmental Impacts of the Build Alternatives during Operation

The energy analysis evaluates operational energy use by the project and the demand on regional energy supply. Sound Transit estimated long-term (operational) impacts from the vehicle-miles-traveled estimates by mode presented in the Puget Sound Regional Council traffic forecast model for 2042. The regional total light rail vehicle-miles-traveled estimates were modeled based on the projected operations plan for the full build out of the Sound Transit 3 Link light rail system. The regional vehicle-miles-traveled total was separated into surface transportation modes to account for differences in energy consumption levels. Transportation energy consumed, including fossil fuels and electricity, was converted to British thermal units to provide a common measure among all energy sources. The British-thermal-unit consumption rate per mile for each mode was obtained from the Transportation Energy Data Book, Edition 40 (Oak Ridge National Laboratory 2022), from Sound Transit, and from the American Public Transit Authority. Energy consumption by surface transportation mode in British thermal units is shown in Table 4.10-1 for the Build Alternatives.

The long-term direct energy impacts of the project are based on projected year 2042 regional traffic volumes and daily vehicle miles traveled, consistent with Puget Sound Regional Council data (2023) and the transit modeling performed by Sound Transit (2023). The vehicle miles traveled, energy consumption rate, and total energy consumption for the No Build and the Build Alternatives are presented in Table 4.10-1.

The Build Alternatives are expected to reduce miles travelled by cars and light trucks by nearly 15,000 miles per day but would increase light rail miles by approximately 4,300 miles per day when compared to the No Build Alternative. This would result in a slight reduction of car and light truck vehicle miles as demand shifts to the light rail system and transit buses. Overall, energy use during project operation is expected to result in slightly less energy use than with the No Build Alternative. Therefore, energy-related impacts during operation of the project are not anticipated.

Operation of the project would place a demand on the local electricity utility, Seattle City Light. The light rail energy consumption for the project is expected to be approximately 108 million British thermal units more energy per day than the No Build Alternative. This is equivalent to 31.7 megawatt hours per day of electricity. On an annual basis, this translates to approximately 11,500 megawatt hours of electricity per year. This represents less than 0.5 percent of Seattle City Light's total 2021 power generation. The project operation is not expected to have a notable impact on the electric utility because the utility could purchase additional electricity on the open market if necessary.



For the minimum operable segment (M.O.S.) to the project's Delridge Station there would be less shift in demand to light rail; therefore, the decrease in energy use would be less than shown in Table 4.10-1. There would also be less energy demand from light rail with the M.O.S., because there would be two fewer stations and less guideway length. Please see Section 3.4.3 in Chapter 3, Transportation Environment and Consequences, for information on M.O.S. ridership.

4.10.5 Environmental Impacts of the Build Alternatives during Construction

Energy-related impacts during construction of the project would be short term in nature and are not anticipated to be adverse. During project construction, energy would be consumed when construction materials are produced and transported to the project construction site. Operating and maintaining construction equipment would also consume energy. Because energy use is highly correlated to total project costs, the analysis compared the total energy consumption projections for both the overall low- and high-cost project scenarios. The energy analysis used the Federal Transit Administration Transit Greenhouse Gas Emissions Estimator (version 3.0) tool to estimate the energy use associated with the project construction (FTA 2022). The tool provides a high-level estimate of energy consumption and allows users to estimate energy emissions using limited data inputs, such as miles of new track and the number of new stations. Table 4.10-2 presents the project inputs used to estimate construction-related energy consumption for the project. The low-cost estimate includes Alternative SODO-1a, Alternative DUW-1b, Alternative DEL-5, and Alternative WSJ-2. The high-cost estimate includes Alternative SODO-1b, Alternative DUW-2, Alternative DEL-4, and Alternative WSJ-3a.

Table 4.10-2. Energy Model Inputs

Scenario	Number of At-Grade Stations	Number of Elevated Stations	Number of Tunnel Stations	Miles of At-Grade Guideway	Miles of Elevated Guideway	Miles of Guideway in Tunnel
Build Alternatives: Low Cost	1	3	0	1.49	7.28	0.00
Build Alternatives: High Cost	1	1	2	1.62	6.80	2.00
Build Alternative: Preferred	2	1	1	1.92	5.71	1.58

Table 4.10-3 shows the estimated energy that would be consumed during construction for the low- and high-cost alternatives and the preferred alternative. Upstream energy is related to the extraction, production, and transportation of construction materials. Downstream energy is related to the energy used during operation of construction equipment and vehicles. The high-cost alternative is estimated to consume approximately twice as much energy as the low-cost alternative. The preferred alternative is estimated to consume less energy than the high-cost alternative. Tunneling and tunnel station construction would use more energy than at-grade and elevated construction. See Appendix L4.6E, Greenhouse Gas Analysis, for all analysis inputs and outputs.

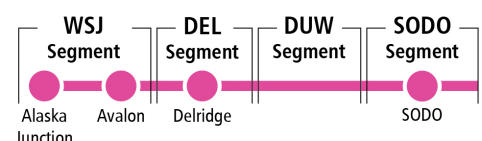


Table 4.10-3. Estimated Energy Consumed During Construction

Scenario	Upstream Energy (Million British Thermal Units)	Downstream Energy (Million British Thermal Units)	Total Energy Consumption ^a (Million British Thermal Units)
Build Alternative: Low Cost	2,084,239	72,867	2,157,105
Build Alternative: High Cost	3,906,947	175,043	4,081,991
Build Alternative: Preferred	3,048,163	138,251	3,186,414

^a Total may not sum due to rounding.

Assuming a 5-year construction period, the average annual energy consumed by construction of the project's preferred alternative would represent approximately 0.1 percent or less of the energy consumed in Washington state. Sound Transit's commitment to sustainability practices includes minimizing greenhouse gas emissions, which could be achieved by conserving energy during construction. Such measures will include, but would not be limited to, conserving fuel use through reductions in construction vehicle idling, setting minimum United States Environmental Protection Agency-tier requirements for construction vehicles, and providing for pre-demolition extraction of salvageable/reusable/recyclable materials. Sound Transit will work with the contractor regarding the implementation of minimization measures in accordance with Sound Transit's sustainability practices.

Sound Transit's *Design Criteria Manual*, Chapter 30 (Sustainability), outlines specific measures around energy efficient design at the station level to minimize impacts on energy use and adopts requirements in line with the United States Green Building Council Leadership in Energy & Environmental Design transit rating system. Lastly, each construction package of the project would pursue Envision certification, which includes elements of construction and operational reductions in energy consumption.

4.10.6 Indirect Impacts of the Build Alternatives

There would be no long-term indirect energy impacts associated with the project because the energy consumed during operations is considered a direct impact. Short-term indirect impacts related to the upstream energy consumption from the extraction, production, and transportation of construction materials for the project are included in the energy consumed during construction units identified in Table 4.10-3.

4.10.7 Mitigation Measures

With the implementation of Sound Transit's Sustainability Plan (Sound Transit 2019), impacts on energy use from the project would be minimized and, therefore, no mitigation is needed.

4.11 Geology and Soils

4.11.1 Introduction to Resource and Regulatory Requirements

This section discusses the potential long-term as well as short-term geology and soils impacts of the proposed West Seattle Link Extension Project (the project). The analysis includes consideration of topography, geology, soil characteristics, groundwater conditions, and geologic hazards. Additional information, including figures, is provided in Appendix L4.11, Geology and Soils.

Washington state's Growth Management Act (Chapter 36.70A Revised Code of Washington) requires all cities and counties to identify critical areas within their jurisdiction and develop regulations to protect such areas. Among the critical areas designated by the Growth Management Act are geologically hazardous areas, which are defined as areas that, because of their susceptibility to erosion, sliding, earthquake-induced damage, or other geologic events, are not readily suited for development consistent with public health and safety concerns without suitable design measures. The Build Alternatives will pass through the city of Seattle, where the City of Seattle includes geologic hazard areas in its Environmentally Critical Areas ordinance (Seattle Municipal Code Section 25.09). Geologic hazards affect project design and the type of construction methods used for the project and, if not adequately considered during project design, could affect the long-term operations and safety of the light rail system.

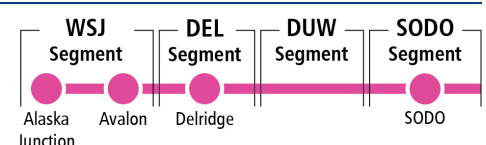
Geology and soil considerations are closely related to groundwater conditions. While this section includes general information on groundwater within the project segments, more detailed information about groundwater along the alternative routes is discussed in Section 4.8, Water Resources. Locations of possible contaminated soils and contaminated groundwater are discussed in Section 4.12, Hazardous Materials.

4.11.2 Affected Environment

Sound Transit assessed geologic units and soil characteristics along each alternative within the study area to establish the affected environment for geology and soils. The study area for geology and soils covers the area within 100 feet of the project limits. The project limits include permanent project improvements and areas needed for project construction. Regional geology was also considered to understand the mechanisms that created the local geology in the study area. Sound Transit assessed geologic units and soil characteristics using maps—including topographic maps, surficial soils maps, geologic maps, and geologic hazard maps—published by the City of Seattle, the United States Department of Agriculture, and United States Geological Survey. Sound Transit also assessed available site-specific geotechnical information for each alternative based on geotechnical explorations conducted for the project and as part of other projects in the study area.

4.11.2.1 Topography and Regional Geology, and Seismicity

The project is in the central portion of the Puget Sound Basin, an elongated, north-south trending depression situated in western Washington between the Olympic Mountain Range to the west and the Cascade Mountain Range to the east. The regional topography consists of a series of north-south trending ridges separated by deep troughs, which are now occupied by streams, lakes, and waterways, including Puget Sound, Elliott Bay, Lake Union, and Lake Washington. Land elevations range from about 15 to approximately 380 feet (North American Vertical Datum of 1988) across the West Seattle Link Extension. Refer to Figure L4.11-1 in Appendix L4.11 for the alignment.



This regional topography was shaped by glaciers as they advanced and receded across the region over 10,000 years ago. As the glaciers—several thousand feet thick in places—melted and receded from the landscape, silt, sand and gravel were deposited by meltwaters (recessional outwash sediments) over very hard or compact soils. The regional topography has been further modified through erosion and landform changes as a result of human development in the area. Geology in the region generally includes recently developed surficial soils (deposited within the last 10,000 years) over a thick sequence of glacially consolidated soils and bedrock (see Figures L4.11-2 to L4.11-5 in Appendix L4.11 for geologic units). Along the Build Alternative alignments, bedrock is generally more than 500 feet below the ground surface.

The region is seismically active—the project vicinity has been subject to earthquakes in the historical and recent past and will undoubtedly experience earthquakes again in the future. Earthquakes in the Puget Sound region result from any one of three sources: the Cascadia subduction zone off the coast of Washington, the deep intraslab subduction zone approximately 20 to 40 miles below the Puget Sound area, or shallow crustal faults. The closest active crustal source is the Seattle Fault Zone, which has a width of roughly 3 to 5 miles and intersects the SODO Segment, the Duwamish Segment, and a portion of the West Seattle Junction Segment. While surface rupture could occur anywhere within the Seattle Fault Zone, it is most likely to occur along an existing fault strand. The closest inferred surface location of a strand within the Seattle Fault Zone is shown on Figures L4.11-7 and L4.11-9 in Appendix L4.11.

4.11.2.2 Site Geology and Groundwater Conditions

Based on the geologic mapping and existing geotechnical reports, the study area is typically underlain by glacially consolidated soils and more recent soils, including unconsolidated recessional outwash, wetland deposits, tidelands, and areas of filled and reclaimed tidelands. Due to the complex glacial stratigraphy in the Seattle area, and its influence on the nature and flow of groundwater, multiple perched groundwater-bearing layers might be encountered. Groundwater is typically found from 5 feet to 120 feet below the ground surface, with the shallowest groundwater in the Duwamish valley. In wetlands, groundwater may be at or near the surface and range to a few feet below ground.

4.11.2.3 Geologic Hazards

Geologic hazard areas include steep slopes and landslide-prone areas, liquefaction-prone areas, peat settlement-prone areas, and seismic and volcanic hazard areas. The City of Seattle defines geologic hazard areas in its Environmentally Critical Areas ordinance (Seattle Municipal Code Section 25.09). Geologic hazard areas in the study area are shown on Figures L4.11-6 through L4.11-9 in Appendix L4.11 and described below.

4.11.2.3.1 Steep Slopes and Landslide-Prone Areas

Landslides can occur as relatively shallow surface debris flows or as relatively deep-seated slope failures. The landslide deposits in the study area generally consist of a disturbed, heterogeneous mixture of one or more soil types and may contain wood and other organics. The consistency of the landslide deposits is loose or soft, with random dense or hard pockets.

Steep slopes hazard areas are slopes greater than 40 percent, with a vertical rise of more than 10 feet. Landslide-prone areas are based on slope, soil types, and evidence of past slide activity.

The areas along the alternatives where landslides have occurred, are likely to occur, or have steep slopes in excess of 40 percent are reflected in the City of Seattle's Environmentally Critical Area mapping and are shown on Figures L4.11-7, L4.11-8, and L4.11-10 through L4.11-12 in Appendix L4.11. These areas are prone to slope failure and considered hazardous; the slopes can become unstable during wet weather, seismic events, and construction activities.

East of the Delridge neighborhood, there are slopes greater than 40 percent in the Pigeon Point area, as well as known and potential landslide hazards on the west, north, and east slopes; these locations are shown on Figures L4.11-7, L4.11-8, L4.11-10, and L4.11-11 in Appendix L4.11. There are also some small, isolated steep slopes between Pigeon Point and State Route 99, south of the West Seattle Bridge.

4.11.2.3.2 Liquefaction-Prone Areas

Many of the shoreline and nearshore areas along Elliott Bay and Puget Sound are composed of historical fill over former Elliott Bay tide flats. These areas are susceptible to liquefaction during a large earthquake. During and following the magnitude 6.8 Nisqually earthquake on February 28, 2001, the region experienced localized building settlements, cracked concrete slabs and walls, and soil liquefaction. Earthquakes in the Puget Sound region with magnitudes of 6 and greater could affect these liquefaction-prone areas.

Liquefaction-prone areas have loose, saturated soils that lose the strength needed to support structures, earth embankments, and slopes during earthquakes.

Liquefaction-prone areas are present in the Delridge valley, the Duwamish valley, and where there is historical fill in the SODO area. The liquefiable soils in the Delridge valley are primarily in the Longfellow Creek area and consist of loose native soil and fill that overlie the glacial soils. In the Duwamish valley, the upper 25 feet to 35 feet consists of loose to medium-dense sand. Interbedded medium-dense to very-dense sand and soft to stiff silt and clay underlie this upper loose to medium-dense sand, down to the stiff glacial soils. The sand deposits in the Duwamish valley could also liquefy under a strong level of ground shaking.

4.11.2.3.3 Peat Settlement-Prone Areas

Peat is an accumulation of decaying organic plant material that typically forms in wetland environments and is highly compressible and prone to settlement when loaded by new structures and fill or when the groundwater table is lowered.

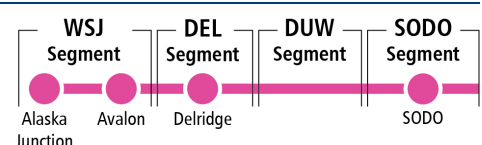
Peat settlement-prone areas contain substantial deposits of organic-rich soils that are susceptible to settling.

City of Seattle Environmentally Critical Area data identify peat settlement-prone areas near the Alaska Junction, between 44th Avenue Southwest and 42nd Avenue Southwest, extending from just north of Southwest Alaska Street to Southwest Edmunds Street (see Figure L4.11-9 in Appendix L4.11) and along 35th Avenue Southwest between Southwest Charleston Street and north of Southwest Manning Street (Figure L4.11-8 in Appendix L4.11). Peat soils were not observed in geotechnical borings drilled for the project in this area.

4.11.2.3.4 Seismic Hazard Areas

The Puget Lowland is in the geologic basin of the Cascadia subduction zone. The tectonics and seismicity of the region are the result of the northeastward subduction of the Juan de Fuca Plate beneath the North American Plate offshore beneath the Pacific Ocean. The nearest potentially active fault to the study area is the east-west trending Seattle Fault Zone, which extends from Bremerton on the west through the Alki peninsula and West Seattle, then passes

Seismic hazard areas include liquefaction-prone areas and areas subject to ground shaking and tsunamis.



beneath Harbor Island and the West Seattle Bridge and continues eastward. The project corridor crosses strands of the Seattle Fault Zone in the SODO, Duwamish, and West Seattle Junction segments (Figures L4.11-7 and L4.11-9). No evidence of fault movement was observed in the available soil boring exploration logs.

Another seismic hazard along the project corridor is the risk of tsunami inundation. Tsunamis are large water waves created from seafloor movement during seismic events. The Duwamish and SODO segments could experience tsunamis during a large regional seismic event.

4.11.2.3.5 Volcanic Hazard Areas

While ashfall from any of the five Cascade volcanoes in Washington could pose statewide risks, Mount Rainier poses the most substantial threat to Seattle in the form of lahars and post-lahar sedimentation. Lahars from Mount Rainier have buried the Kent valley, but there is no evidence that a lahar has reached Seattle in the past 10,000 years. It is possible for a lahar to reach Seattle along the Duwamish Waterway (also known as the Duwamish River), but it would be extremely unlikely (Sound Transit 2020).

Volcanic hazard areas are subject to inundation by lahars (mudflows and debris flows that originate from the slopes of a volcano) or flooding resulting from volcanic activity on Mount Rainier.

Post-lahar sedimentation occurs after a lahar, when rivers are choked with debris and mud, which blocks the normal drainage channels and causes increased flooding and progressive burial by remobilized sediment. Sediment deposition is exacerbated by rainstorms that transport loose materials from the lahar down the drainage channel. Recent studies have revealed extensive layers of sandy sediment from Mount Rainier that extend along the Green River and Duwamish River valleys to the mouth of the Duwamish Waterway at Harbor Island (Driedger and Scott 2008).

4.11.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, the existing geology and soils environment in the study area would remain unchanged. The existing risk from seismic hazards would still exist. New development would continue to take place in existing steep slope, erosion, and seismic hazard areas as allowed by City code.

4.11.4 Environmental Impacts of the Build Alternatives during Operation

4.11.4.1 Impacts Common to All Alternatives

4.11.4.1.1 Slope Stability, Retaining Structures, and Landslides

Earth slopes and retaining wall structures could be a hazard if not permanently stabilized. Earth slopes include existing slopes, slopes that could be steepened as part of the project, and slopes for embankment fills needed to support the light rail alignment. Slope instability could result in damage to structures in the path of moving soil or in a loss of the soil's supporting capacity for structures on or near the slope. The risk of inadequate slope stability would be greater if a large seismic event occurred. See Figures L4.11-7 through L4.11-12 in Appendix L4.11 for locations of potential or known landslide hazard areas and steep slopes.

Steep slopes are within the Duwamish, Delridge, and West Seattle Junction segments. With the exception of the Delridge Segment, ground slope conditions are generally stable in most areas along the Build Alternatives alignments. Land clearing in steep slope areas could increase soil erosion, but Sound Transit would implement erosion-control management practices to reduce hazards and keep the overall risk low. Sound Transit would use measures such as slope stabilization or retaining walls to stabilize the areas of potential risk. Some structures could require permanent soil anchors or tiebacks that extend underground onto adjacent properties.

4.11.4.1.2 Seismic Hazard

The primary seismic hazard is ground shaking caused by a seismic event. Potential impacts are listed following:

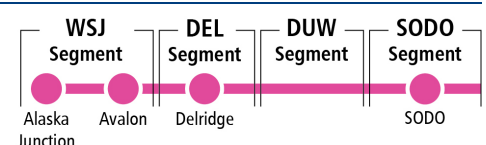
- Seismic ground shaking during light rail operation would be transmitted to the guideway structures supporting the light rail system.
- If the project is built on sloping ground, the shaking could result in permanent movement of the ground and supported facilities.
- Seismic ground shaking could also lead to liquefaction of loose, saturated soils with related co-seismic effects, such as:
 - Lateral spreading and flow on relatively gently sloping ground
 - Displacement of structures and embankments from loss of bearing support
 - Settlement from densification of loose soils
 - Increased risk of unstable earth slopes
 - Increased earth pressures on retaining walls or guideway columns supporting elevated guideways

Although these impacts would pose a risk to light rail facilities and users, Sound Transit would minimize the risk by designing the elevated, at-grade, and below-grade light rail support systems and retaining structures to withstand the effects of seismic ground shaking. Ground improvements in liquefaction-prone soils could include the following:

- Installing stone guideway columns, which are vertical columns of stone compacted in the ground on 5- to 10-foot spacing to stabilize the soil
- Jet grouting, where specialized drilling equipment working from the ground surface uses high pressure air or water to mix cement grout in the ground forming a cement-stabilized guideway column or wall
- Deep soil mixing, which uses specialized drilling equipment working from the ground surface to mix grout into existing soil, thereby binding the soil into a cement-stabilized mass

4.11.4.1.3 Groundwater

Groundwater depths throughout the project corridor range from approximately 5 feet to 120 feet below the ground surface. Retaining structures (such as walls) and subsurface structures (such as tunnels) can affect or be affected by local groundwater movement and seepage. Retaining structures could block or redirect groundwater. Retaining structures and subsurface structures could also change shallow or perched groundwater flow directions. During design, Sound Transit would consider groundwater conditions and provide appropriate means of drainage for controlling groundwater.



4.11.4.1.4 Settlement and New Earth Fills

Retained fills would be used in some areas where the project facilities would be above the existing grade to transition between profiles. The fill would cause increased loads on the existing soil, which would result in settling of soft compressible soil. Loads at foundations for stations and guideway structures could also have this effect. Without implementation of appropriate design measures, this settlement could damage light rail structures and nearby structures, roadways, and utilities.

The overall risk of settlement for all Build Alternatives is low in the West Seattle Junction Segment, which is underlain by glacially consolidated soils and is not expected to experience settlement because these soils have already been loaded with much higher pressures from glaciers. There would be greater potential for settlement in the SODO, Duwamish, and Delridge segments, where compressible soils are present. The project design would incorporate measures to improve the soils or offset the effects of the compressible soil where the potential for settlement is identified. These measures could include use of piled foundations, use of prefabricated (wick) drains with preloading and surcharging to reduce settlement and increase strength, or use of lightweight fills to limit settlement. Alternately, some structures could be designed to allow tolerances for anticipated settlement.

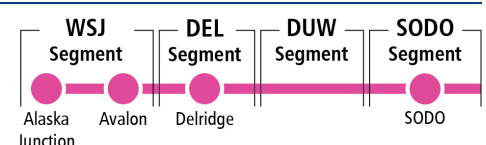
4.11.4.2 SODO Segment

All of the West Seattle Link Extension SODO Segment alternatives would be in liquefaction-prone soils. Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would be almost entirely at-grade and are not expected to require ground improvements for light rail or the Lander Street overpass. Alternative SODO-2 would require ground improvements around guideway columns for stability or strengthened foundations in the liquefaction-prone soils.

4.11.4.3 Duwamish Segment

Similar to the SODO Segment, all Duwamish Segment alternatives, including connections to the Operations and Maintenance Facility Central, would pass through liquefaction-prone soils and therefore ground improvements or strengthened foundations would be needed in these areas. Option DUW-1b would have the longest length of guideway in liquefaction-prone soils. Ground improvements could include stone guideway columns, jet grouting, or deep soil mixing around guideway column foundations or other methods as determined during final design.

Preferred Alternative DUW-1a would be on the north side of Pigeon Point, which is a landslide-prone area of steep, 40 percent or greater slopes with a history of slides. In combination with shallow groundwater, if encountered, steep slopes along Pigeon Point could be susceptible to slope instability. Permanent slope stabilization could include retaining walls, soil nails, and erosion mats. Depending on which alternative in the Delridge Segment Preferred Alternative DUW-1a would connect to, the methods used for slope stabilization may be different because the guideway could be elevated or retained fill in this area. Option DUW-1b would have the same considerations but a greater length of guideway in steep slope areas. Alternative DUW-2 would avoid these steep slopes on the north side of Pigeon Point.



4.11.4.4 Delridge Segment

Preferred Option DEL-6b, Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would be constructed along or west of Delridge Way Southwest and therefore avoid the steep slopes on the east side of Delridge Way Southwest. Alternatives DEL-3 and DEL-4 would have station access elements on the east side of Delridge Way Southwest and require permanent slope stabilization measures on a steep slope with known slides. These measures would be similar to those used in the Duwamish Segment and would prevent future slides from emanating from the disturbed areas.

All Delridge Segment alternatives would also travel through liquefaction-prone areas associated with Longfellow Creek. Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would span most of this area but could have guideway columns in liquefaction-prone soils that would require ground improvements or strengthened foundations. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have a longer length of guideway in liquefaction-prone soils in the Delridge Segment and likely have more foundations-supporting guideway columns requiring ground improvements.

4.11.4.5 West Seattle Junction Segment

All West Seattle Junction Segment alternatives would avoid major geologic hazard areas. While some deposits of peat are identified along California Avenue Southwest at Southwest Alaska Street in the City of Seattle's Environmentally Critical Area maps, these deposits appear to be far enough away from the project alignments to not pose a design, construction, or operational issue.

Bored and/or sequential excavation mined tunnels would generally pass through or be within layers of water-bearing soils. Construction of shafts from the surface for station access and ancillary facilities, such as vents, would excavate through layers of water-bearing soils. Sound Transit would provide waterproofing gaskets in bored tunnel lining, and sequential excavation mined tunnels and shafts would be lined with waterproofing membrane to minimize groundwater seepage into the facilities and to avoid permanent drawdown of groundwater levels.

Disposal of any groundwater seepage is discussed in Section 4.8. No special geologic considerations are expected in this area beyond those discussed in Section 4.11.4.1, Impacts Common to All Alternatives.

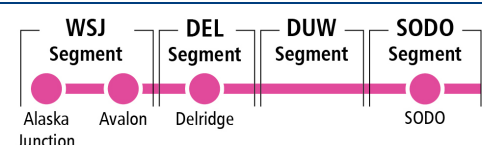
4.11.5 Environmental Impacts of the Build Alternatives during Construction

Construction activities have the potential to cause short-term geology- and soils-related impacts on the environment.

4.11.5.1 Slope Instability Hazard

Sound Transit would conduct detailed slope stability evaluations during design and, where appropriate, develop and use slope stabilization methods during construction. Earthworks would be designed, and specifications prepared, to avoid creating unstable conditions that could cause slope instability. Methods that could help minimize slope stability hazards include, but are not limited to, the following:

- Use retaining structures with catchment for landslide debris
- Use onsite slope reinforcement, such as soil nailing or tieback anchors



4.11.5.2 Erosion Hazards

Clearing vegetation, placing fill, and removing, grading, or stockpiling spoils during construction allow rainfall and runoff to erode soil particles. The risk of erosion and how severe the erosion would be is a function of the area of exposed soil, rainfall intensity and duration, soil characteristics, and the volume and configuration of soils stockpiled. Best management practices that could help minimize erosion hazards include, but are not limited to, the following:

- Maintaining as much vegetation as possible and designing surface water runoff systems
- Installing silt fences downslope of all exposed soil and using straw, mulch, or plastic covering over exposed earth
- Using temporary erosion-control blankets and mulching to minimize erosion prior to vegetation establishment

4.11.5.3 Groundwater

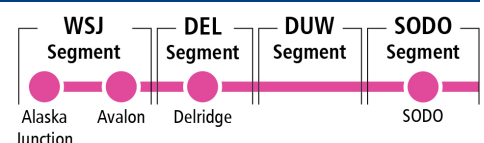
Light rail facilities would create new loads and potentially affect groundwater conditions along the alternatives. Retaining structures can affect or be affected by local groundwater movement and seepage. During design of the retaining structures, Sound Transit would consider groundwater conditions and provide appropriate means of drainage for controlling groundwater both during construction and in the permanent condition. Dewatering could also cause settlement, as described in the following section.

4.11.5.4 Settlement

Retaining walls would be used to retain fills to meet track grade requirements. Sound Transit would use standard retaining wall construction techniques and compaction of the retained fill to avoid or minimize settlement impacts behind the wall from new earth loads. Where unsuitable soils exist close to the ground surface, they could be removed and replaced with compacted gravel. Pile foundations could be used where soft soils extend to greater depths.

The West Seattle Junction Segment tunnel alternatives (Preferred Option WSJ-5b, Alternative WSJ-3a, Option WSJ-3b, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6) have potential for settlement of the ground above or adjacent to tunneling work. Removal of excess soil for tunnels could create voids or loose zones in the soil that could progressively migrate upward. This could result in settlement and damage to adjacent facilities such as roadways, utilities, and buildings from loss of foundation bearing support. Loss of ground is most often encountered in poorly graded sands and gravels below groundwater. Settlement above tunnels could also occur from volume loss, which is when the amount of excavated soil is in excess of the calculated geometry of the tunnel. If a greater volume of material is excavated than is displaced by the tunnel, then this material was lost from around the tunnel, which could cause settlement. Volume loss would be minimized by using appropriate tunnel boring machine operation and ground improvement methods such as grouting. Supplemental ground support could be used to support nearby buildings as needed. A settlement monitoring program would be implemented to warn of any settlements exceeding pre-established settlement criteria.

Where groundwater is present, sequential excavation mining and excavation from the surface for these tunnel alternatives could require localized dewatering, which has the potential to result in subsidence or settlement in soft or loose soils. Where soil is settlement-prone, Sound Transit could implement measures to avoid and minimize it. Temporary ground freezing might also be needed where cross passages between tunnels would be constructed.



4.11.5.5 Seismic Hazards

An earthquake could occur during project construction and cause embankment slope failures, liquefaction, or ground settlement. The risk of seismic hazards to construction is considered low because there is a low probability that an earthquake would occur during the construction period.

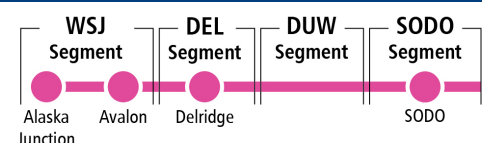
If a large earthquake were to occur, the major risk would be to the ongoing construction activities. Work schedules would likely be delayed as efforts are made to repair damaged components of the work. Utilities or nearby structures could also experience some disruption from the damage to exposed cuts or fills. If needed, ground improvements could be used to stabilize liquefaction-prone soils.

4.11.6 Indirect Impacts of the Build Alternatives

Indirect impacts from the West Seattle Link Extension could result from permanent soil anchors or tiebacks that would be used in retaining wall structures. These wall support systems could restrict the type of excavation feasible for the future developments within the anchor zones.

4.11.7 Mitigation Measures

With appropriate use of engineering design standards and best management practices as described above, no adverse geological or soils impacts are expected. Therefore, no mitigation is needed.



4.12 Hazardous Materials

4.12.1 Introduction to Resource and Regulatory Requirements

This section discusses the West Seattle Link Extension Project (the project) alternatives' potential to encounter hazardous materials or to introduce new sources of hazardous materials contamination that could pose risks to human health and the environment along with potential mitigation measures. Applicable laws and regulations related to hazardous materials are listed in Appendix L4.12, Hazardous Materials.

4.12.2 Affected Environment

The study area for hazardous materials extends 1/8 mile from either side of the project limits and the area used for construction. The project limits include permanent project improvements and areas needed for project construction.

Sound Transit acquired information about sites with known contamination or potential contamination within the study area, as well as relevant historical conditions within the study area from several sources that are listed in Appendix L4.12. Based on the information collected and reviewed, Sound Transit categorized sites into three risk categories (high, medium, and low) to prioritize sites and determine the need for avoidance, remediation, or mitigation when considering project impacts. The risk levels are defined as follows:

- **High** – Sites that involve substantial contamination of large areas, including soil and groundwater, and multiple contaminants. High-risk sites might represent a higher risk of further releases of hazardous materials to people or the environment or would be likely to involve high levels of regulatory approvals, extensive or lengthy remediation activities that may create other impacts to the environment, or could pose major delays to the development of the project.
- **Medium** – Sites where the nature of potential contamination is known based on existing investigation data, the potential contaminants are not extremely toxic or difficult to treat, and probable remediation approaches are straightforward.
- **Low** – Sites where the nature of potential contamination is known based on existing investigation data and the sites are not expected to have notable impacts on the project due to their location, or sites where hazardous materials were used but had no or only very small reported releases.

In contrast to sites that fell into one of these three designations, sites that were considered minimal risk were not reviewed or further counted. Minimal-risk sites include sites that had regulatory interactions not related to the potential release of hazardous materials to soil or groundwater (i.e., permitted air emissions) or sites with a small one-time spill that was reported as cleaned up.

In addition to the high-, medium-, or low-risk designation, sites were further split into two categories: (1) sites with documented release and (2) sites with potential release. Table L4.12-1 in Appendix L4.12 provides a complete list of hazardous materials sites identified in the study area.

Tables 4.12-1 through 4.12-4 list the number of sites in the study area by risk category for each alternative. The high-risk sites are discussed in more detail in Sections 4.12.4, Environmental Impacts of the Build Alternatives during Operation, and 4.12.5, Environmental Impacts of the Build Alternatives during Construction, and in Appendix L4.12.

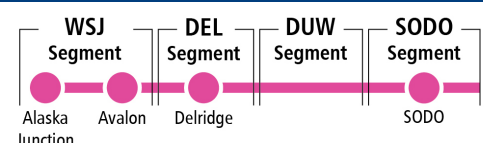


Table 4.12-1. Number of Hazardous Materials Sites by Alternative – SODO Segment

SODO Segment Alternative	High-Risk Sites	Medium-Risk Sites	Low-Risk Sites
Preferred At-Grade Lander Access Station Option (SODO-1c)	1	16	42
At-Grade Alternative (SODO-1a)	1	16	43
At-Grade South Station Option (SODO-1b)	1	14	37
Mixed Profile Alternative (SODO-2)	1	14	36

Table 4.12-2. Number of Hazardous Materials Sites by Alternative – Duwamish Segment

Duwamish Segment Alternative	High-Risk Sites	Medium-Risk Sites	Low-Risk Sites
Preferred South Crossing Alternative (DUW-1a)	6^a	32 to 34	70 to 74
South Crossing South Edge Crossing Alignment Option (DUW-1b)	6 ^a	33	74
North Crossing Alternative (DUW-2)	7 ^a	37	88

Notes:

Ranges reflect differences from connecting to different alternatives in adjacent segments.

Number of sites does not include Harbor Island or the Lower Duwamish Waterway Superfund sites.

^a One high-risk site is partially within the Duwamish Segment but is counted within impacts for the Delridge Segment in Table 4.12-3.

Table 4.12-3. Number of Hazardous Materials Sites by Alternative – Delridge Segment

Delridge Segment Alternative	High-Risk Sites	Medium-Risk Sites	Low-Risk Sites
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	1	3	10
Dakota Street Station Alternative (DEL-1a)	1	1	8
Dakota Street Station North Alignment Option (DEL-1b)	1	1	8
Preferred Dakota Street Station Lower Height Alternative (DEL-2a)	1	1	10
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	1	1	10
Delridge Way Station Alternative (DEL-3)	1	1	8
Delridge Way Station Lower Height Alternative (DEL-4)	1	1	8
Andover Street Station Alternative (DEL-5)	1	3	10
Andover Street Station Lower Height Alternative (DEL-6a)	1	3	11
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	1	3	10

Table 4.12-4. Number of Hazardous Materials Sites by Alternative – West Seattle Junction Segment

West Seattle Junction Segment Alternative	High-Risk Sites	Medium-Risk Sites	Low-Risk Sites
Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	2	14	73
Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	2	19	82
Elevated Fauntleroy Way Station Alternative (WSJ-2)	2	14	53
Tunnel 41st Avenue Station Alternative (WSJ-3a)	2	14 to 16	70
Tunnel 42nd Avenue Station Option (WSJ-3b)	1	16	76
Short Tunnel 41st Avenue Station Alternative (WSJ-4)	2	18	77
Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	2	14	69
No Avalon Station Tunnel Alternative (WSJ-6)	1	7	43

Note: Ranges reflect differences from connecting to different alternatives in adjacent segments.

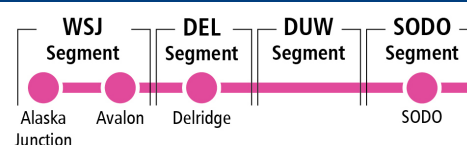
4.12.2.1 Historical and Current Uses

Prior to the 1900s, the area encompassing the present-day SODO and Duwamish segments consisted of tide flats. The areas were filled in the early 1900s with unknown fill material, including an informal landfill site along 6th Avenue South (Sixth Avenue South Landfill). Both of these segment areas were historically used for industrial and manufacturing activities and are currently zoned for industrial use. Historical and current uses within both segment areas include railyards, shipping and cargo facilities, sawmills, metal foundries, and metal works.

The study area for all West Seattle Link Extension Build Alternatives is within the Tacoma smelter plume. The Asarco Company operated a copper smelter in Tacoma from 1890 to 1985, and air pollution from the smelter resulted in elevated arsenic, lead, and other heavy metals in surface soil throughout the Puget Sound area. Based on regional data, the Delridge, Duwamish, and SODO segments have estimated arsenic concentrations below 20 parts per million, which is the level considered as protective of both human health and the environment under the Washington State Model Toxics Control Act. The West Seattle Junction Segment has estimated arsenic concentrations between 20 and 40 parts per million, which is above the 20 parts per million concentration considered as protective of human health and the environment by Washington State Department of Ecology (Ecology) (Ecology 2019). Within the study area, there are no Ecology actions planned for mitigating the arsenic contamination from Asarco. If concentrations in soil above 20 parts per million are encountered, soil will need to be handled in accordance with applicable rules and regulations.

4.12.2.2 Superfund Sites

There are two Superfund sites with ongoing cleanups that overlap within the project limits in the Duwamish Segment: Harbor Island and the Lower Duwamish Waterway. Pollutants at the Harbor Island Superfund Site include polychlorinated biphenyls, arsenic, carcinogenic polycyclic aromatic hydrocarbon, tributyltin, and mercury in soil or groundwater, as well as sediment impacts within the Duwamish Waterway (East Waterway). Cleanup is complete at five of the six operable units, and contaminants within these five complete operable units are below the cleanup values set by the United States Environmental Protection Agency. The Proposed Plan for cleanup at the sixth operable unit, the East Waterway, was published in April 2023. The preferred alternative described in the Proposed Plan includes a mix of dredging, capping, enhanced natural recovery, in-situ treatment, and monitored natural recovery across the East Waterway (United States Environmental Protection Agency 2023).



The Lower Duwamish Waterway Superfund Site, which is south of the Duwamish Segment, has sediments impacted by polychlorinated biphenyls, arsenic, carcinogenic polycyclic aromatic hydrocarbon, as well as dioxins and furans. Cleanup has been completed or is ongoing at five Early Action Areas identified in the Record of Decision. Cleanup of the waterway is expected to begin in 2025 and will include a mix of dredging, capping, enhanced natural recovery, monitored natural recovery, institutional controls, and long-term monitoring (United States Environmental Protection Agency 2014).

Additional details on the status of the Superfund sites is provided in Appendix L4.12 and Section 4.12.4.3, Duwamish Segment.

4.12.2.3 Abandoned Landfills

Development on abandoned landfills is subject to Seattle-King County Health Department requirements, as described in the Seattle Municipal Code. Abandoned landfills may generate landfill gas, which is caused by decomposition of organic material and is composed mainly of methane gas.

The Sixth Avenue South Landfill was an informal disposal area between South Forest Street and South Charlestown Street along 6th Avenue South (Seattle-King County Department of Public Health 1984). This site is present under and in the vicinity of the Operations and Maintenance Facility Central; however, it is not a high-risk site and therefore is not discussed further in this section.

The West Seattle Landfill is outside of the Duwamish Segment study area but within 1,000 feet of the Duwamish Segment study area. This landfill is considered an environmentally critical area due to the potential presence of methane because areas within 1,000 feet of methane-producing landfills might be susceptible to accumulation of hazardous levels of methane gas in enclosed spaces.

4.12.2.4 Transportation-Related Uses

Transportation-related land uses in the West Seattle Link Extension study area that could contain contamination include the Port of Seattle terminals on Harbor Island, Union Pacific Railroad's Argo Yard between East Marginal Way South and Interstate 5, and BNSF Railway's International Gateway Intermodal Facility west of SODO.

4.12.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would not introduce the potential for release of contaminants during construction but would also not provide removal or cleanup of potentially hazardous materials, including contaminated groundwater or soil, within the study area. Contaminated properties would remain in their current state, and the potential for uncontrolled migration of existing contaminants could continue.

4.12.4 Environmental Impacts of the Build Alternatives during Operation

4.12.4.1 Impacts Common to All Alternatives

This section discusses the potential long-term operational impacts the Build Alternatives could have on known contaminated sites and the potential impacts that the contaminated sites could have on project development. Potential impacts would likely be restricted to the areas immediately adjacent to the alternatives. The likelihood of impacts from the normal long-term operation and maintenance activities are low. Because the light rail trains operate on electricity, major spills are unlikely. However, minor hazardous materials releases could result during maintenance activities because hazardous materials, including lubricants, solvents, hydraulic fluids, or other chemicals, could be used at the maintenance facilities or during track maintenance. Light rail vehicles would be serviced at the existing Operations and Maintenance Facility Central in the Duwamish Segment. Sound Transit would manage generated hazardous waste according to applicable regulatory requirements.

High-risk sites in the SODO, Duwamish, Delridge, and West Seattle Junction segments are mapped on Figures 4.12-1 through 4.12-4. Contaminated sites affected by the project would be addressed before and during project construction, as discussed in Section 4.12.5. However, long-term operational impacts could occur if Sound Transit acquires properties that are a source of contamination, possibly requiring ongoing cleanup responsibility. Long-term monitoring or other protective measures or restrictions could be required.

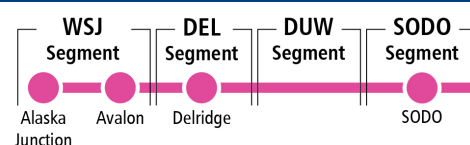
4.12.4.2 SODO Segment

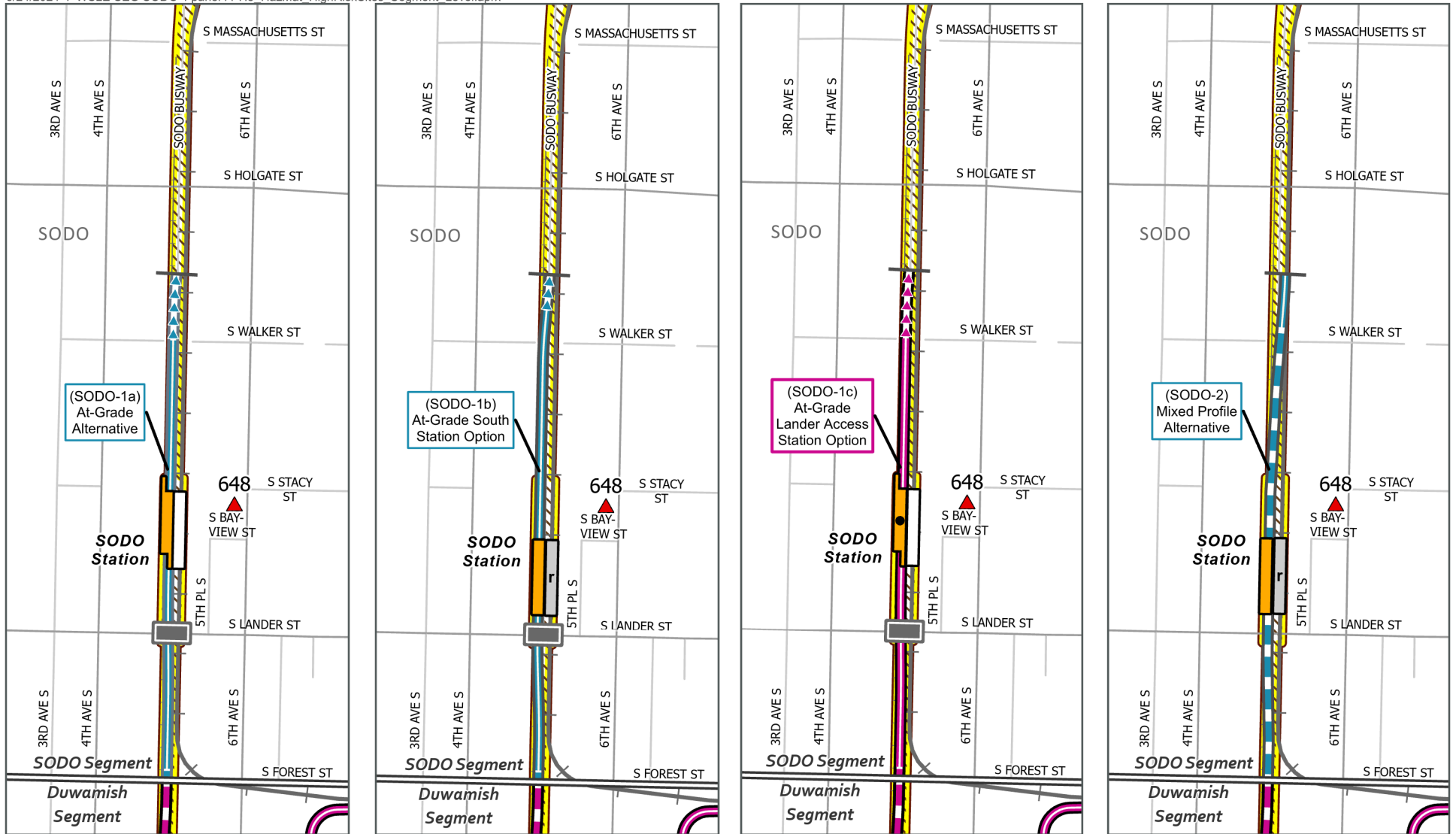
The SODO Segment has one high-risk site in the study area at 2411 6th Avenue South, as shown on Figure 4.12-1. There are no properties proposed for acquisition where long-term operational impacts are a concern in the SODO Segment.

4.12.4.3 Duwamish Segment

High-risk hazardous material sites in the Duwamish Segment are shown on Figure 4.12-2. The two Superfund sites described above in Section 4.12.2.2, Superfund Sites, could require protective measures and restrictions. All Duwamish Segment alternatives would be within the Harbor Island Superfund Site, and all alternatives are close to the Lower Duwamish Waterway Superfund Site. Sound Transit would coordinate with the United States Environmental Protection Agency and Ecology on any potential protective measures or restrictions that might be required for the project during operation.

Nucor Steel (formerly Seattle Steel) (Map Identification Number [I.D.] 805) is a steel plant that has operated at its current location since 1905 and also had facilities on some adjacent properties that have since been redeveloped with other uses. A variety of contamination has been confirmed at one or more of these properties, including polychlorinated biphenyls, polycyclic aromatic hydrocarbons, metals, and solvents. This site would be affected with Alternative DUW-2. Preferred Alternative DUW-1a and Option DUW-1b would affect this property when connecting to Preferred Option DEL-6b, Alternatives DEL-5, DEL-6a, and DEL-7. The site could require remediation or long-term monitoring during project operation.





Source: City of Seattle, King County, U.S. Environmental Protection Agency, Environmental Data Resources Inc., Ecology (2023).

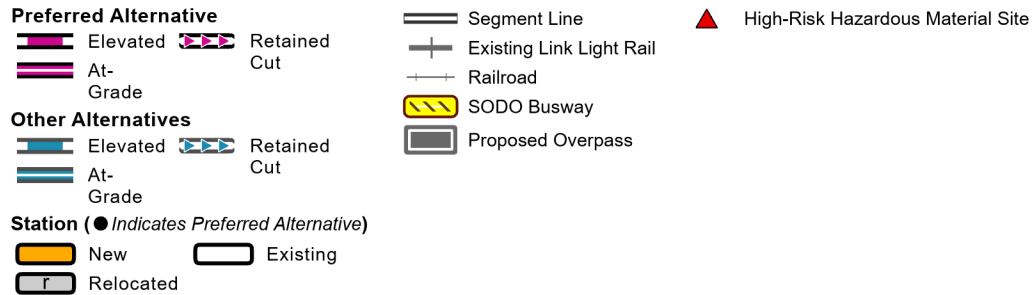
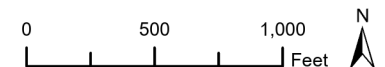
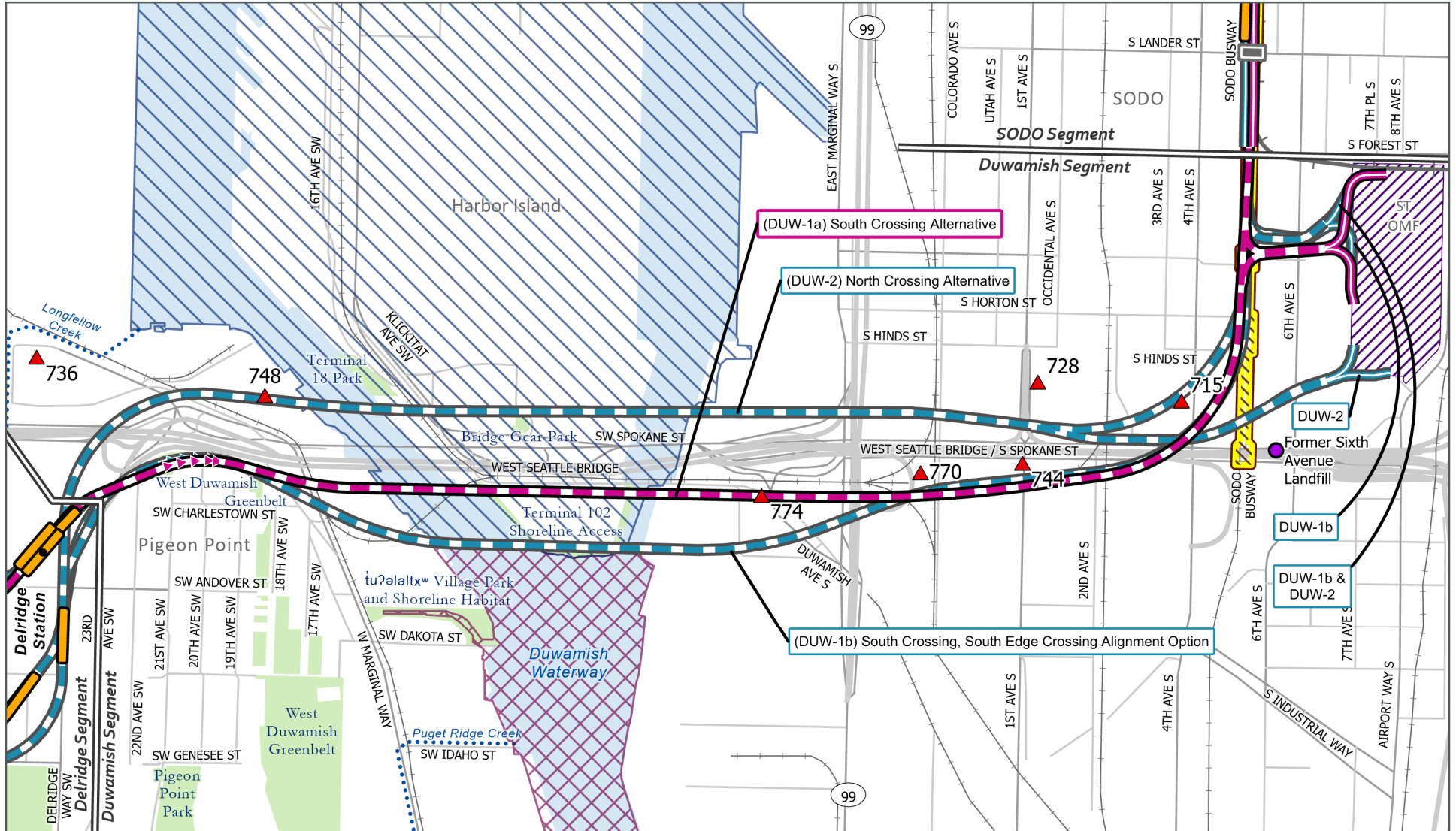


FIGURE 4.12-1
High-Risk Hazardous Material Sites
SODO Segment

West Seattle Link Extension





Source: City of Seattle, King County, U.S. Environmental Protection Agency, Environmental Data Resources Inc., Ecology (2023).

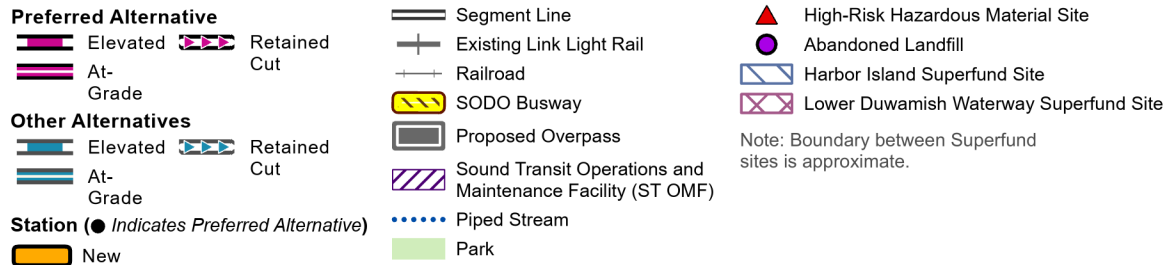
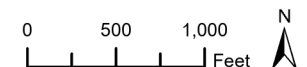
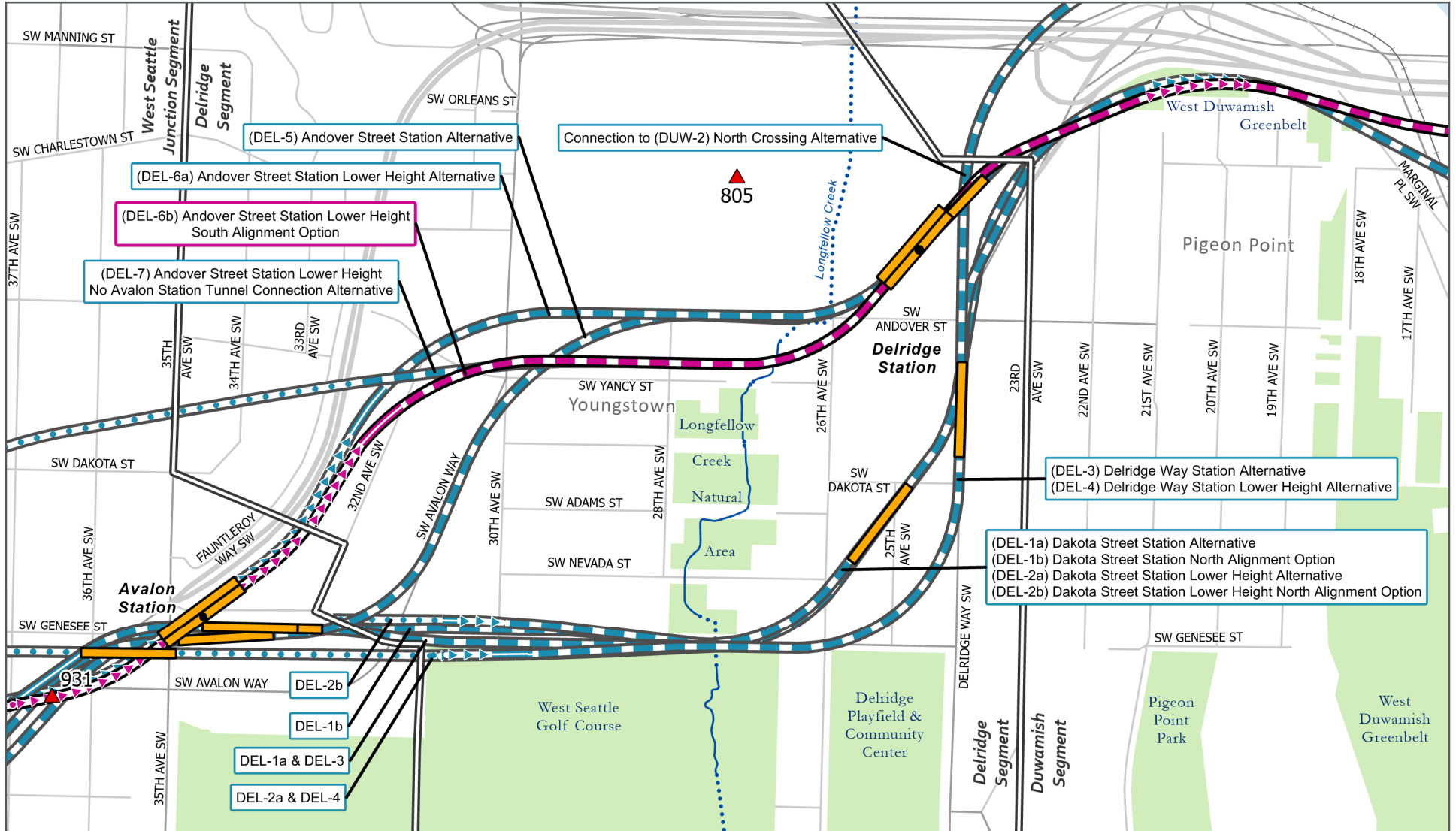


FIGURE 4.12-2
High-Risk Hazardous Material Sites
Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County, U.S. Environmental Protection Agency, Environmental Data Resources Inc., Ecology (2023).

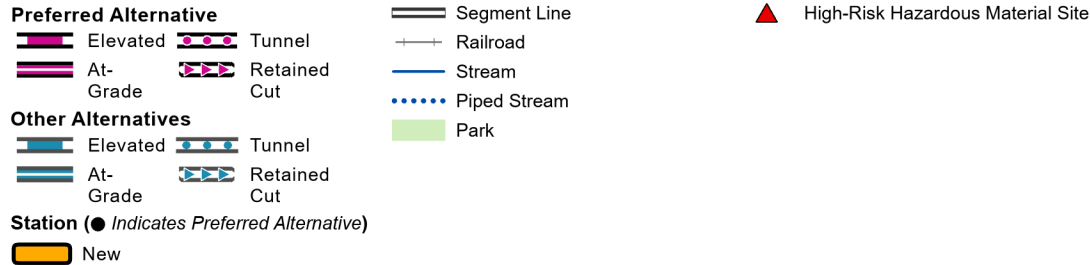
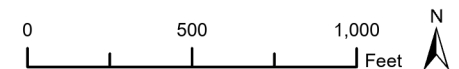
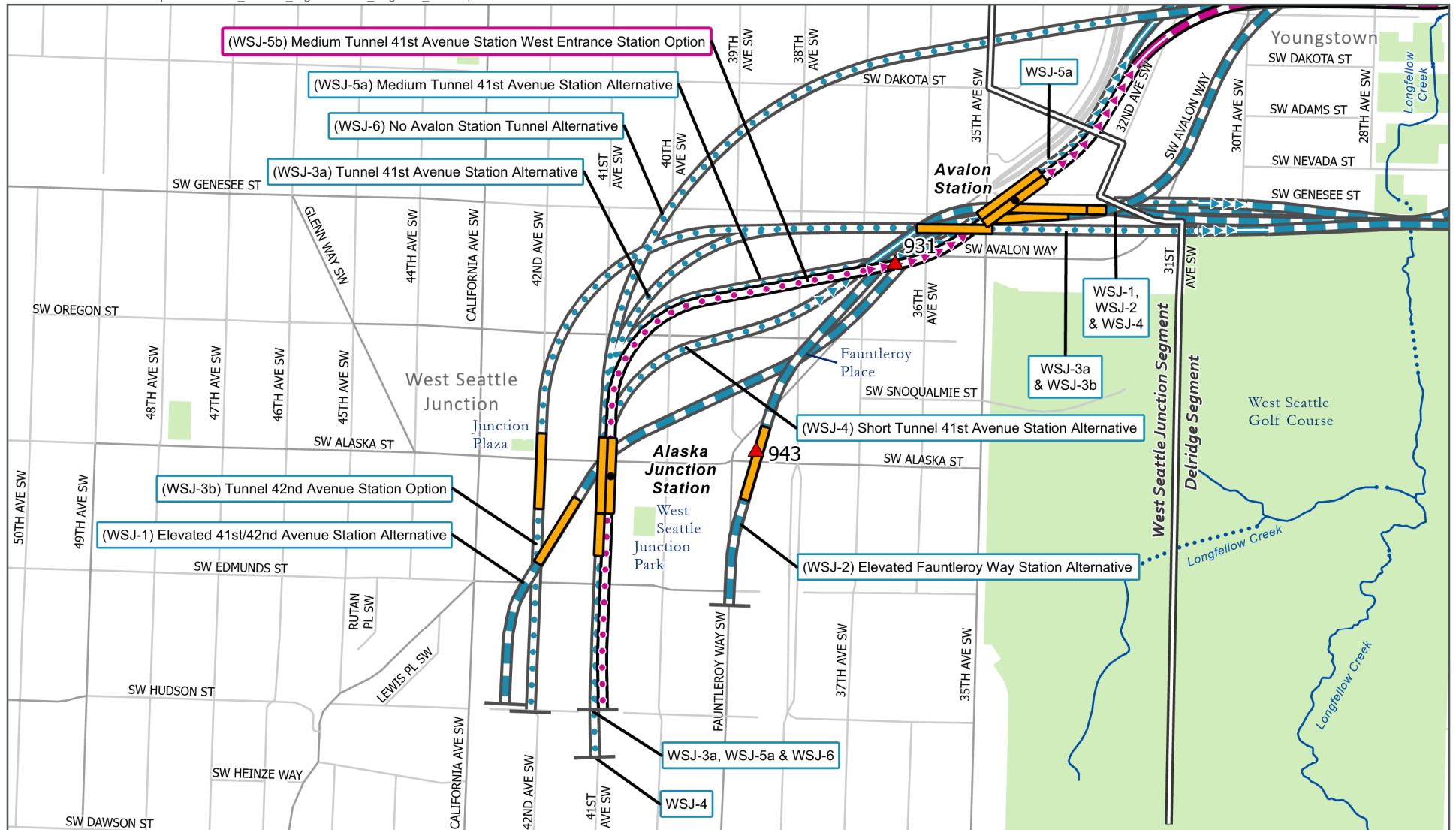


FIGURE 4.12-3
High-Risk Hazardous Material Sites
Delridge Segment

West Seattle Link Extension









Source: City of Seattle, King County, U.S. Environmental Protection Agency, Environmental Data Resources Inc., Ecology (2023).

Preferred Alternative

 Elevated
  Tunnel

 At-Grade
  Retained Cut

Other Alternatives

 Elevated
  Tunnel
 At-Grade
  Retained Cut

Station (● Indicates Preferred Alternative)

New

 Segment Line

- Stream
- Piped Stream
- Park


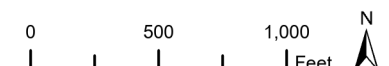
 High-Risk Hazardous Material Site

FIGURE 4.12-4
High-Risk Hazardous Material Sites
West Seattle Junction Segment

West Seattle Link Extension



4.12.4.4 Delridge Segment

The high-risk hazardous material site in the Delridge Segment is shown on Figure 4.12-3. This site would be affected and include partial acquisition for Preferred Option DEL-6b, Alternatives DEL-5, DEL-6a, and DEL-7, although a small portion of the affected property would be in the Duwamish Segment. As described above in the Duwamish Segment, the site could require remediation or long-term monitoring during project operation.

4.12.4.5 West Seattle Junction Segment

High-risk hazardous material sites in the West Seattle Junction Segment are shown on Figure 4.12-4. Long-term, ongoing groundwater monitoring is currently occurring at the high-risk site Conoco Philips 30124 (Map I.D. 943), an active gasoline service station with an ongoing remediation system in operation, due to the presence of petroleum and the potential presence of tetrachloroethylene and trichloroethylene in the soil or groundwater, as discussed in Appendix L4.12. This site would be directly affected by Alternative WSJ-2 and could require remediation or long-term monitoring during operation.

4.12.5 Environmental Impacts of the Build Alternatives during Construction

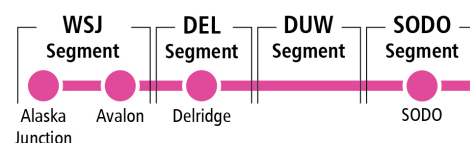
The following discussion identifies high-risk sites within each segment study area. Potential impacts would likely be restricted to the areas immediately adjacent to the alternatives. Additional detail on high-risk sites is provided in Appendix L4.12.

4.12.5.1 Impacts Common to All Alternatives

Potential construction impacts could result from existing soil or groundwater contamination encountered during construction activities.

Contamination may be found on or adjacent to known contaminated sites or within rights-of-way and utility corridors. Construction methods for each alternative would influence the potential impacts during construction, with bored or mined tunnel construction less likely to encounter contaminated soil or groundwater than excavation and construction activities from or at the ground surface. Construction impacts could include the following:

- Grading or excavation activities could uncover contamination, thus allowing direct exposure to workers or the public.
- Grading or excavation activities could generate contaminated soil that would need treatment and proper disposal.
- Existing contamination could spread as the result of construction activities, such as dewatering, which might mobilize contamination.
- If contamination is present, dewatering during construction could generate contaminated groundwater that would need treatment and proper disposal.
- Construction activities could discover contamination that was otherwise unknown.
- Construction activities could encounter previously unknown underground or above-ground storage tanks containing hazardous materials that would require special disposal.



- Construction activities could encounter pole-mounted electrical transformers, which might contain polychlorinated biphenyl-contaminated transformer oil and require special disposal.
- Demolishing, removing, and disposing of existing structures could release hazardous materials, such as asbestos or lead. Asbestos was once commonly used in building construction and is most dangerous when crushed, broken, or otherwise disturbed. Lead was historically often found in lead pipes or in lead-based paint.
- Construction activities could encounter materials that require special disposal, such as creosote- or arsenic-treated wood, railroad ties, telephone poles, and marine or building piles.
- Construction activities could result in a spill or accidental releases of hazardous materials, such as lubricants or fuels from heavy equipment.

Construction activities could also encounter contaminated materials that require special handling or disposal along former and historical railway corridors. Historically, railroads often used chemicals, such as metals, pesticides, or petroleum products, during normal railroad operations along the railroad tracks. In particular, arsenic is common in soil along railroad corridors from arsenic weed-control sprays, arsenic slag in bed fill, or arsenic-treated railroad ties. Petroleum impacts are also likely along the tracks from spilled lubricating oils or fuels used by trains.

During construction activities, contaminated soil could also be encountered in areas with artificial fill material. The SODO and Duwamish segments are in areas where substantial volumes of artificial fill were imported to raise the ground surface level. The source material for artificial fill is usually unknown and might contain debris or elevated levels of metals, polycyclic aromatic hydrocarbons, or petroleum products that could require special handling and disposal.

Sound Transit would minimize construction impacts by avoiding known contaminated sites or portions of sites when possible. However, the study area might have other constraints, such as physical, environmental, or topographic impacts that would make avoidance infeasible. Sound Transit would perform environmental due diligence for properties along the corridor before acquisition to avoid or minimize impacts from contaminated sites. Environmental due diligence would include the completion of a Phase I Environmental Site Assessment for properties that would be acquired or that represent a substantial risk to the project during construction activities. A subsequent Phase II Environmental Site Assessment might be necessary for sites where contamination has been identified or is suspected.

As part of the project, Sound Transit would adhere to local, state, and federal regulations and implement applicable best management practices, which include construction stormwater pollution prevention plans, spill control and prevention plans, contaminated media management plans, and health and safety plans. These plans establish protocols for handling hazardous materials to ensure compliance with local, state, and federal standards while minimizing impacts to the project.

The following discussion identifies high-risk sites within each segment study area. Potential impacts would likely be restricted to the areas immediately adjacent to the alternatives.

4.12.5.2 SODO Segment

Table 4.12-5 identifies the high-risk site within the SODO Segment study area by alternative.

The SODO Segment is currently zoned for industrial and manufacturing use and has a long history of industrial activities. The area is also underlain by artificial fill. Contaminated soil and groundwater could be encountered within the SODO Segment as a result of contaminated fill material or past industrial use.

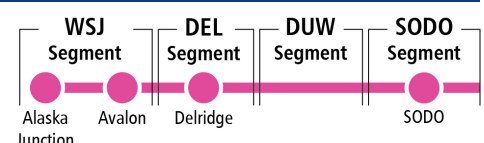


Table 4.12-5. Potential High-Risk Sites Affected by Alternative – SODO Segment

Site Name (Map I.D.)	Potential Impact	Preferred At-Grade Lander Access Station Option (SODO-1c)	At-Grade Alternative (SODO-1a)	At-Grade South Station Option (SODO-1b)	Mixed Profile Alternative (SODO-2)
Industrial Plating (#648)	Encounter soil and groundwater impacted by trichloroethylene.	Affected	Affected	Affected	Affected
Total Sites Affected	Not Applicable	1	1	1	1

Note: All high-risk sites have documented releases.

4.12.5.3 Duwamish Segment

Table 4.12-6 identifies the high-risk sites within the Duwamish Segment study area by alternative. These sites are shown on Figure 4.12-2. All of the Duwamish Segment alternatives would pass within the boundaries of the Harbor Island Superfund Site and have the potential to affect areas of the Lower Duwamish Waterway Superfund Site. All Duwamish Segment alternatives would disturb areas within the Soil and Groundwater Operable Unit (OU1), where previous remediation activities included excavation of soils and treatment/disposal of these soils offsite, capping of remaining contaminated soil that exceeds cleanup goals, institutional controls, and implementation of long-term groundwater monitoring.

Contaminated soils in the interior of Harbor Island that exceeded cleanup criteria were capped. Cleanup of this unit is considered to be complete (United States Environmental Protection Agency 2020).

Depending on bridge type, all alternatives could have construction activities in the East Waterway during installation of guideway columns for the bridge, where cleanup of contaminated sediments is still underway. For Preferred Alternative DUW-1a, in-water construction activities would be limited to moving riprap adjacent to the guideway columns while the tide is out and is not anticipated to disturb contaminated sediments on the benthic floor. The United States Environmental Protection Agency has determined that no additional cleanup is necessary in the West Waterway Sediments Operable Unit (OU8) because the sediment poses no current unacceptable risks to human health or the environment (United States Environmental Protection Agency 2015).

Construction methods and activities in the area of the Superfund sites would be coordinated with the United States Environmental Protection Agency and Ecology, as appropriate, to avoid conflicts with existing and future cleanup actions at the Superfund sites. For project elements within the Harbor Island Superfund Site or the Lower Duwamish Waterway Superfund Site, Sound Transit would coordinate with the United States Environmental Protection Agency and Ecology on any potential protective measures or restrictions that might be required for the project.

In addition to the high-risk sites, the unknown fill material as well as former and current industrial activities within the Duwamish Segment might have resulted in releases of hazardous substances. Due to this, there is a high likelihood of encountering metals or polycyclic aromatic hydrocarbons in shallow soil or groundwater during construction.

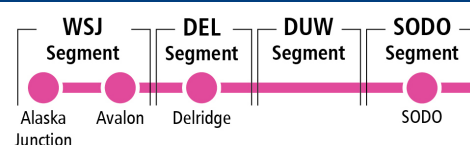


Table 4.12-6. Potential High-Risk Sites Affected by Alternative – Duwamish Segment

Site Name (Map I.D.)	Potential Impact	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
Harbor Island Superfund Site	Encounter soil, groundwater, and sediment contaminated with metals, polycyclic aromatic hydrocarbons, dioxin and furans, and polychlorinated biphenyls.	Affected	Affected	Affected
Lower Duwamish Waterway Superfund Site	Encounter sediments contaminated with polychlorinated biphenyls, metals, carcinogenic polycyclic aromatic hydrocarbons, or dioxin/furans	Affected	Affected	Affected
Southwest Harbor Project (#736)	Encounter soil, groundwater, and surface water contaminated by metals, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and petroleum products.	Not Affected	Not Affected	Affected
Island Tug and Barge (#748)	Encounter groundwater contaminated by dioxin/furans.	Not Affected	Not Affected	Affected
Port of Seattle Terminal 106 Northwest (#774)	Encounter soil and groundwater contaminated by lead.	Affected	Affected	Not Affected
Nelson Iron Works (#770)	Encounter soil and groundwater contaminated by petroleum, carcinogenic polycyclic aromatic hydrocarbons, and metals.	Affected	Affected	Not Affected
Business Pro Computers (#715)	Encounter soil and groundwater impacted with petroleum.	Not Affected	Not Affected	Affected
Buffalo Industries (#744)	Encounter soil contaminated with tetrachloroethylene and groundwater contaminated with petroleum and polycyclic aromatic hydrocarbons.	Affected	Affected	Not Affected
Enterprises Northwest (#728)	Encounter soil or groundwater contaminated with petroleum, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls.	Not Affected	Not Affected	Affected
Nucor Steel (#805)	Encounter soil and groundwater contaminated with polychlorinated biphenyls, polycyclic aromatic hydrocarbons, metals, or solvents	Affected^a	Not Affected	Affected
Total Sites Affected	Not Applicable	5	5	7

Note: All high-risk sites have documented releases. The potential for each alternative to affect high-risk sites is based on direct construction impacts. If a high-risk site falls within the construction area, it could be affected, which could result in associated impacts.

^a Nucor Steel is partially within the Duwamish Segment but would only be affected with Preferred Alternative DUW-1a when connecting to Preferred Option DEL-6b and alternatives DEL-5, DEL-6b, and DEL-7 in the Delridge Segment, and therefore is counted in the total for those alternatives in the Delridge rather than in the Duwamish Segment total.

4.12.5.4 Delridge Segment

Table 4.12-7 identifies the high-risk site within the Delridge Segment study area by alternative. The site is shown on Figure 4.12-3.

4.12.5.5 West Seattle Junction Segment

Table 4.12-8 identifies the high-risk sites within the West Seattle Junction Segment study area by alternative. These sites are shown on Figure 4.12-4.

4.12.6 Indirect Impacts of the Build Alternatives

The construction of the project would support redevelopment of properties around station areas where local zoning allows. Redevelopment of properties in the study area might result in cleanup of contamination earlier than might otherwise occur, which would be an indirect benefit of the project.

4.12.7 Mitigation Measures

With inclusion of the best practices described under Section 4.12.5.1, Impacts Common to All Alternatives, and adherence to regulatory requirements as part of the project, there are no anticipated impacts and no mitigation is needed.

Table 4.12-7. Potential High-Risk Sites Affected by Alternative – Delridge Segment

Site Name (Map I.D.)	Potential Impact	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Preferred Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
Nucor Steel (#805)	Encounter soil and groundwater contaminated with polychlorinated biphenyls, polycyclic aromatic hydrocarbons, metals, or solvents	Affected	Not Affected	Not Affected	Not Affected	Not Affected	Not Affected	Not Affected	Affected	Affected	Affected
Total Sites Affected	Not Applicable	1	1	1	1	1	1	1	1	1	1

Note: All high-risk sites have documented releases. The potential for each alternative to affect high-risk sites is based on direct construction impacts. If a high-risk site falls within the construction area, it could be affected, which could result in associated impacts.

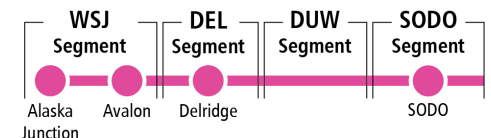
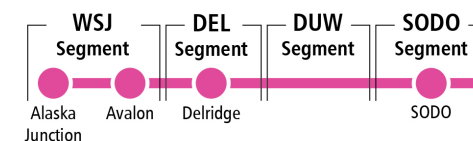


Table 4.12-8. Potential High-Risk Sites Affected by Alternative – West Seattle Junction Segment

Site Name (Map I.D.)	Potential Impact	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
Conoco Philips 30124 (#943)	Encounter soil and groundwater contaminated with petroleum and soil vapor. Active remediation system in place.	Not Affected	Not Affected	Affected	Not Affected	Not Affected	Not Affected	Not Affected	Not Affected
House of Kleen Inc. (#931)	Encounter soil and groundwater contaminated with tetrachloroethylene, trichloroethylene, and petroleum.	Affected	Affected	Affected	Affected	Affected	Affected	Affected	Not Affected
Total Sites Affected	Not Applicable	1	1	2	1	1	1	1	0

Note: All high-risk sites have documented releases. The potential for each alternative to affect high-risk sites is based on direct construction impacts. If a high-risk site falls within the construction area, it could be affected, which could result in associated impacts.



4.13 Electromagnetic Fields

4.13.1 Introduction to Resource and Regulatory Requirements

This section discusses the possibility that electromagnetic fields from light rail trains and facilities might interfere with the operation and function of sensitive equipment along the West Seattle Link Extension Project (the project) alternatives. Electromagnetic fields are created by the generation, transmission, distribution, and use of electricity.

Examples of Electromagnetic Field Sources

Electromagnetic field sources include the earth's static magnetic field (about 0.53 gauss in Seattle); 60-hertz electric power distribution and use; heavy steel-laden flatbed truck (0.18 gauss at approximately 16 feet); and radio emitters such as broadcast antennas, wireless internet routers, cellular phones, and many others.

Electromagnetic fields surround all electrical equipment, appliances, and facilities, including light rail trains. Metal objects such as trucks and buses move through the earth's static magnetic field, creating electromagnetic fields. Electromagnetic fields can result in electromagnetic interference by disrupting the performance or function of sensitive equipment such as magnetic resonance imaging equipment used in laboratory and medical settings, electron microscopes, mass spectrometers, and magnetic devices, such as heart pacemakers. There are no regulatory requirements or exposures limits for electromagnetic field exposures from light rail trains. However, several organizations, such as the Institute of Electrical and Electronics Engineers, have developed guidelines and standards for electromagnetic field exposure. Standard practices for protecting sensitive equipment from electromagnetic fields, such as shielding, have also been developed.

In certain situations, with sufficiently high exposure, electromagnetic fields can affect human health. The World Health Organization, however, has concluded that "current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields" (World Health Organization 2016). Electromagnetic fields expected to be generated by this project would be low; these are discussed in Section 4.13.4.1, Electromagnetic Field Impacts to Sensitive Equipment and Human Health. Therefore, the impact discussion focuses on potential for interference with sensitive equipment as well as the potential impact of stray currents. Appendix L4.13, Electromagnetic Fields, provides figures that summarize the dissipation of the static magnetic field disruption caused by light rail trains.

4.13.2 Affected Environment

Sound Transit reviewed existing and planned property uses where potential electromagnetic fields from light rail trains and facilities (such as traction power substations) might interfere with normal operation and function of sensitive equipment. The study area for electromagnetic field impacts extends 300 feet from the Build Alternatives track alignments, including stations. In the study area, no properties with sensitive equipment were identified.

4.13.3 Environmental Impacts of the No Build Alternative

The existing electromagnetic field environment would not change if the project is not built.

4.13.4 Environmental Impacts of the Build Alternatives during Operations

To evaluate the potential for localized electromagnetic field effects to sensitive equipment from the project, Sound Transit evaluated the potential for electromagnetic interference at properties with sensitive equipment, as well as areas along the alternatives where electromagnetic fields generated from operating the project are expected to be greater, such as at traction power substations and where trains must accelerate or ascend an incline.

The impacts of electromagnetic fields and stray currents from construction and operation of the project would be the same for all Build Alternatives.

4.13.4.1 Electromagnetic Field Impacts to Sensitive Equipment and Human Health

There are no properties with sensitive equipment in the study area, so no long-term electromagnetic field impacts on sensitive equipment are expected from any of the Build Alternatives. Expected electromagnetic fields generated by the project would be much lower than the applicable limits specified by the World Health Organization and the Institute of Electrical and Electronics Engineers, so no health impacts on people are expected from any of the Build Alternatives.

Electromagnetic fields from the project operation would be generated from direct-current electricity flowing from the traction power substation through overhead catenary wires to the light rail trains, from movement of the large metal trains, and from radio frequency fields from wireless systems such as communications, data transmission, and monitoring systems on the light rail vehicles and along the corridor. The strongest electromagnetic field source would be the slowly varying magnetic fields from direct current flowing from the traction power substations through overhead catenary wires to the light rail trains. These slowly varying electromagnetic fields would diminish in level with lateral distance from the rail line.

The direct current from the traction power substations carried by the catenary wires to the light rail trains would slowly vary in amplitude depending on train acceleration. The direct current also includes low levels of low-frequency alternating currents. These low-frequency alternating currents also generate electromagnetic fields, which could interfere with low-frequency radio waves from other sources such as AM radios. Such interference might annoy the listener, but does not damage the radio equipment. Additional detail on traction power substations can be found in Chapter 2, Alternatives Considered.

The magnetic field from light rail operation would not exceed 10 gauss, which is less than 1/100th of the 1,180 gauss maximum permissible exposure considered safe for human health by the Institute of Electrical and Electronics Engineers (2019). The light rail system would not be a notable source of magnetic fields for human exposure. Example sources of electromagnetic fields are listed in Section 4.13.1, Introduction to Resource and Regulatory Requirements.

Key Electricity Terms

A **volt** is the base unit of electric potential between two points. An **amp** is the base unit of electric current that flows between two points in an electric circuit. Electric fields are measured in units of **volts per meter** and magnetic fields are measured in units of **gauss**. Electromagnetic wave frequency is measured in units of **hertz**, or cycles per second. **Direct-current power** refers to current that flows in one direction (from higher to lower potential), so its frequency of reversal is 0 hertz. Electric power is measured in units of **watts**. Electric work or energy is measured in units of **kilowatt-hours** (1 kilowatt of power expended for one hour).

Within the SODO Segment, all Build Alternatives would relocate an overhead 230-kilovolt, 60-hertz, alternating-current power line from the SODO Busway to the east side of 6th Avenue South between South Massachusetts Street and the substation south of South Spokane Street. There are existing 26-kilovolt lines on both sides of the road. The relocated 230-kilovolt power line would move farther from the SODO Busway businesses and closer to some 6th Avenue South businesses and would potentially increase the 6th Avenue South 60-hertz electromagnetic field. However, businesses in Seattle already operate near 230-kilovolt and 26-kilovolt power lines with no negative effect. Further, the electromagnetic field of the combined 230-kilovolt and 26-kilovolt would be less than 0.1 gauss, far lower than the broadly accepted human health limit of 9 gauss for exposure of the general public to 60-hertz fields, in the Institute of Electrical and Electronics Engineers (2019) standard.

In summary, expected electromagnetic fields generated by the project would be much lower than the limits specified by the World Health Organization and the Institute of Electrical and Electronics Engineers; there are no expected impacts to business operations or human health.

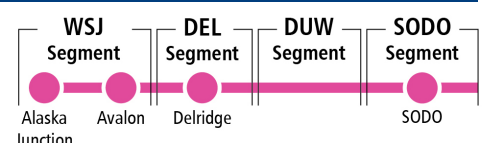
4.13.4.2 Impacts from Stray Currents

Without control measures, a portion of the electrical current flowing from the traction power substations to the light rail trains may produce stray currents, where the current flows in alternative conducting paths such as metal structures, water, or the earth. The stray currents can corrode adjacent metal structures if the currents are not sufficiently controlled and if the metal structures are not sufficiently protected. Sound Transit would minimize or avoid the effect of stray currents on neighboring facilities by incorporating best management practices appropriate for the project. The best management practices may include:

- Installing cathodic protections systems in nearby utility lines to protect them from corrosion
- Installing insulating unions to break the electrical conductivity of nearby utility pipes and force the stray current to take another path
- Isolating the electrical rails from the ground
- Installing stray-current-control track-fastening systems where appropriate

4.13.5 Environmental Impacts of the Build Alternatives during Construction

No electromagnetic field impacts would occur as a result of construction of any of the Build Alternatives because there are no sensitive properties in the study area. However, there could be an impact on construction activities associated with the Delridge Segment alternatives caused by a low power 5-kilowatt AM radio tower at 1050 and 1250 kilohertz, approximately 1,000 feet from the construction area. Under some conditions, the electric field from the radio tower could cause a touch potential on cranes. A touch potential is a substantial voltage that could shock a worker who stood on the ground and touched the crane hook. Given the distance of the construction area from the AM radio tower, there is low probability that this impact would occur. Sound Transit would employ best management practices such as insulating or grounding the crane to avoid this impact. The presence of a vertical crane near an AM broadcast tower could incrementally reduce the quality of AM reception from the tower in a narrow swath of land beyond the crane along the line from the tower to the crane. Any detectable effect to an AM radio user would be localized and transient, and would end once the crane changes its orientation.



4.13.6 Indirect Impacts of the Build Alternatives

There are no sensitive properties in the study area, and no indirect electromagnetic field impacts are expected from any of the Build Alternatives.

4.13.7 Mitigation Measures

There would be no electromagnetic field impacts from construction and operation of the project; therefore, no mitigation measures would be needed.

4.14 Public Services, Safety, and Security

4.14.1 Introduction to Resource and Regulatory Requirements

This section discusses potential impacts from the West Seattle Link Extension Project (the project) on the following types of public services within the study area or with service areas within the study area:

- Fire and emergency medical services (including hospitals)
- Police
- Schools (public and private)
- Solid waste and recycling collection
- United States Postal Service
- Other government facilities

4.14.2 Affected Environment

The study area for public services is 0.5 mile from the edge of project limits for operations and construction. The project limits include permanent project improvements and areas needed for project construction. Table 4.14-1 identifies the public service providers that have facilities in the study area. Information on public transit facilities can be found in Section 3.4, Affected Environment and Impacts during Operation – Transit, and Section 3.11, Construction Impacts, in Chapter 3, Transportation Environment and Consequences. Facility locations are shown on Figures 4.14-1 through 4.14-4.

Table 4.14-1. Public Service Providers in Study Area

Type	Service Provider	Locations in Study Area
Police	Seattle Police Department	<ul style="list-style-type: none">• Seattle Police Support Facility, 730 South Stacy Street and 2203 Airport Way South
Fire/Emergency Medical, Local	Seattle Fire Department	<ul style="list-style-type: none">• Seattle Fire Department Fire Station 14, 3224 4th Avenue South• Seattle Fire Department Fire Station 32, 3715 Southwest Alaska Street• Seattle Fire Department Fire Station 36, 3600 23rd Avenue Southwest
Public Schools	Seattle Public Schools	<ul style="list-style-type: none">• Fairmount Park Elementary School, 3800 Southwest Findlay Street• Genesee Hill Elementary School, 5013 Southwest Dakota Street• Pathfinder K-8 School, 1901 Southwest Genesee Street
Private Schools	Multiple	<ul style="list-style-type: none">• Holy Rosary School, 4142 42nd Avenue Southwest• Hope Lutheran School, 4446 42nd Avenue Southwest• Tilden School, 4105 California Avenue Southwest
Other Government Facilities	Seattle Public Schools	<ul style="list-style-type: none">• Seattle Public Schools John Stanford Center for Educational Excellence (Administrative Building), 2445 3rd Avenue South
	United States Postal Service	<ul style="list-style-type: none">• United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office, 2460 4th Avenue South• West Seattle Post Office, 4412 California Avenue Southwest
	Washington State Department of Social and Health Services	<ul style="list-style-type: none">• Secure Community Transition Facility, 132 South Spokane Street

Source: City of Seattle 2020.

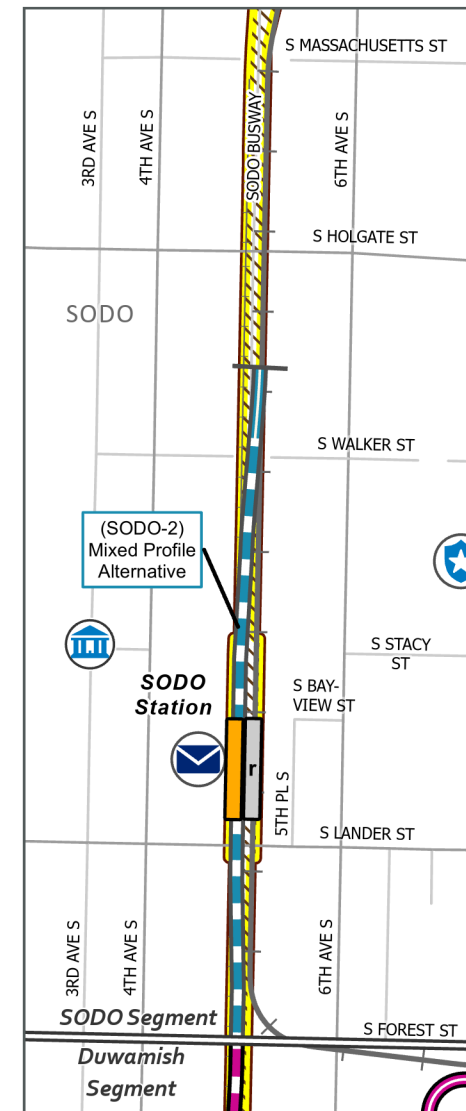
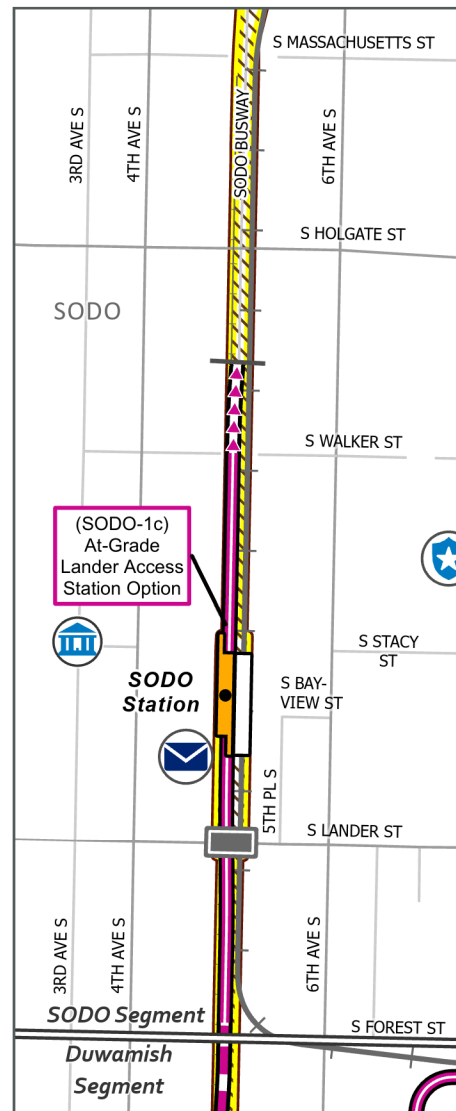
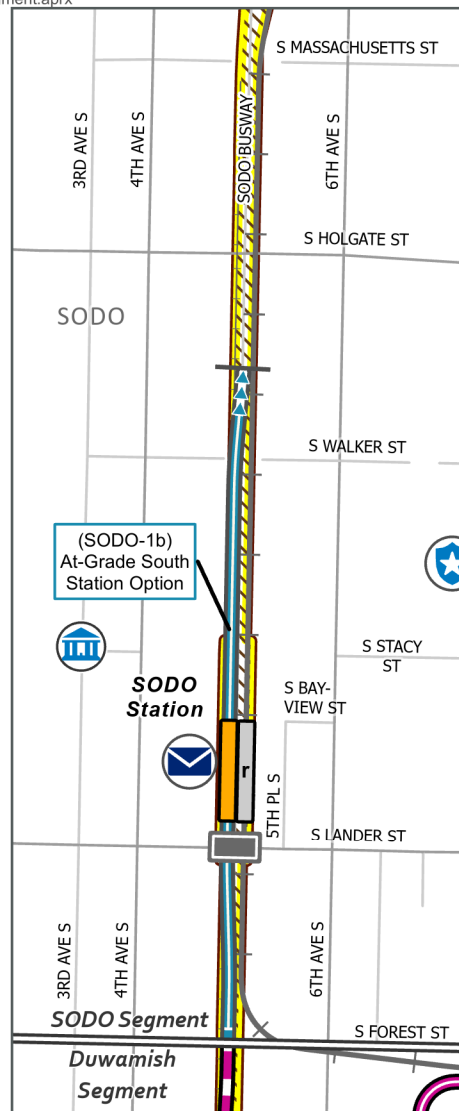
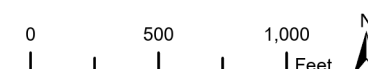
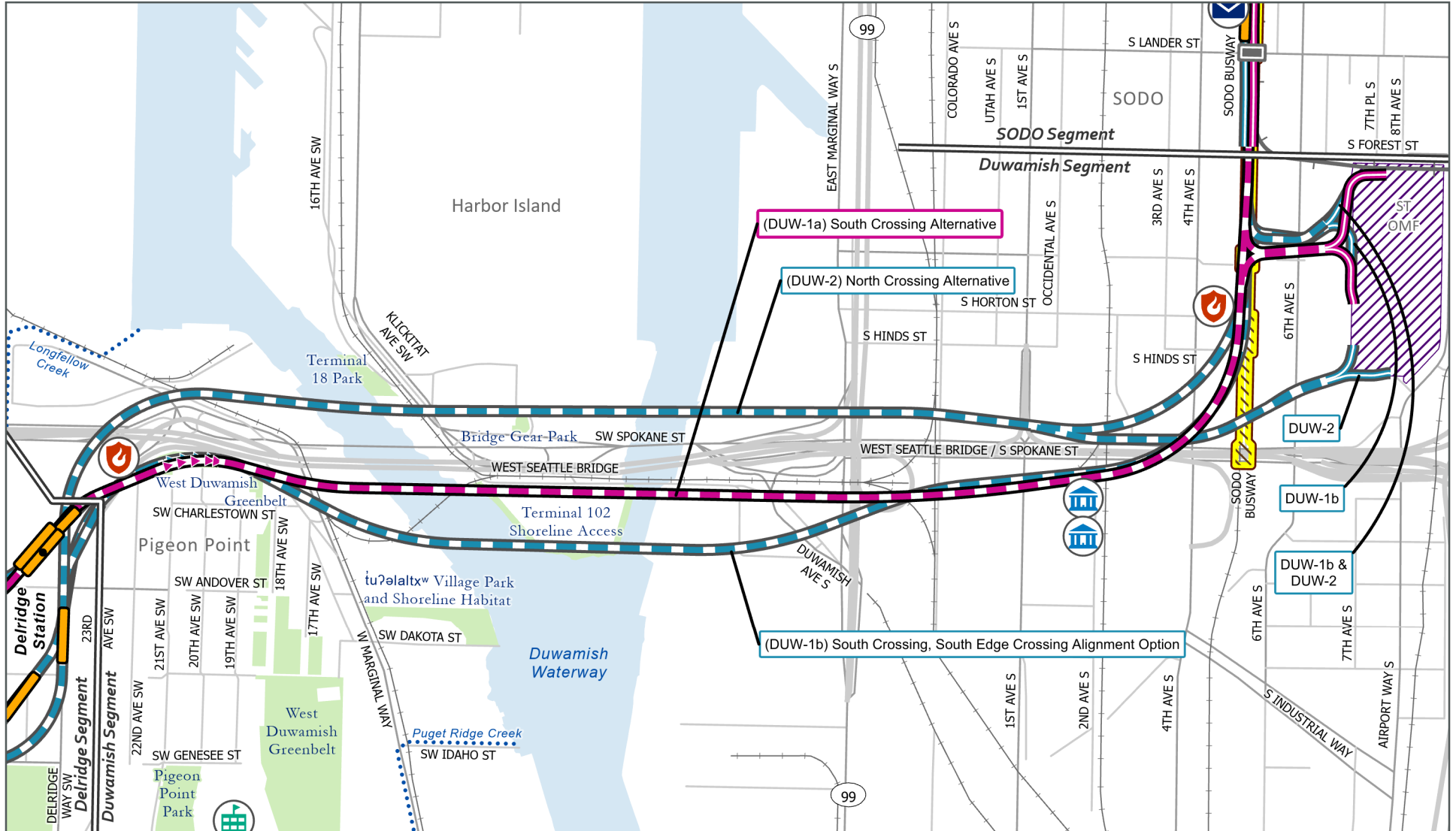


FIGURE 4.14-1
Public Services
SODO Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

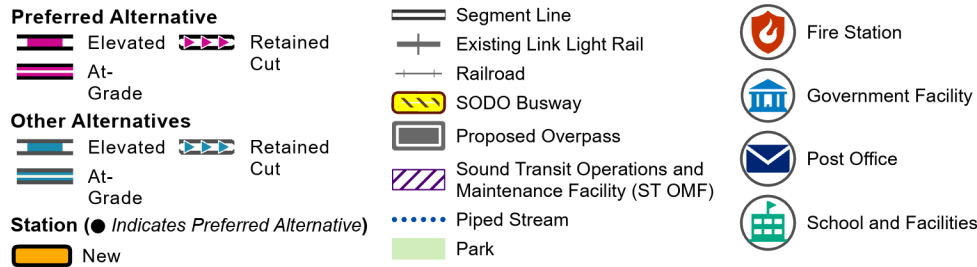
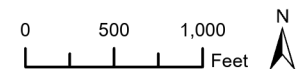
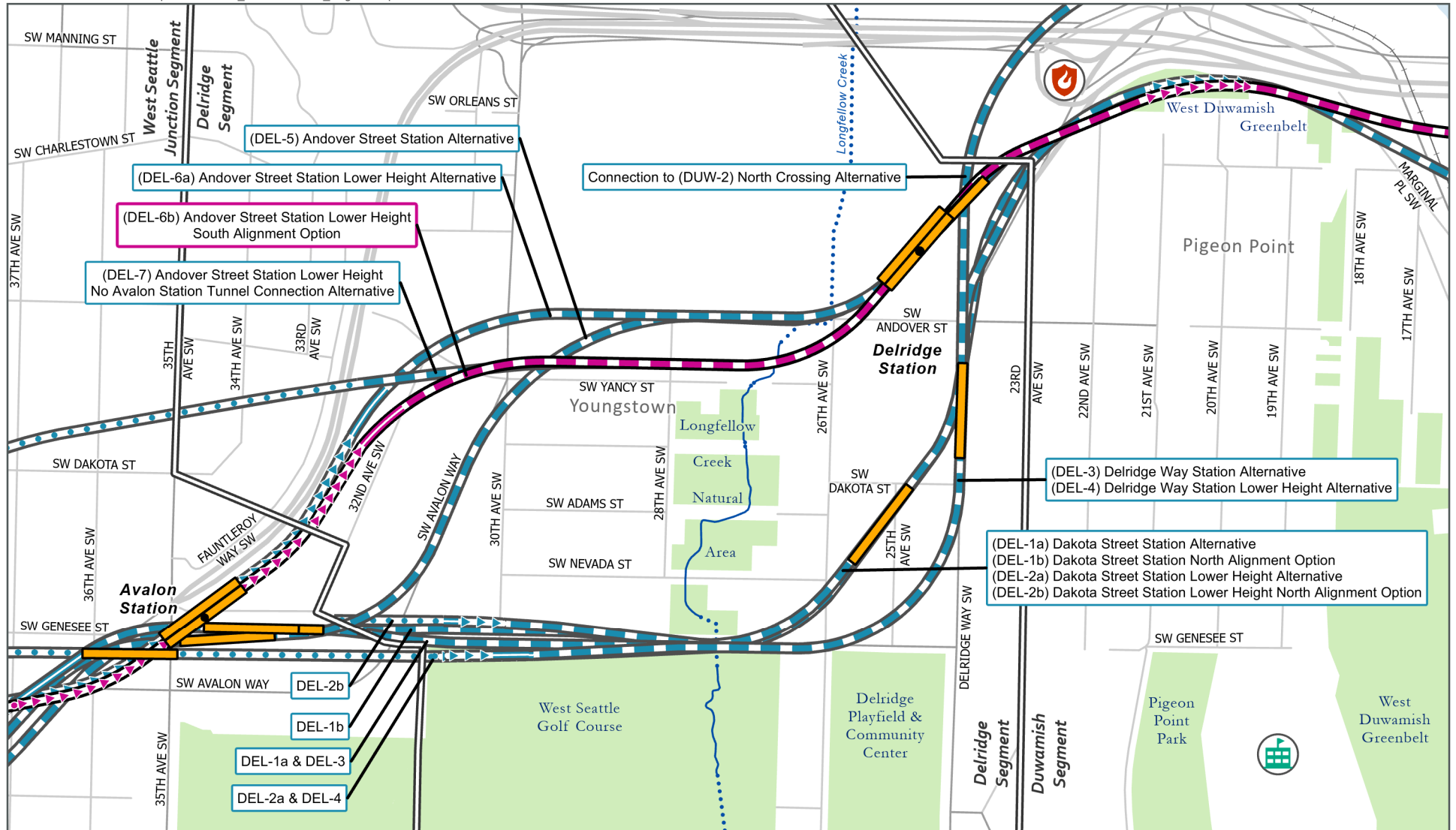


FIGURE 4.14-2
Public Services
Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

- Segment Line
- Railroad
- Stream
- Piped Stream
- Park



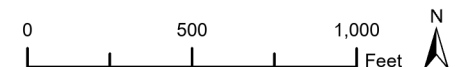
Fire Station

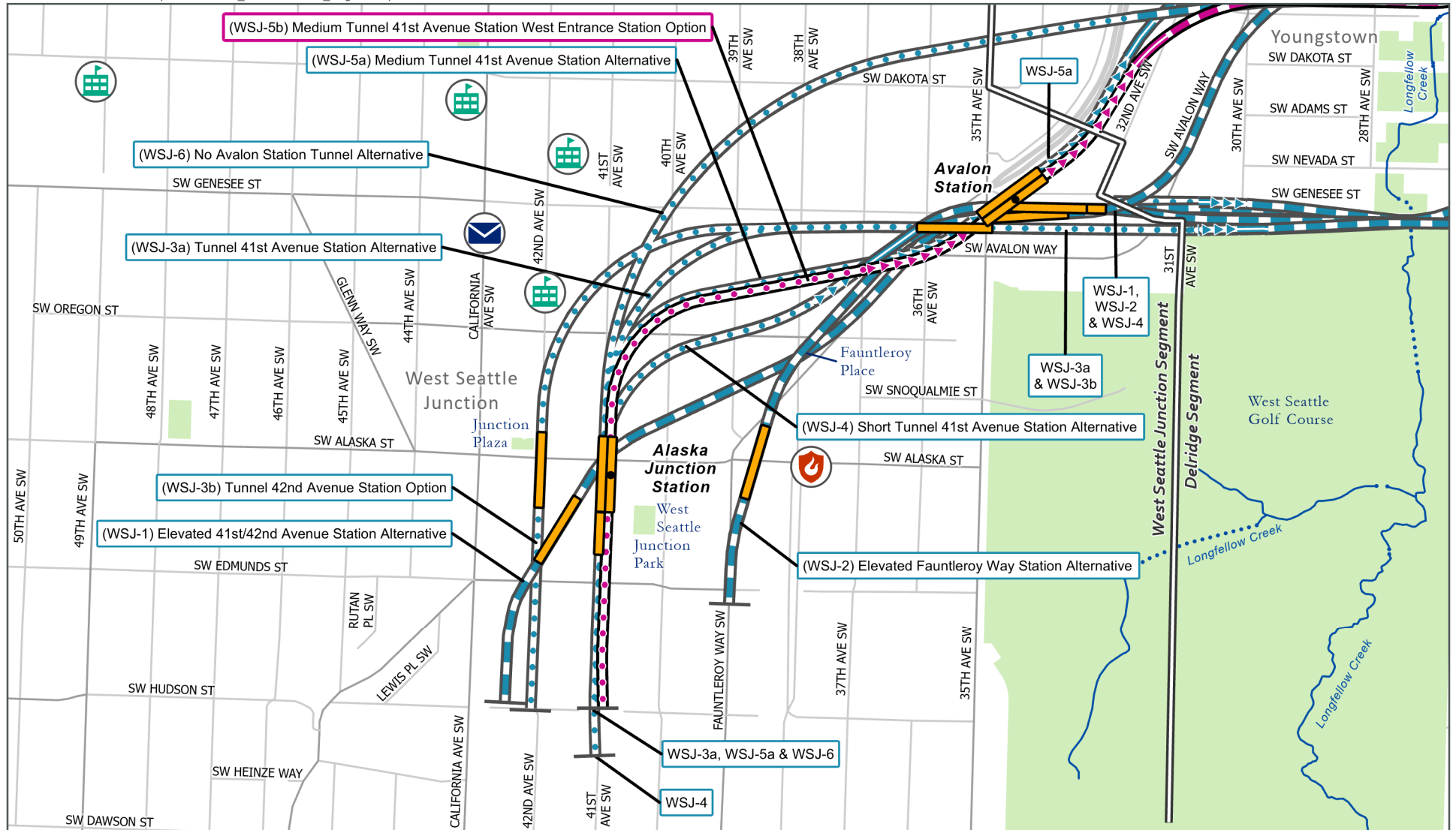


School and Facilities

FIGURE 4.14-3
Public Services
Delridge Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

- Segment Line
- Stream
- Piped Stream
- Park



Fire Station



Post Office

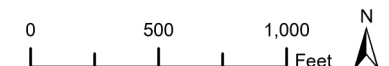


School and Facilities

Note: Fairmount Park Elementary School is located within the West Seattle Junction Segment but outside of the map extent.

FIGURE 4.14-4
Public Services
West Seattle Junction Segment

West Seattle Link Extension



4.14.2.1 Fire and Emergency Medical Services

The Seattle Fire Department provides fire and emergency medical services in the study area. In 2021, the Seattle Fire Department's average response time from dispatch to arrival was as follows (City of Seattle 2022):

- 75 percent of the time arrived within 4 minutes for the first-arriving engine for fires and hazardous materials responses (standard is 90 percent)
- 91 percent of the time arrived within 8 minutes for full alarm assignment (15 firefighters) for fires and hazardous materials responses (standard is 90 percent)
- 73 percent of the time arrived within 4 minutes for basic life support services (standard is 90 percent)
- 81 percent of the time arrived within 8 minutes for advanced life support services (standard is 90 percent)

Fire Station 14 in the Duwamish Segment houses Rescue 1, the technical rescue team (tunnel rescue, structural collapse, trench/cave-in rescue, dive rescue, and similar) and their equipment. Fire Station 36 in the Delridge neighborhood houses Marine 1, a land-based team that fights fires on or near the water, and contains specialty equipment for this team. All other fire stations serve their surrounding areas.

The Seattle Fire Department Commissary and Utility Shop is located at 3601 2nd Avenue South. The facility houses the Seattle Fire Department supplies and is where the majority of repairs and replacements of fire department equipment is conducted.

4.14.2.2 Police Services

The Seattle Police Department provides law enforcement, public safety services, and emergency response to 911 calls throughout Seattle. The project is within the South and Southwest Seattle Police Department precincts. The King County Metro Transit (Metro) Police and King County Sheriff provide law enforcement services for Sound Transit. Sound Transit operates its own transit police composed of contracted security personnel, law enforcement officers, or a combination of both at its facilities. See Appendix L4.14, Public Services, Safety, and Security, for information on Seattle Police Department's response times and crime data for the city of Seattle, the state of Washington, and the areas near existing Link light rail stations.

Seattle Police Harbor Patrol is on the north shore of Lake Union. While the headquarters and boat docks are outside the study area, Harbor Patrol operates in waterways within the study area, including Elliott Bay and the Duwamish Waterway, and provides marine law enforcement, rescue, fire response, and assistance.

4.14.2.3 Solid Waste and Recycling Collection Services

Waste Management is currently contracted to provide solid waste, yard waste, and recycling collection within the study area. Nonhazardous solid waste collected in the study area is taken to the South Transfer Station at 130 South Kenyon Street and then to a landfill outside of King County. Collection vehicles travel throughout the roadways in the study area.

4.14.2.4 Schools

The study area is served by the Seattle Public Schools (see Table 4.14-1). There are also three private schools in the study area, which are concentrated around the West Seattle Junction. Collectively, the public schools in the project study area served approximately 1,413 students in the 2022 to 2023 school year. The John Stanford Center for Educational Excellence is the main administrative building for Seattle Public Schools and is also in the study area. Many students attending public schools use school bus transportation. Middle school and high school students also use Metro buses through an ORCA card program. Seattle Public Schools provide school walking and bicycling routes, with designated school crosswalks.

4.14.2.5 Other Government Facilities

United States Postal Service facilities and an administrative school building for Seattle Public Schools are in the study area (see Table 4.14-1). There are two United States Postal Service facilities in the SODO Segment and one in the West Seattle Junction Segment. The United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office in SODO is on an about 4.6-acre site. The site includes an approximately 4,000-square-foot warehouse, an approximately 4,000-square-foot office building, an approximately 345-stall parking garage, and surface parking. The facility provides customer service similar to other post offices, and also includes mail sorting for the City, maintenance, and a parking garage for mail delivery trucks and partner delivery trucks.

City of Seattle central warehouse for surplus properties is in the Duwamish Segment at 3807 2nd Avenue South. This warehouse is used by the City for storage. A Washington State Department of Social and Health Services secure community transition facility is also located in the Duwamish Segment.

4.14.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would have no direct impacts on public services in the area. However, continued population and employment growth in the study area would increase public service demands. As described in Chapter 4, Arterial and Local Street Operations, of Appendix N.1, Transportation Technical Report, traffic congestion would increase with the No Build Alternative, which would therefore increase emergency service response times.

4.14.4 Environmental Impacts of the Build Alternatives during Operation

4.14.4.1 Impacts Common to All Alternatives

4.14.4.1.1 Fire and Emergency Medical Services

Sound Transit's safety design criteria are used to avoid conflicts with vehicular, bicycle, and pedestrian traffic. Sound Transit would prepare a safety and security management plan for the project. The management plan would establish the safety and security measures required throughout the project lifecycle (design, construction, and operation).

The project would operate within its own exclusive grade-separated right-of-way, and light rail operations would not directly affect fire and emergency medical services routes or response times on public roadways. Increased congestion at station areas, particularly those that are close to fire stations, could affect response times but traffic impacts would be mitigated. Section 3.5, Affected Environment and Impacts during Operation-Arterial and Local Street Operations, identifies locations where traffic congestion could occur and potential mitigation to improve traffic conditions.

In accordance with the City of Seattle's fire code, Sound Transit would maintain access to fire hydrants, fire lanes, and fire response access points adjacent to the project where possible. Where it is not possible, Sound Transit would coordinate with the Seattle Fire Department to redesign access. Design for elevated and tunnel emergency access and evaluation would conform with state and local fire codes and with National Fire Protection Association 130, Standard for Fixed Guideway Transit and Passenger Rail Systems (2020). Access to trains could generally be provided by trains on the adjacent track. When a second train is not practical, Sound Transit would follow the local and state fire codes and National Fire Protection Association 130. Emergency access to tunnels would be maintained for prompt response times and for the safety of passengers and emergency service providers. Tunnel stations would include several safety design features to address fire prevention, ventilation and fire protection, and evacuation, such as automatic fire suppression equipment; emergency ventilation shafts, fans, and dampers; and emergency lighting, communications equipment, and exit signage. Emergency services providers and Sound Transit personnel would be trained to respond to emergencies on elevated guideways, tunnels, and in retained cut profiles. Provisions for emergency access would be included at the stations.

Sound Transit's Fire/Life Safety Committee would review safety requirements and develop solutions regarding access to the light rail system, emergency routes, water and fire hydrant needs, training, costs, and other design features; specific emergency procedures and necessary equipment would be determined during final design.

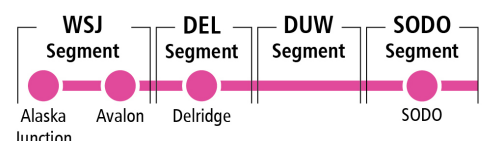
4.14.4.1.2 Police

Police vehicles are not anticipated to experience increased response times. Police could have difficulty responding to calls at elevated or tunneled sections of guideway. Sound Transit would coordinate with local emergency service providers to provide additional planning for these situations; however, trains would generally proceed to the nearest station for a police response because emergency access is incorporated in the design of all stations. Sound Transit would also coordinate with emergency responders to have a plan for unanticipated emergencies.

All Build Alternatives would require additional Sound Transit transit police and security staff to monitor stations, entryways, and adjacent areas to protect people and property. Sound Transit's transit police would remain at some stations throughout the day and patrol other facilities and respond to incidents in coordination with local law enforcement.

Previous studies have shown that crime at transit stations generally mirrors crime levels in the surrounding area (Moudon et al. 2018, Billings et al. 2011, City of Seattle 1999). Over 90 percent of crimes in transit facilities relate to quality of life crimes (e.g., vandalism, drunkenness, and panhandling) and property crimes. An increase in the number of people in the area from light rail and implementation of security measures could deter crime along the project corridor.

Design of access points and the location of facilities could influence crime if stations provide places where crimes can go unseen by others. The *Sound Transit Agency Safety Plan* (Sound Transit 2020) requires a threat and vulnerability assessment for all new transit facilities during the preliminary design phase. For this assessment, Sound Transit would review existing crime



data in new station locations and interview law enforcement to identify possible security threats and risks. Stations would be designed using the principles of Crime Prevention Through Environmental Design to include numerous features such as abundant light, open access, and visibility to address security issues. Crime Prevention Through Environmental Design measures would also minimize impacts by controlling passenger movements with specific traffic flow patterns and installing closed-circuit television cameras, emergency telephones, controlled exits, and sealed fare boxes. Sound Transit would continue consultation with police and public safety services throughout the design process to minimize risk.

Sound Transit would build upon existing safety and security management plans from other Link projects and apply lessons learned from these projects to meet the latest Federal Transit Administration guidelines on safety and security. Sound Transit would work with the United States Department of Homeland Security, Federal Transit Administration, emergency service providers, and local law-enforcement agencies to create a project-specific safety and security management plan that would meet all federal, state, and local requirements and develop strategies to prevent and respond to potential threats to public safety.

4.14.4.1.3 Solid Waste

Operation of the project would not impact solid waste collection and disposal within the study area. Sound Transit would not acquire any property currently used by recycling, composting, and solid waste facilities or operating bases. No collection routes would be negatively affected or experience delay or altered services due to minor changes in existing roadways. In addition, the project would not increase demand for waste services.

4.14.4.1.4 Schools

Because the project would be entirely grade-separated, it would not affect school bus/van travel through residential neighborhoods. In areas where new stations are within walking distance to schools, students and staff could experience improved travel times. For information on overall travel times, see Section 3.4, Affected Environment and Impacts during Operation - Transit.

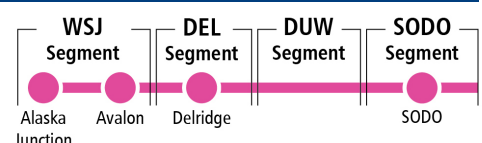
4.14.4.1.5 Other Government Facilities

Sound Transit would coordinate with United States Postal Service officials to ensure that changes in existing roadways resulting from project operations would not negatively affect postal routes or create delivery delays. Because the project would be entirely grade-separated, conflicts with United States Postal Service routes are not anticipated.

4.14.4.2 SODO Segment

Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would displace bus use of the SODO Busway. Impacts to the busway could create slightly longer travel times for staff and students at schools served by these routes who rely on Metro bus services to commute. These alternatives include an overpass on South Lander Street, which would remove the at-grade crossing of the 1 Line that creates a traffic delay for all vehicles on this road when trains pass. The new overpass would benefit emergency response and travel times since it would remove this traffic delay. Alternative SODO-2 would keep bus use of the SODO Busway but would not include the South Lander Street overpass.

All SODO alternatives are adjacent to the United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office at 4th Avenue South and South Lander Street. Preferred Option SODO-1c and Alternative SODO-1a would avoid permanent impacts (i.e.,



operation and maintenance) to the United States Postal Service facility. Accordingly, these station configurations would not require relocation of the facility. As station design advances on Preferred Option SODO-1c, station elements may be shifted to enhance station access. However, Preferred Option SODO-1c would be designed to avoid acquisition of the United States Postal Service facility.

For Preferred Option SODO-1c and Alternative SODO-1a, the existing driveway at the United States Postal Service Carrier Annex and Distribution Center/Terminal Post Office's southern access point would be connected under the new South Lander Street overpass to 4th Avenue South, which then provides access to South Lander Street. Access to the United States Postal Service facility is not anticipated to be disrupted during operations, as South Lander Street would serve as the main access for bicyclists and pedestrians and bus drop-off would be provided on 6th Avenue South.

Both Option SODO-1b and Alternative SODO-2 would displace the United States Postal Service facility. Relocation of the facility could be challenging due to its size, functions, and the service area that it would need to be within. Impacts of relocating the United States Postal Service facility are yet undefined, and should an alternative that triggers relocation of the facility move forward, additional environmental review will be conducted to evaluate and disclose impacts of relocating the facility.

4.14.4.3 Duwamish Segment

Preferred Alternative DUW-1a and Option DUW-1b would acquire a portion of Fire Station 36 when connecting to Alternative DEL-3 or Alternative DEL-4 in the Delridge Segment. If Fire Station 36 needs to be relocated, Sound Transit would work closely with fire department officials to identify a suitable property within the surrounding area and ensure operations continue with minimal impacts during relocation.

All of the Duwamish Segment alternatives would have a moderate noise impact on Seattle Fire Department Fire Station 14 on 4th Avenue South, which could be mitigated with a sound wall (see Section 4.7, Noise and Vibration). Preferred Alternative DUW-1a and Alternative DUW-2 would acquire part of the Fire Station 14 property that includes parking, a transformer, and electric vehicle parking but is not expected to require relocation of the station and no long-term effects are expected.

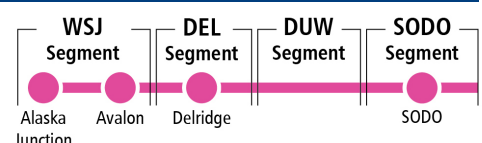
Preferred Alternative DUW-1a and Option DUW-1b would acquire a portion of the Seattle Fire Department Commissary and Utility Shop located on 3601 2nd Avenue South and require relocation. Sound Transit would work closely with fire department officials to identify a suitable property within the surrounding area and ensure operations continue with minimal impacts during relocation. Alternative DUW-2 would displace a Department of Social and Health Services secure community transition facility, which has specific siting requirements and would be difficult to relocate.

4.14.4.4 Delridge Segment

Alternatives in this segment would not cause additional impacts to public services, safety, and security other than those discussed in Section 4.14.4.1, Impacts Common to All Alternatives.

4.14.4.5 West Seattle Junction Segment

Alternatives in this segment would not cause additional impacts to public services, safety, and security other than those discussed in Section 4.14.4.1.



4.14.5 Environmental Impacts of the Build Alternatives during Construction

4.14.5.1 Impacts Common to All Build Alternatives

Construction of any project alternative would require temporary lane and roadway closures, shifts in roadway alignments, and detours associated with the project, which could result in increased congestion along adjacent roadways. Sound Transit also requires contractors to fence off all construction sites and to provide site security during construction. Sound Transit secures purchased properties as soon as possible and expedites the demolition of buildings on these properties to minimize potential for safety hazards and illegal activity. Attachment N.1E, Construction-Related Roadway Modifications, of Appendix N.1, Transportation Technical Report, includes all proposed roadway closures by alternative. Prior to construction, Sound Transit would coordinate with public service providers to establish alternate routes and ensure required access during established time periods. Traffic control plans would be reviewed and approved by affected agencies before being implemented to minimize increases in travel and response times and to avoid interference with emergency response, collection of solid waste and recyclables, or transportation of students. Through continued coordination and communication with local agencies, Sound Transit anticipates that there would be minimal impact to public services, safety, and security during construction.

4.14.5.1.1 Fire and Emergency Medical Services

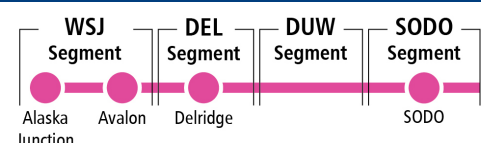
Temporary closures could affect access and response times for fire and emergency medical vehicles. Throughout the construction period, Sound Transit would maintain access and egress for fire and emergency medical vehicles to minimize impacts on response and travel times within project segments. Sound Transit would also develop contingency plans with emergency service providers to reduce response and travel times and ensure access to hydrants and water lines during construction of the project. City of Seattle fire and emergency medical providers would respond to potential emergencies at the construction sites.

4.14.5.1.2 Police

Temporary closures could affect access and response times for police vehicles. Additional police may be required to direct traffic in areas where project construction requires alterations to existing roadways, especially in areas where road closures would occur. Sound Transit would coordinate with the City of Seattle and Washington State Patrol to provide adequate police services. Traffic congestion and new traffic patterns resulting from construction could temporarily increase the number of traffic incidents and therefore increase demand on existing police resources. New traffic patterns and circulation changes would be coordinated with local police and emergency service providers prior to their establishment. Seattle Police Department would respond to potential emergencies at the construction sites.

4.14.5.1.3 Solid Waste

As with other public service providers, waste and recycling vehicles could experience delays along collection routes close to the project. Sound Transit would maintain access and egress for solid waste and recycling collection vehicles to minimize impacts on collection. Sound Transit would work with collection companies to identify if any access points are required to be closed and develop alternative access points, collection locations, or other needed measures. Project construction would likely increase the amount of debris and refuse; however, there are several waste facilities in the region that could accept this waste with no impacts to solid waste operations.



4.14.5.1.4 Schools

The project Build Alternatives are not in close proximity to schools and therefore are unlikely to result in any construction-related impacts, such as noise and dust, on students or school staff. Full and partial road closures during construction could result in the temporary rerouting of school and/or transit buses, which could affect student and staff travel times. However, Sound Transit would work with local school bus operators and other transit authorities to identify relocated bus stops near those temporarily closed stops. See Section 3.11, Construction Impacts, for further discussion of impacts to buses during construction.

4.14.5.1.5 Other Government Facilities

United States Postal Service vehicles could experience delays during construction; however, Sound Transit would ensure that access and egress for such vehicles would be maintained and closure of an access point would be remedied by an alternate access developed in coordination with local post offices.

4.14.5.2 SODO Segment

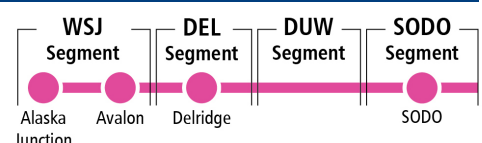
Preferred Option SODO-1c, Alternative SODO-1a, and Option SODO-1b would close South Lander Street between 4th Avenue South and 6th Avenue South for construction of the South Lander Street overpass. There would also be a partial closure of the 4th Avenue South and South Lander Street intersection related to the overpass construction. This could increase emergency response and travel times for vehicles that typically use this road, especially at the nearby Seattle Police Support Facility, but detours would be coordinated with service providers. These closures would also result in temporary detour routes and potential traffic delays for people accessing the John Stanford Center for Educational Excellence. Access to this facility would remain open during construction. Temporary closure of South Lander Street would be limited to nights and weekends with Alternative SODO-2.

Preferred Option SODO-1c and Alternative SODO-1a would not occupy property owned by the United States Postal Service and would not require replacement of the Carrier Annex and Distribution Center/Terminal Post Office. During construction of the South Lander Street overpass, access from the United States Postal Service facility would be maintained at their southern access point, except for short durations over nights and weekends. However, pedestrian access to the United States Postal Service garage from South Lander Street would be closed during construction of this roadway overpass. The majority of the United States Postal Service access road interruptions are anticipated to occur over a 1.5-year period.

The north entrance to the United States Postal Service facility from 4th Avenue South would remain open. Sound Transit would coordinate with United States Postal Service officials to minimize construction impacts to United States Postal Service operations.

All of the alternatives would also close the SODO Busway during construction. After construction, service would be restored on the SODO Busway for Alternative SODO-2. While Sound Transit would work with Metro and the Seattle Department of Transportation to find alternate bus routes, impacts to the busway could create slightly longer travel times for staff and students at schools served by these routes who rely on Metro bus services to commute.

With all alternatives, utility relocations could result in temporary roadway closures that could affect Metro's access to their Atlantic/Central Bus Base. However, it is accessible on all four sides, and construction would be coordinated to maintain access at one or more points.



4.14.5.3 Duwamish Segment

The Southwest Klickitat Way bridge allows access to the Port of Seattle Harbor Marina Corporate Center at Terminal 102 when the Spokane Street Bridge is inaccessible from freight train movement on the existing BNSF Railway line. The Preferred Alternative DUW-1a and Option DUW-1b would require construction close to the Southwest Klickitat Way bridge, but the bridge would remain open to maintain emergency access.

Fire Station 36 would need to be temporarily relocated during construction with Preferred Alternative DUW-1a and Option DUW-1b if connecting to Alternative DEL-3 or Alternative DEL-4 in the Delridge Segment. Preferred Alternative DUW-1a and Alternative DUW-2 would require temporary relocation of some uses at Fire Station 14, including parking for electric fleet vehicles and training facilities that currently use the eastern portion of this fire station property. For necessary relocations, Sound Transit would work closely with fire department officials to identify a suitable property within the surrounding area and ensure operations continue with minimal impacts during relocation. Contingency response routes would be developed to identify alternate response pathways, as necessary.

Response times of Seattle Police Harbor Patrol to the Duwamish Waterway could be impacted during construction during temporary closures of the navigation channel and from increased waterway congestion (refer to Section 3.9, Affected Environment and Impacts during Operation – Navigation for additional information). Sound Transit would coordinate with Seattle Police Harbor Patrol prior to and throughout construction at key milestones or phases where navigation conditions could change.

4.14.5.4 Delridge Segment

The Dakota Street station alternatives and options (Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b) and the Delridge Way station alternatives (Alternatives DEL-3 and DEL-4) would result in partial temporary closures to Delridge Way Southwest, which is used for access to Pathfinder Elementary K-8 school, and the partial closure could affect student and staff travel times. See Section 3.11, Construction Impacts, for further discussion of impacts on buses and traffic during construction.

4.14.5.5 West Seattle Junction Segment

Preferred Option WSJ-5b would result in the temporary full closure of 35th Ave Southwest between Southwest Avalon Way and Fauntleroy Way Southwest, which could affect response times. The temporary partial closure of Fauntleroy Way Southwest between the West Seattle Bridge and Southwest Avalon Way with Preferred Option WSJ-5b, Option WSJ-3b; and Alternatives WSJ-3a, WSJ-4, WSJ-5a, and WSJ-6 could also affect emergency response times. The alternatives elevated over Fauntleroy Way Southwest (Alternatives WSJ-1, WSJ-2, and WSJ-4) would fully close this section of Fauntleroy Way Southwest during nights and weekends, and therefore could affect responses times during this time period. The full closure of Southwest Alaska Street between Fauntleroy Way Southwest and 38th Avenue Southwest for construction of Alternative WSJ-2 could affect response times from Fire Station 32. Contingency response routes would be developed to identify alternate response pathways, as necessary, but access to and from the fire station would need to be maintained at all times. The alternatives in this segment would have no further impacts to public services, safety, and security.

4.14.6 Indirect Impacts of the Build Alternatives

The project would not lead to unplanned or induced increase in the population of Seattle or King County and would be unlikely to cause an increased demand for public services beyond those already planned. There could be a redistribution of some populations and employment growth to areas adjacent to new stations, which is consistent with City and regional plans. For more information on changes to populations and areas surrounding stations, see Section 4.2, Land Use.

4.14.7 Mitigation Measures

Sound Transit's design, construction, and operation practices incorporated into the project include measures to address safety, security, and emergency access. Sound Transit will follow Link light rail's design standards that address emergency, safety, and security. During final design, Sound Transit will work with affected agencies to develop emergency response and safety and security plans and programs. Finally, Sound Transit will operate the light rail in accordance with Link light rail's existing approaches to ensure safety and security throughout the system. The discussion below identifies mitigation measures for the project.

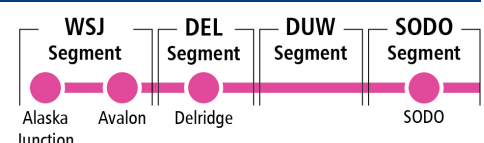
For Option SODO-1b and Alternative SODO-2, Sound Transit would identify a replacement property for the Carrier Annex and Distribution Center/Terminal Post Office at 4th Avenue South and South Lander Street. Sound Transit would be responsible for future environmental review that further analyzes potential impacts of relocating the facility and the design and construction of replacement parking or a replacement facility. The replacement parking or facility would meet siting criteria and requirements that would be identified by the United States Postal Service. Relocation would occur in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 and the Sound Transit *Real Property Acquisition and Relocation Policy, Procedures and Guidelines* (Sound Transit 2017). Postal parking or operations would be relocated prior to the project impacting the existing facility.

If Preferred Alternative DUW-1a or Option DUW-1b would require permanent relocation of Fire Station 36 or the Seattle Fire Department Commissary and Utility Shop, Sound Transit would work closely with fire department officials to identify a suitable property within the surrounding area and ensure operations continue with minimal impacts during relocation. Permanent relocation of Fire Station 36 and the Seattle Fire Department Commissary and Utility Shop would occur in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 and the Sound Transit *Real Property Acquisition and Relocation Policy, Procedures and Guidelines* (Sound Transit 2017).

Sound Transit would coordinate with the Seattle Fire Department on temporary relocation of Fire Station 36, if needed, with Preferred Alternative DUW-1a or Option DUW-1b. Sound Transit would also coordinate with the Seattle Fire Department regarding temporary relocation of parking and the transformer at Fire Station 14 during construction for Preferred Alternative DUW-1a and Alternative DUW-2.

Sound Transit would coordinate with public service providers before and during construction to maintain reliable emergency access and alternative plans or routes to minimize delays in response times. This would include coordination with Seattle Police Harbor Patrol prior to and throughout construction at key milestones or phases where navigation conditions could change.

Sound Transit would also coordinate with solid waste and recycling companies and schools should rerouting of collection or school bus routes need to occur.



4.15 Utilities

4.15.1 Introduction to Resource and Regulatory Requirements

This section discusses potential impacts to utilities from the West Seattle Link Extension Project (the project). Existing utilities in the study area include electricity, water, wastewater management, stormwater management, natural gas, petroleum, and telecommunications. Utilities within the project corridor are regulated by policies and procedures for Seattle Public Utilities, Seattle City Light, and King County, as well as by Washington Administrative Code Section 468-34 and Washington State Department of Transportation policies within the department's right-of-way.

4.15.2 Affected Environment

The study area for utilities is the area within 100 feet of the track alignment, stations, and associated facilities (operation and construction). Existing and planned utilities considered in this analysis include water, sanitary sewer, storm sewer, electrical power, natural gas, telephone and communications infrastructure, and petroleum product pipelines. Table 4.15-1 summarizes the existing utility providers in the study area.

Table 4.15-1. Summary of Existing Utility Providers in the Study Area

Utility	Provider
Electricity	<ul style="list-style-type: none">• Seattle City Light
Natural gas	<ul style="list-style-type: none">• Puget Sound Energy
Water	<ul style="list-style-type: none">• Seattle Public Utilities
Stormwater Management	<ul style="list-style-type: none">• Port of Seattle• Seattle Public Utilities• Washington State Department of Transportation
Wastewater Management	<ul style="list-style-type: none">• King County Wastewater Treatment Division• Seattle Public Utilities
Petroleum	<ul style="list-style-type: none">• Olympic Pipeline
Telecommunications	<ul style="list-style-type: none">• Lumen Technologies• Seattle Information Technology• Mobilite (Sound Transit systems)• Verizon Communications Inc.• Comcast Corporation• T-Mobile• WaveDivision Holdings LLC• T-Mobile• Atlas Networks• Earthlink• AT&T Inc• Crown Castle Fiber• Zayo Group
Steam	<ul style="list-style-type: none">• Enwave

Sources: Federal Communications Commission 2018, City of Seattle 2019.

Water and high-pressure gas lines are typically 3 to 6 feet underground, while sewer lines are usually 6 or more feet underground. Some smaller utilities, such as fiber optic cables and telephone lines, are buried less than 3 feet underground. Water, sewer, and storm drain pipelines typically run parallel beneath streets, while fiber optic cables, telephone lines, and power lines often run below sidewalks. Seattle Public Utilities owns and maintains the Southwest Genesee Street Detention Dam, a flood control and stormwater detention dam on Longfellow Creek on the south side of Southwest Genesee Street. See Section 4.8, Water Resources, for additional information on this dam and potential impacts.

Information on planned utility upgrades and new projects in the study area was gathered from the City of Seattle Capital Improvement Program (City of Seattle 2023) and Regional Wastewater Services Plan (King County 2018) and is summarized in Appendix L4.15, Utilities. Sound Transit would continue to coordinate with King County and appropriate departments within the City of Seattle through final design on any conflicts between the West Seattle Link Extension and planned utility upgrades and new projects.

4.15.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would not impact utilities in the project study area.

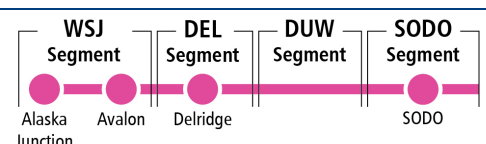
4.15.4 Environmental Impacts of the Build Alternatives during Operation

The project would increase electricity usage in the study area through the operation of light rail trains using direct-current power taken from 26-kilovolt electric distribution facilities, as well as through lighting installed at stations, safety lighting along the alignment, and other light rail facilities. Seattle City Light would provide the electricity to operate the project's light rail vehicles, stations, and facilities. Section 4.10, Energy Impacts, describes the Build Alternatives' energy consumption and identifies energy-related impacts. Seattle City Light has the capacity to supply the electricity needed for the light rail extension, and Sound Transit will continue to coordinate with Seattle City Light to determine if improvements to any Seattle City Light infrastructure would be necessary.

Traction power substations placed at or near light rail stations would provide power to the overhead catenary system that would power the light rail vehicles. The substations would be powered by 26-kilovolt electric lines connecting to the nearest power pole. In some cases, additional distribution lines might be needed to serve individual substations. Stray electrical current from a light rail system's traction power electrical system could cause damage and corrosion to nearby underground utilities if not properly controlled. Section 4.13, Electromagnetic Fields, provides additional discussion of potential stray current effects on utilities.

Major service disruptions to utility customers during light rail repair and maintenance operations are unlikely and would be limited if they occur. Sound Transit would design the light rail to maintain access to utilities for maintenance and repair. In some cases, that would require Sound Transit to relocate sewer maintenance holes, pipes, vaults, or other access points. Sound Transit would work with utility providers to maintain required access to these utilities and relocated sewer maintenance holes and vaults, utility mains, fire hydrants, and other features.

Sound Transit would integrate efficient operating practices at existing and new facilities and use equipment to reduce energy and water demand and to recycle water. Sound Transit's sustainability requirements are described further in Section 4.10. Implementing these and other sustainable practices would reduce consumption and demand on utilities.



4.15.5 Environmental Impacts of the Build Alternatives during Construction

4.15.5.1 Impacts Common to All Alternatives

Sound Transit inventoried major utilities in the study area to identify potential conflicts that might require utility relocation and to understand the degree of utility impacts. Major utilities were defined as follows:

- Water mains that are 16 inches in diameter or greater
- Sanitary sewer force mains and gravity sewers that are 24 inches in diameter or greater
- Stormwater drains that are 36 inches in diameter or greater and drainage ponds
- Electrical transmission lines that are 115-kilovolt or greater
- High-pressure gas mains
- Intermediate-pressure gas lines that are 8 inches in diameter or greater
- Telephone and fiber optic duct banks with three or more conduits
- Petroleum product pipelines
- Steam pipelines that are 12 inches in diameter (carrier pipe diameter) or greater

Sound Transit did not evaluate or inventory impacts to minor utilities but will evaluate and inventory them as the project design progresses from preliminary to final design. Additional impacts would occur from minor utility relocations and would be coordinated with utility providers and the City of Seattle.

The purpose of identifying these conflicts is to plan for relocating the utilities during construction to remove possible conflicts, prevent disturbing the route during future maintenance of overhead or underground utilities, ensure that the light rail infrastructure is separated from the utility by the minimum distance required, and account for relocation costs.

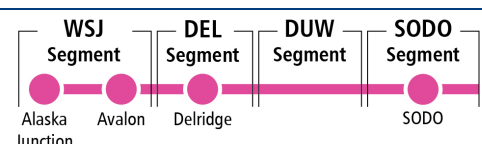
Potential impacts during construction may require the following:

- Relocating utility poles supporting overhead lines
- Raising overhead power lines to heights that do not interfere with guideway or catenary system
- Constructing new distribution lines to provide power to substations
- Relocating underground utilities
- Inspecting, repairing, and casing underground utilities at guideway track crossings
- Service disruptions

There also may be potential settling of ground around utilities, as described in Section 4.11, Geology and Soils.

Construction could affect access to underground utility providers, and in some cases, utilities would need to be relocated in consultation with the utility provider and the City of Seattle. Sound Transit would coordinate with utility providers to establish replacement procedures and facility design standards, as applicable.

Construction could lead to impacts such as displacement, relocation, or interrupted service to utilities. The degree of impact would depend on depth, material composition, excavation limits, construction methods, project alignment, and other factors. Within the study area, most underground utilities are within about 6 feet of the surface and within 35 feet of the centerline of each alternative. To allow for excavation and to minimize load impacts from the weight of light rail vehicles, underground utilities would be relocated or cased for protection. Utilities within public road rights-of-way would generally be moved to a different location within the right-of-way.



In some cases, utilities may need to be relocated to adjacent rights-of-way and/or require additional easements from affected private properties.

Where feasible, columns for elevated guideways would avoid impacts on underground utilities. Elevated guideways might also require that existing power lines be relocated or elevated over the overhead catenary system. Bored tunnel profiles would generally avoid utility lines, except at stations, where Sound Transit would use cut-and-cover construction. Potential settlement of utilities is described in Section 4.11, Geology and Soils.

Temporary connections to utility customers would typically be established before relocations to minimize service disruptions. However, inadvertent damage to underground utilities could occur if utility locations are uncertain or misidentified. Sound Transit would work with utility companies to identify damaged utility lines or connections and restore service as soon as possible. Efforts to minimize impacts would also include potholing and pre-construction surveys to identify utility locations, as well as outreach to inform customers of potential service disruptions.

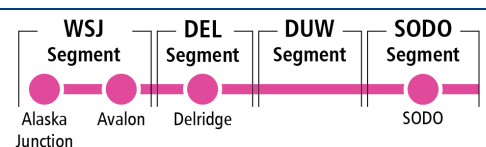
The following subsections summarize the notable utility conflicts in each segment. Appendix L4.15 summarizes all major conflicts for each Build Alternative. Where major utilities would be directly under or above the project limits, the approximate length of the relocation is provided. Where major utilities would intersect with an alternative, the number of crossings is identified because the length of the relocation has not yet been determined. Sound Transit would determine relocation lengths during final design.

4.15.5.2 SODO Segment

All SODO Segment Build Alternatives would relocate an overhead 230-kilovolt power line from the SODO Busway. Based on continuing coordination with Seattle City Light, it is anticipated that the line will be moved to 6th Avenue South between South Massachusetts Street and the substation south of South Spokane Street, although other locations could be considered during final design. This relocation would require rebuilding portions of 6th Avenue South, but existing underground utilities would be protected in place. All Build Alternatives would relocate a 24-inch-diameter storm drain along 5th Avenue South. All Build Alternatives would also affect a water line on South Lander Street, but it would be cased to accommodate light rail weight.

4.15.5.3 Duwamish Segment

All Build Alternatives in the Duwamish Segment would relocate gas lines and fiber optic lines for guideway columns at the Duwamish Waterway (also known as the Duwamish River). All Build Alternatives would also relocate an overhead 230-kilovolt power line from 5th Avenue South to 6th Avenue South and raise an overhead 230-kilovolt power line along 2nd Avenue South. Option DUW-1b would place guideway columns on Duwamish Avenue South near a 96-inch-diameter pressurized sewer force main, which would need to be relocated. Similarly, Alternative DUW-2 would require relocation of a 96-inch-diameter combined sewer line along West Marginal Way due to placement of guideway columns. Alternative DUW-2 is the only alternative that would require the relocation of an approximately 100-foot-long portion of Olympic Pipeline's oil pipeline on Harbor Island. All alternatives would relocate a 24-inch-diameter storm drain along a portion of the SODO Busway within the Duwamish Segment. Option DUW-1b would relocate storm drain outfalls at the Duwamish Waterway. Portions of sewer lines at West Marginal Way Southwest would need to be replaced under Alternative DUW-2.



4.15.5.4 Delridge Segment

All Build Alternatives in the Delridge Segment have gas lines that would conflict with proposed guideway columns. All alternatives except Alternative DEL-2a and Option DEL-2b would require relocation of these gas lines. For Alternative DEL-2a and Option DEL-2b, these gas lines could be protected in place. Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would conflict with a gas line along Southwest Andover Street, while Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would conflict with a gas line along Delridge Way Southwest.

All alternatives except Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b would relocate a fiber optic telecommunications line at 23rd Avenue Southwest. A fiber optic telecommunications line on Southwest Genesee Street would need to be relocated for Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, Alternative DEL-4, and Alternative DEL-5. A sewer line at 26th Avenue Southwest would be relocated with Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, Alternative DEL-4, Alternative DEL-5, and Alternative DEL-6a, and a sewer line at 32nd Avenue Southwest would be relocated with Preferred Option DEL-6b and Alternative DEL-7. Preferred Option DEL-6b and Alternative DEL-7 would relocate portions of overhead power lines at 32nd Avenue Southwest and Southwest Andover Street. None of the Build Alternatives in this segment would conflict with any major water lines.

4.15.5.5 West Seattle Junction Segment

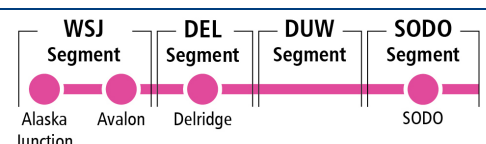
All alternatives except Alternative WSJ-6 would require the relocation of existing gas lines and fiber optic lines for guideway columns and Avalon Station. All Build Alternatives in the West Seattle Junction Segment except Alternative WSJ-2 and Option WSJ-3b would require the relocation of sanitary sewer lines at Southwest Alaska Street and 41st Avenue Southwest. None of the alternatives would affect major power utilities.

4.15.6 Indirect Impacts of the Build Alternatives

For the West Seattle Link Extension, indirect impacts would be the same for all Build Alternatives. The improved transit access would support planned transit-oriented development or redevelopment near the project stations. This increase in population and development would also likely increase demand for utility services in some areas surrounding stations. The project corridor is entirely within Seattle's urban growth boundary, and development near the project would not be denser than allowed within the adopted land use plan. Increased development and associated utility demands within these areas are addressed by City of Seattle plans, and future development would undergo environmental review and permitting independent from the project. Section 4.2, Land Use, provides more details on adopted land use plans and potential project impacts.

4.15.7 Mitigation Measures

Through pre-construction measures and coordination with utility providers, no impacts on major utilities are expected during construction of the project and no mitigation would be needed.



4.16 Historic and Archaeological Resources

4.16.1 Introduction to Resource and Regulatory Requirements

This section identifies and describes the potential historic and archaeological resource impacts from the West Seattle Link Extension Project (the project). The Historic and Archaeological Resources Technical Report (Appendix N.5, Historic and Archaeological Resources Technical Report) provides a detailed methodology for this project, and more information about federal, state, and local regulations regarding historic properties. The two main federal laws pertaining to historic and archaeological resources are the National Historic Preservation Act and the National Environmental Policy Act (NEPA). The National Historic Preservation Act requires that federal agencies, in this case the Federal Transit Administration (FTA), identify and assess the effects of federally assisted undertakings on historic properties (any prehistoric or historic district, site, building, structure, or object) and consult with other regulatory agencies, Native American Tribes, and interested parties to find acceptable ways to avoid, minimize, or mitigate adverse effects.

Historic and archaeological resources must also be given consideration under NEPA. In addition, for United States Department of Transportation projects, Section 4(f) of the United States Department of Transportation Act includes protections for National Register of Historic Places (National Register)-eligible properties.

Historic properties are identified and evaluated by the lead federal agency in consultation with the State Historic Preservation Officer at the Washington State Department of Archaeology and Historic Preservation, interested and affected Native American Tribes, local jurisdictions, and other consulting parties, as appropriate.

Applicable state laws and authorities include the Washington State Environmental Policy Act and laws and regulations relating to cultural and archaeological resources such as the Washington Heritage Register program. The Washington Heritage Register program is administered by the Washington State Department of Archaeology and Historic Preservation. Under state law, Revised Code of Washington 27.53, Archaeological Sites and Resources, any alteration to an archaeological site requires a permit from the Washington State Department of Archaeology and Historic Preservation. State law, Revised Code of Washington 27.44, Indian Graves and Records, also protects Native American burial sites. Revised Code of Washington 76.09 (Confidentiality of Information) provides for the confidentiality of information on archaeological sites.

The analysis presented in this section follows guidance provided by the Department of Archaeology and Historic Preservation's Washington State Standards for Cultural Resources Reporting.

The City of Seattle's Landmarks Preservation Ordinance (SMC 25.12) states that, in order to be eligible for landmark designation, a property must be at least 25 years old, possess integrity or the ability to convey its significance, and meet at least one of six criteria. Only the Seattle Landmarks Preservation Board can determine whether a property meets the criteria.

A Certificate of Approval from the Board is required to alter or demolish a landmark.

National Register Eligibility

To be eligible for listing in the National Register, a historic property must retain integrity and meet at least one of the following criteria (36 Code of Federal Regulations, part 60.4):

- a) Is associated with an important event or series of events that have made a significant contribution to the broad patterns of American history.
- b) Is associated with an important individual who was significant in our past.
- c) Embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master or possesses high artistic values; or represents a significant and distinguishable entity whose components lack individual distinction.
- d) Has yielded, or may be likely to yield, information important in history or prehistory.

4.16.2 Affected Environment

Appendix N.5 includes a history of the West Seattle Link Extension study area; additional information about federal, state, and local regulations affecting cultural resources; and further detail on the resources eligible for the National Register that are described in the following sections. It also includes information on the area of potential effects for the project and detailed information for each of the parcels inventoried as part of the built environment survey.

The area of potential effects for each alternative extends from elements of the project limits (e.g., guideway, stations, and construction staging areas) to the nearest tax parcel or a maximum of 200 feet where large tax parcels are adjacent to project elements. One parcel is a standard area of potential effects extent for linear transportation projects, because potential direct and indirect effects to historic properties typically do not extend beyond one parcel. The area of potential effects is larger in the following areas to account for potential visual effects:

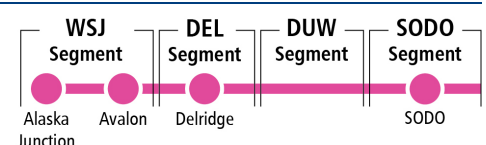
- **SODO Segment.** Area of potential effects extended one additional parcel from the guideway where project alternatives would reconstruct South Lander Street to cross over the existing and new light rail alignments.
- **Delridge Segment.** For Southwest Genesee Street between 26th Avenue Southwest and 30th Avenue Southwest, the high guideway height of some alternatives extends the area of potential effects to two parcels to the north of Southwest Genesee Street.

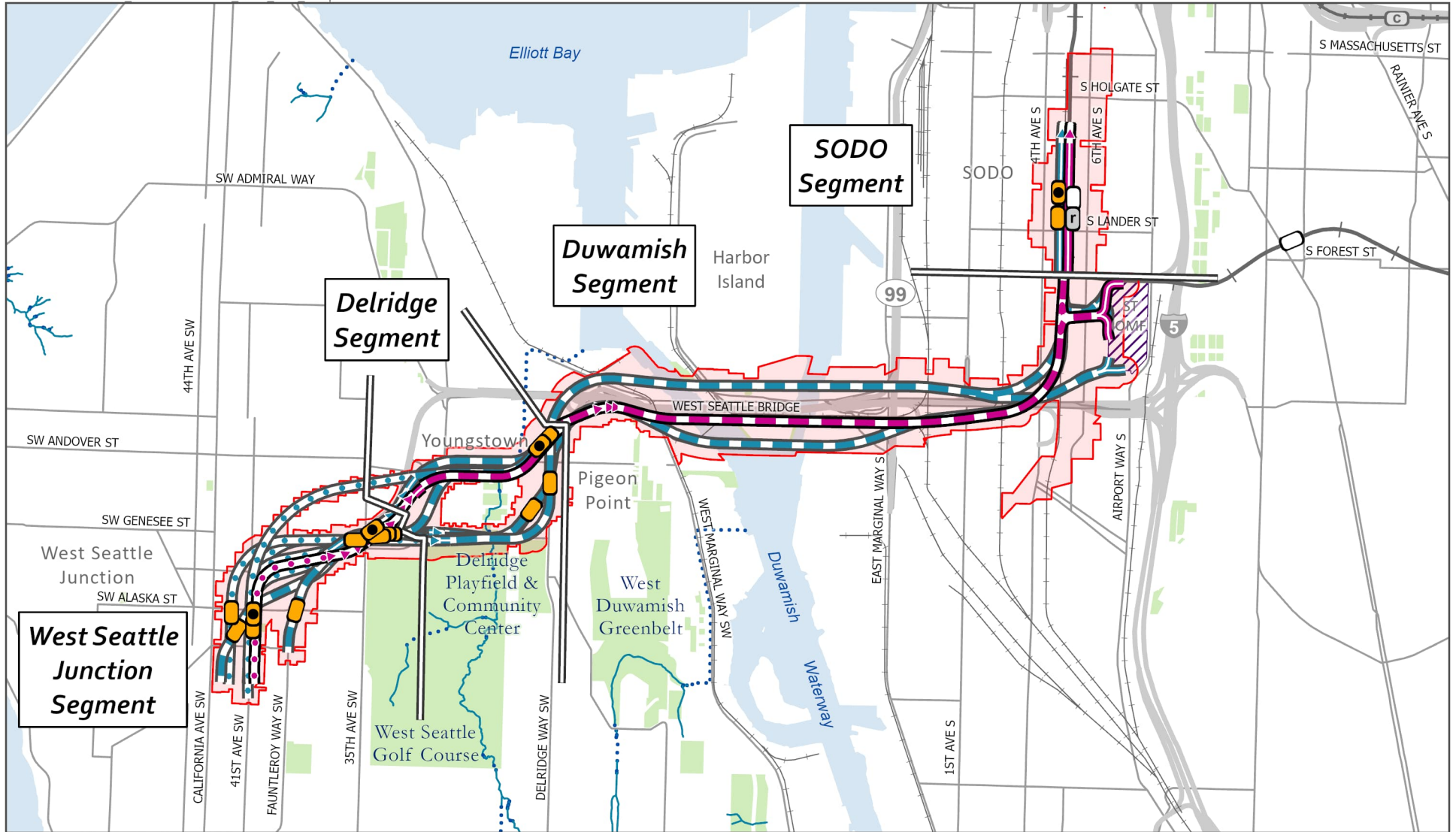
Area of Potential Effects

In accordance with Section 106 of National Historic Preservation Act, the area of potential effects includes all areas where one or more alternatives or project elements has the potential to adversely affect historic and/or archaeological resources. FTA, in consultation with the State Historic Preservation Officer, Tribes, and other consulting parties, determines the Section 106 area of potential effects for historic and archaeological resources.

FTA established the area of potential effects for the West Seattle and Ballard Link Extensions Project in coordination with Sound Transit and in consultation with the State Historic Preservation Officer, Tribes, and consulting parties in February 2020. On March 25, 2021, FTA, in cooperation with Sound Transit, revised the area of potential effects to include proposed station locations, staging areas, and other project elements that had not previously been identified; the State Historic Preservation Officer concurred with the revised area of potential effects on March 26, 2021. Sound Transit identified new construction elements that required additional revisions to the area of potential effects in September 2021. FTA consulted on the revised area of potential effects based on these additional revisions on September 7, 2021, and the State Historic Preservation Officer conditionally concurred with FTA's revised area of potential effects on October 5, 2021. The State Historic Preservation Officer, FTA, and Sound Transit met on November 18, 2021 to follow up and discuss concerns raised by consulting parties and the State Historic Preservation Officer regarding the proposed revisions to the area of potential effects. The West Seattle and Ballard Link Extensions Project was subsequently redefined in August 2023 as the West Seattle Link Extension with a revised area of potential effects. FTA, in coordination with Sound Transit, consulted on the redefined West Seattle Link Extension Project and area of potential effects on August 3, 2023. The State Historic Preservation Officer provided no comments on the project area of potential effects. Figure 4.16-1 depicts the area of potential effects.

To better understand the potential to encounter archaeological resources within the area of potential effects, known sites within an additional 0.25-mile area were studied. Additional information on methods for the review of archaeological resources within the study area and area of potential effects is in Appendix N.5.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

- New
- Relocated
- Existing

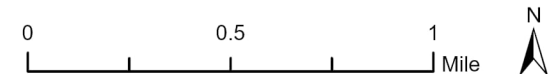
Segment Line

- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park

Area of Potential Effects

FIGURE 4.16-1
Area of Potential Effects
West Seattle Link Extension

West Seattle Link Extension



4.16.2.1 Historic Built Environment Resources

Historic built environment resources in the area of potential effects that were built in or before 1980 were surveyed and inventoried. Table 4.16-1 summarizes the National Register-listed and eligible historic properties (either previously identified or determined as part of this evaluation) and designated Seattle landmarks within each segment within the area of potential effects. These resources are also listed by segment in Section 4.16.4, Environmental Impacts of the Build Alternatives during Operation. All National Register-listed or eligible resources, including districts, would also meet Seattle landmark eligibility criteria. The State Historic Preservation Officer has concurred with all determinations of National Register eligibility.

Table 4.16-1. Historic Built Environment Resources within the Area of Potential Effects

Segment	National Register Resources		Designated Seattle Landmarks
	Listed	Determined Eligible	
SODO	0	7	0
Duwamish	0	58	2
Delridge	0	14	1
West Seattle Junction	0	31	1
Linear resources spanning multiple segments	0	1	0
Total	0	111	4

4.16.2.2 Archaeological Resources

Project-specific archaeological field inventory has been limited to two sets of investigations within the area of potential effects, one near West Marginal Way Southwest on the west side of the Duwamish Waterway and one on Pigeon Point. Neither of these investigations yielded archaeological resources or evidence of buried surfaces potentially associated with archaeological deposits. To date, archaeological inventory has been limited for multiple reasons, largely because of a lack of access to private property and substantial existing development in public rights-of-way. The remainder of the archaeological fieldwork to date has consisted of archaeological monitoring of geotechnical boring activities currently being conducted in support of design, which has provided some insight into the archaeological potential of the project corridor. Desktop research included examination of the history of the area of potential effects, the presence of previously identified archaeological resources, the archaeological predictive model (for precontact resources; developed by the Washington State Department of Archaeology and Historic Preservation), ethnographic information, and archival resources. U.S. Meander lines were also used in the analysis to help determine probability for archaeological resources near modern day or historically documented shorelines.

Ten archaeological resources were identified within 0.25 mile of the area of potential effects for the four segments of the West Seattle Link Extension using the Washington Information System for Architectural and Archaeological Records Data (WISAARD) system. None of these resources have been determined eligible for listing in the National Register. Site types identified during the search included both precontact and historical-period resources. Table 4.16-2 identifies the number of archaeological resources associated with the West Seattle Link Extension by segment. The area of potential effects is shown on Figure 4.16-1.

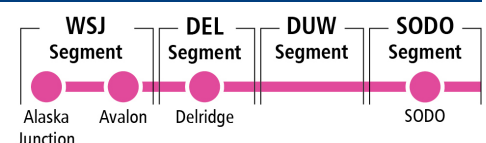


Table 4.16-2. Archaeological Resources within 0.25 Mile of the Area of Potential Effects

Segment	Archaeological Resources within 0.25 mile of Area of Potential Effects	National Register-Eligible Archaeological Resources in Area of Potential Effects	Non-National Register-Eligible Archaeological Resources in Area of Potential Effects	Unevaluated or Undetermined Eligibility Archaeological Resources in Area of Potential Effects
SODO	0	0	0	0
Duwamish	8	0	3	1
Delridge	0	0	0	0
West Seattle Junction	2	0	0	0
Total	10	0	3	1

Of the 10 resources identified, only four fall within the area of potential effects (45KI529, 45KI530, 45KI688, and 45KI1353), all of them within the Duwamish Segment of the alignment. The remaining six resources are within 0.25 mile of the area of potential effects and were identified for context. Of the four resources in the area of potential effects, 45KI1353 is a precontact archaeological site (a potential midden site), while the other three (45KI529, 45KI530, and 45KI688) are historical-period refuse dumps and a named landfill. Archaeological site 45KI1353 has not been evaluated for eligibility for listing in the National Register. The three historical-period archaeological sites have all been archaeologically tested and determined not eligible for listing in the National Register.

Geotechnical borings to support the Draft Environmental Impact Statement began in 2018 and concluded in 2021. Of the 35 boreholes completed for conceptual design of the project, 15 were archaeologically monitored following the recommendations developed within the *Geotechnical Investigation, Cultural Resources Assessment and Inadvertent Discovery Plan* (Bumback et al. 2019). No archaeological features or artifacts were identified in any of the boreholes.

In addition to the archaeological monitoring of the geotechnical borings, an archaeological field survey was conducted in 2022. The survey consisted of an archaeologist-directed geoprobe effort to investigate whether site 45KI1353 extended further north than its mapped boundary. The effort included six geoprobes along the Southwest Marginal Place right-of-way. No archaeological features or artifacts were identified in any of the geoprobes.

In 2023, three archaeologically focused shovel test probes were excavated in the area immediately north of Pigeon Point in conjunction with geotechnical investigations. Shovel test probes were hand excavated in advance of three geotechnical boring locations (DS2017, DS2019, and DS2020) to better understand near-surface soil deposits in the area of Pigeon Point. Shovel test probes identified a relatively thick modern refuse scatter atop noncultural soils along the slope between the northmost residences atop Pigeon Point and West Marginal Way Southwest. No cultural materials greater than 50 years of age were identified during the shovel probe testing.

4.16.3 Environmental Impacts of the No Build Alternative

Under the No Build Alternative, archaeological resources may be identified through other construction activities as the area continues to expand and develop. Similarly, the number of historic built environment resources could decrease with increased development or through neglect.

4.16.4 Environmental Impacts of the Build Alternatives during Operation and Construction

This section discusses potential direct impacts during operations (long-term impacts) and construction (short-term impacts) of the West Seattle Link Extension on archaeological sites and historic built environment resources. In cases where historic resources or districts exceed the one-parcel or 200-foot boundary, effects to historic properties are still considered on the entire resource or district.

Under federal regulations (National Historic Preservation Act, 36 *Code of Federal Regulations*, part 800.5), a project would have an adverse effect if it would alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the National Register in a manner that would diminish the property's integrity of location, design, setting, materials, workmanship, feeling, or association. All qualifying characteristics of a historic property shall be considered, including those that may have been identified after the original evaluation of the property's National Register eligibility.

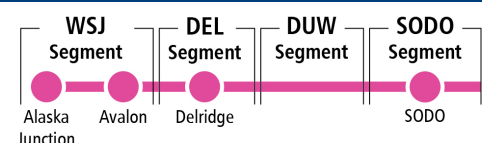
To determine the effects on historic properties in the West Seattle Link Extension area of potential effects, the following information was used:

- The location of project elements and proximity to historic properties
- Potential partial or complete acquisition and/or demolition of historic properties
- Construction methods and location
- Potential for vibration (short- or long-term) that could damage historic properties
- Potential for settlement that could damage historic properties
- Potential changes to the visual setting that adversely affect the historic setting
- Traffic detours related to roadway closures

Effects on archaeological resources is determined by the presence of known archaeological sites and the potential for unknown archaeological sites within the area needed for project construction and operations.

What are Adverse Effects on Historic Properties?

- Physical destruction of or damage to all or part of the property.
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 *Code of Federal Regulations* 68) and applicable guidelines.
- Removal of the property from its historic location.
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance.
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.
- Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an indigenous Tribe or Native Hawaiian organization.
- Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.



4.16.4.1 Historic Built Environment Resources

For this project, property-specific adverse effects are characterized as follows:

- **Property demolition.** Property would be acquired and demolished.
- **Partial property acquisition.** Part of the property would be acquired for the project but would not necessitate demolition of the historic built environment resource. An adverse effect would occur if the acquisition diminished one or more aspects of the property's integrity of significant historic features. Not all partial property acquisitions would result in an adverse effect.
- **Permanent proximity effects.** Proximity to the project and/or visual intrusion would cause permanent diminishment of setting, feeling, and/or other aspects of integrity.
- **Construction disruption.** A property in direct proximity (typically within one parcel) would be affected by reduced access, extensive noise, and/or vibration over an extended duration, diminishing one or more aspects of integrity. Construction in proximity of a historic property would not necessarily diminish integrity or result in an adverse effect.

Operation-related impacts are defined in this section as long-term, permanent impacts when revenue service begins. These on-going impacts are typically associated with the introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.

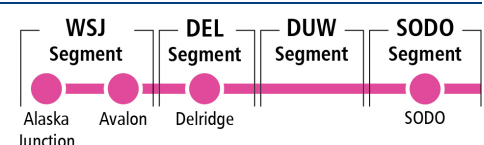
Construction-related impacts to historic built environment resources can be caused by several factors, including, but not limited to, restricted access, increased truck traffic along haul routes, glare, noise, vibration, and temporary changes to setting. Together, these factors can lead to reduced commercial activity, and reduced investment in historic properties. Typically, these effects would not be considered adverse unless they would diminish characteristics that contribute to a historic property's National Register eligibility.

Construction-related vibration would potentially affect built environment historic properties. As described in Appendix N.3, Noise and Vibration Technical Report, the primary concern from vibration as a result of construction activities is the potential for damage to buildings, particularly historic properties. Because the details of the construction means and methods for this project are not available at this time and there are several Build Alternatives, the construction vibration analysis focused on determining the distance beyond which the damage risk criteria and annoyance criteria would not be exceeded. A construction vibration control plan would be developed to address locations where there are historic properties that would have the potential to be affected. Properties in the West Seattle Link Extension area of potential effects that would experience adverse construction-related effects are noted in Tables 4.16-3 through 4.16-6.

All resources that have been determined National Register-eligible historic properties are assumed to be eligible for Seattle landmark designation. The anticipated potential effects are also assumed to be identical.

Designated Seattle landmarks and districts that incur an alteration would be subject to review and issuance of certificate of approval from the Landmarks Board and/or District Review Boards; greater detail regarding City of Seattle review of actions related to designated landmarks can be found at https://library.municode.com/wa/seattle/codes/municipal_code?nodeId=TIT25ENPR_HIPR_CH25.12LAPR. Projects across the street or adjacent to any city landmark require consultation with Seattle Department of Neighborhoods for site-specific impact mitigation.

The State Historic Preservation Officer concurred with FTA's findings of adverse effect on April 16, 2024.



4.16.4.2 Archaeological Resources

Based on the archaeological predictive model, there is a very high potential that unknown archaeological sites exist in areas where ground disturbance would occur for the project and could be impacted by construction of any of the West Seattle Link Extension alternatives.

4.16.4.3 Linear Resources Spanning Multiple Segments

A segment of Seattle and Walla Walla Railroad/Puget Sound Shore Railroad Company/Seattle, Lake Shore and Eastern Railroad/Northern Pacific Railway Black River Junction to the Lake Washington Ship Canal is contained within both the SODO and Duwamish segments. However, it would be avoided in its entirety and would not be adversely affected by any project alternatives.

4.16.4.4 SODO Segment

4.16.4.4.1 Historic Built Environment Resources

As summarized in Table 4.16-3, all four SODO Segment alternatives would adversely affect one historic property, the Graybar Electric Company Building at 1919 6th Avenue South (1030). Any effects to other historic properties would be associated with proximity to the new alignments, but those effects are not anticipated to be adverse.

There are no National Register-eligible historic districts in this segment.

4.16.4.4.2 Archaeological Resources

All of the SODO Segment alternatives fall within a zone defined by the archaeological predictive model as “survey highly advised: very high risk” for archaeological resources, indicating that there is a very high risk of impacting previously unidentified archaeological resources in this area across most of the segment. There are no recorded archaeological sites within the area of potential effects or within 0.25 mile of the area of potential effects for this segment.

4.16.4.5 Duwamish Segment

4.16.4.5.1 Historic Built Environment Resources

All three Duwamish Segment alternatives would adversely affect built environment historic properties (Table 4.16-4). There is one designated Seattle landmark within this segment, Fire Station 14, but it will not be adversely affected.

There are no previously identified historic districts within the Duwamish Segment. Two National Register-eligible historic districts were identified within this segment: the Pacific Forge Company/Bethlehem Steel Nut and Bolt Factory (1122) and the Spokane Street Manufacturing Historic District (multiple identification numbers). None of the individual buildings within Pacific Forge Company/Bethlehem Steel Nut and Bolt Factory are individually eligible for listing in the National Register; therefore, each contributing building is not listed in Table 4.16-4. The Spokane Street Manufacturing District contains three buildings that are individually eligible for listing in the National Register, and each is listed in Table 4.16-4.

Common to all alternatives in this segment is the relocation of a 230-kilovolt power line along 6th Avenue South and Diagonal Avenue, south of South Spokane Street, leading to the Seattle City Light Substation. This project element would not directly or indirectly alter or diminish any aspect of integrity of adjacent historic properties, and the line itself was not constructed in or before 1980 and is not considered historic.

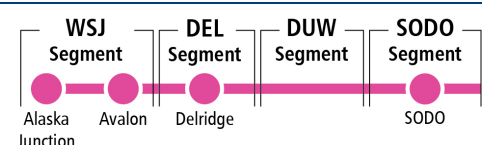


Table 4.16-3. Effects to Built Environment Historic Properties: SODO Segment

Survey Number	WISAARD Number	Property Name	Address	Date Built	National Register Eligibility Status	Preferred At-Grade Lander Access Station Option (SODO-1c)	At-Grade Alternative (SODO-1a)	At-Grade South Station Option (SODO-1b)	Mixed Profile Alternative (SODO-2)
1028	342325	Lincoln Moving & Storage, Alaska Orient Van Lines Building	1924 4th Avenue South	1966	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1030	720609	Graybar Electric Company Building	1919 6th Avenue South	1960	Eligible (Criterion C)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition
1276	720594	Platt Electric Supply Co.	2757 6th Avenue South	1970	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1899	342236	Holgate Terminals Incorporated	1762 6th Avenue South	1960	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
2085a	343198	Mill & Mine Supply Co. Building and Warehouse	625 South Lander Street	1953	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3317	721855	Northwest Wire Works	2752 6th Avenue South	1947	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
6012	728870	Denny's	2742 4th Avenue South	1968	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
Total Number of Adversely Affected Properties	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	1	1	1	1

Note:

Property names correspond with the resource names documented on the Historic Property Inventory forms prepared for the Department of Archaeology and Historic Preservation. Property names typically reflect historic names of businesses or individuals that occupied the building in the past.

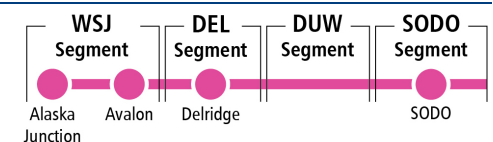
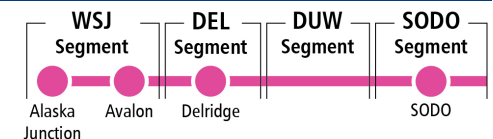


Table 4.16-4. Effects to Built Environment Historic Properties: Duwamish Segment

Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
Not Applicable	Multiple	Spokane Street Manufacturing Historic District	Multiple	1908 to 1968	Eligible Historic District (Criterion A)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected
881	342274	Seattle Pacific Sales Company Warehouse	3800 1st Avenue South	1968	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1005	45159	Link-Belt Company Property	3405 6th Avenue South	1946	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1083	718431	Viking Automatic Sprinkler Company	3434 1st Avenue South	1964	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition
1090a	720509	Transportation Equipment Rentals Office Building	3443 1st Avenue South	1968	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition
1090b	720510	Transportation Equipment Rentals Maintenance Warehouse	3443 1st Avenue South	1968	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition
1094a	720511	Acme Tool Works	3626 East Marginal Way South	1941	Eligible (Criterion A), contributes to Spokane Street Manufacturing Historic District (Criterion A)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected

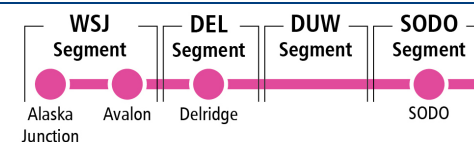
4.16 Historic and Archaeological Resources

Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
1122a through 1122e	721620, 721624, 721625, 721628, 721629	Pacific Forge Company/ Bethlehem Steel Nut and Bolt Factory Historic District	3800 West Marginal Way Southwest	1917 to 1968	Pacific Forge Company/ Bethlehem Steel Nut and Bolt Factory Historic District (Criteria A and C)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected
1138	45086	Fire Station 14	3224 4th Avenue South	1922	Eligible (Criterion C), Designated Seattle Landmark	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1274	45085	Pacific Hoist and Warehouse Company	3200 4th Avenue South	1931	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1275a	342730	Langendorf United Bakeries	2901 6th Avenue South	1952	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1275b	720593	Langendorf United Bakeries Repair Garage	2901 6th Avenue South	1955	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1388	38533	A.M. Castle and Company	3640-60 East Marginal Way South	1945	Eligible (Criteria A and C), contributes to Spokane Street Manufacturing Historic District (Criterion A)	Adversely Affected: Permanent Proximity Effect	Adversely Affected: Property Demolition	Not Adversely Affected
1915	38532	Alaskan Copper Works/Eagle Brass Foundry Company	3600 East Marginal Way South	1918	Eligible (Criterion A), contributes to Spokane Street Manufacturing Historic District (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



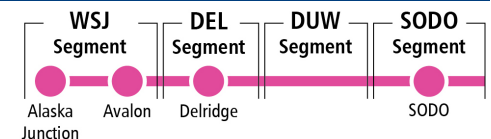
4.16 Historic and Archaeological Resources

Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
1941	342160	Pacific Reefer Fisheries	3480 West Marginal Way Southwest	1964	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1943	48502	Alaskan Copper and Brass Company	3223 6th Avenue South	1953	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3214	294616	Single-Family Residence	3842 23rd Avenue Southwest	1914	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3320b	722008	NW Motor Parts Corporation Building	2930 6th Avenue South	1951	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3321	721857	M.J.B. Coffee Company Warehouse	2940 6th Avenue South	1954	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3322a	342997	Alaskan Copper Company Employment Office	2958 6th Avenue South	1941	Eligible (Criterion C)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition
3322b	721997	Auto Repair Garage	2958 6th Avenue South	1948	Eligible (Criterion A)	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected
3324	340010	Los Angeles-Seattle Motor Express Company	3200 6th Avenue South	1945	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3327	342709	Scientific Supplies Company	600 South Spokane Street	1954	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



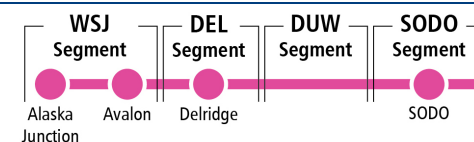
4.16 Historic and Archaeological Resources

Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
3329a	86871	Department of Highways District No. 1 Headquarters/ Maintenance Facility – Office/ Administrative Building	450 South Spokane Street	1931	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: <i>Partial Property Acquisition</i>
3329b	722096	Department of Highways District No. 1 Headquarters/ Maintenance Facility – Maintenance Building	450 South Spokane Street	1931	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: <i>Partial Property Acquisition</i>
3329c	722098	Department of Highways District No. 1 Headquarters/ Maintenance Facility – Storage Building	450 South Spokane Street	1931	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: <i>Partial Property Acquisition</i>
3329d	722100	Department of Highways District No. 1 Headquarters/ Maintenance Facility – Car/Paint Building	450 South Spokane Street	1931	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: <i>Property Demolition</i>



4.16 Historic and Archaeological Resources

Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
3329e	722101	Department of Highways District No. 1 Headquarters/ Maintenance Facility – Maintenance/ Garage Building	450 South Spokane Street	1959	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: <i>Property Demolition</i>
3339	342259	Riches & Adams Co./Seattle Opportunities Industrialization Center, Inc.	3627 1st Avenue South	1954	Eligible (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3344	344061	General Construction Company Office	3840 West Marginal Way Southwest	1931	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5136	725824	Air Mac, Inc.	3838 4th Avenue South	1953	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5137	725825	Warehouse and Office Building	3623 6th Avenue South	1961	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5139a	45089	Seattle City Light South Receiving Substation	3839 4th Avenue South	1938	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5139b	725921	Seattle City Light South Receiving Substation Switchyard	3839 4th Avenue South	1924	Eligible a(Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5139d	730783	Seattle City Light Warehouse and Office Building	400 South Spokane Street	1965	Eligible ^a (Criteria A and C) (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
5139e	730784	Seattle City Light South Rectifier Substation	400 South Spokane Street	1952	Eligible ^b (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



4.16 Historic and Archaeological Resources

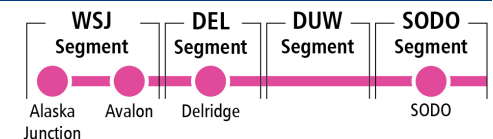
Survey Number	WISAARD Number	Property Name	Address	Built Date	National Register Eligibility Status	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
LIN-12	44440	Northern Pacific Railway Bridge Over the West Waterway	South of South Spokane Street, near Southwest Klickitat Way	1911	Eligible (Criterion C), Designated Seattle Landmark	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
LIN-17	730874	Spokane Street East and West Towers, Harbor Island-Delridge-West Seattle 230-kilovolt Transmission Line	West Marginal Way Southwest and Southwest Spokane Street	1922	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
Total Number of Adversely Affected Properties	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	6	6	9

Notes:

Property names correspond with the resource names documented on the Historic Property Inventory forms prepared for the Department of Archaeology and Historic Preservation. Property names typically reflect historic names of businesses or individuals that occupied the building in the past.

^a A portion of this property—but not the building or access to the facility—would be acquired only if this alternative connects to Alternatives DEL-3 and DEL-4. Although this would result in alteration of setting, the effect would not be adverse, and no other aspects of integrity would be altered or diminish. No portion of the property would be acquired when connecting to any of the other Delridge Segment Build Alternatives.

^b Individual resources within the area of potential effects were evaluated and considered within the context of a historic district. This resource is associated with the Seattle City Light South Substation/South Service Center property at 400 South Spokane Street and it appears to meet National Register historic district eligibility criteria as a contributing resource. However, only a portion of the Seattle City Light South Substation/South Service Center property is within the area of potential effects, so the property is not counted as a historic district for this project.



4.16.4.5.2 Archaeological Resources

All of the Duwamish Segment alternatives fall within a zone defined by the archaeological predictive model as “survey highly advised: very high risk” for archaeological resources. There are seven recorded archaeological sites within the area of potential effects or within 0.25 mile of the area of potential effects for this segment (45KI688, 45KI1425, 45KI722, 45KI529, 45KI530, 45KI52, 45KI1353). Out of the four archaeological sites within the area of potential effects for the Duwamish Segment (45KI688, 45KI529, 45KI530, and 45KI1353), three (45KI688, 45KI529, 45KI530) have been determined not eligible for listing in the National Register and are therefore subject to impact with no additional evaluation. Archaeological site 45KI1353 could be a precontact midden site that has the potential to be directly impacted by Preferred Alternative DUW-1a and Option DUW-1b. The area to the north of 45KI1353 was the subject of a geoprobe investigation in 2022 to determine the northernmost extent of the archaeological resource and whether the project construction footprint for one or more alternatives would encroach on the site (see Section 4.16.2, Affected Environment). No cultural deposits associated with the archaeological site were identified as a result of the geoprobe testing.

Archaeological site 45KI52, while not currently within the area of potential effects, has been mapped within approximately 900 feet of both Preferred Alternative DUW-1a and Option DUW-1b. The boundary of this archaeological resource is based solely on documentary information and this site has not previously been verified. The extent of the boundary and the actual proximity of the site to either of the southern alignments is currently unknown.

Archaeological sites 45KI722 and 45KI1425 are outside of the area of potential effects but were mapped within 600 feet of Alternative DUW-2. These two sites, both historical, were determined not eligible for listing in the National Register and therefore do not require further evaluation or mitigation.

4.16.4.6 Delridge Segment

4.16.4.6.1 Historic Built Environment Resources

As summarized in Table 4.16-5, Alternative DEL-6a would cause no adverse effects to historic properties in the Delridge Segment. All other alternatives would adversely affect one or more historic property.

There is one designated Seattle landmark, Cettolin House at 4022 32nd Avenue Southwest, within this segment. It would be adversely affected by Preferred Option DEL-6b and Alternative DEL-7. All resources that have been determined National Register-eligible historic properties are assumed to be eligible for Seattle landmark designation. The anticipated potential effects are also assumed to be identical.

There are no previously or newly identified National Register-eligible historic districts in this segment.

4.16.4.6.2 Archaeological Resources

All of the Delridge Segment alternatives fall within a zone defined by the archaeological predictive model as “survey highly advised: very high risk” for archaeological resources. There are no recorded archaeological sites within the area of potential effects or within 0.25 mile of the area of potential effects for this segment.

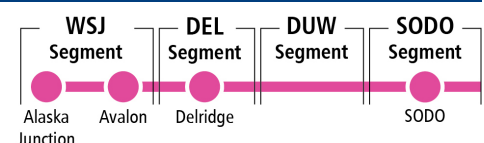
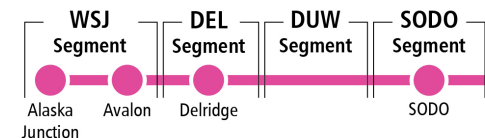


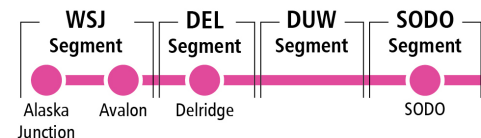
Table 4.16-5. Effects to Built Environment Historic Properties: Delridge Segment

Survey Number	WISAARD Number	Historic Property	Address	Construction Date	National Register Eligibility Status	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6a)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
242	717063	West Seattle Golf Course	4600 35th Avenue Southwest	1936	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Partial Property Acquisition; Permanent Proximity Effects	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Partial Property Acquisition; Permanent Proximity Effects	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
443	344641	Bethlehem Pacific Coast Steel Company Office Building	4045 Delridge Way Southwest	1960	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
444	721070	Residence	4030 Delridge Way Southwest	1906	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
449	38466	Seattle Steel Company/ Bethlehem Pacific Coast Steel Corporation	2424 Southwest Andover Street	1966	Eligible (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
453	47869	Mrachke & Son	3860 – 3864 Delridge Way Southwest	1930	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1166	376099	Single-Family Craftsman Residence	4108 25th Avenue Southwest	1907	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



4.16 Historic and Archaeological Resources

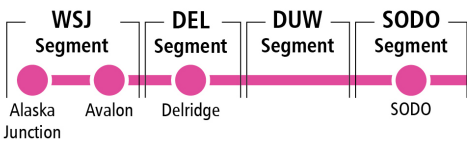
Survey Number	WISAARD Number	Historic Property	Address	Construction Date	National Register Eligibility Status	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6a)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
1787	721178	Single-Family Residence	4139 25th Avenue Southwest	1909	Eligible (Criterion C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1977	418305	Contemporary Ranch House	4150 32nd Avenue Southwest	1959	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
2254	335189	Kirlow Four-Plex	3074 Southwest Avalon Way	1967	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
3345	287692	Residence	4017 23rd Avenue Southwest	1907	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3391	300990	Residence	4044 32nd Avenue Southwest	1925	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3396	45978	Cettolin House	4022 32nd Avenue Southwest	1928	Eligible (Criterion C) and designated Seattle landmark	Adversely Affected: Permanent Proximity Effects	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Permanent Proximity Effects
7063	730028	Single-Family Residence	4019 Fauntleroy Way Southwest	1931	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
7075	730040	Single-Family Residence	4032 35th Avenue Southwest	1932	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



Survey Number	WISAARD Number	Historic Property	Address	Construction Date	National Register Eligibility Status	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6a)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
Total Number of Adversely Affected Properties	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	1	6	7	6	6	4	4	2	0	1

Note:

Property names correspond with the resource names documented on the Historic Property Inventory forms prepared for the Department of Archaeology and Historic Preservation. Property names typically reflect historic names of businesses or individuals that occupied the building in the past.



4.16.4.7 West Seattle Junction Segment

4.16.4.7.1 Historic Built Environment Resources

As summarized in Table 4.16-6, three West Seattle Junction Segment alternatives, Preferred Option WSJ-5b, Alternative WSJ-5a, and Alternative WSJ-6, would not adversely affect historic properties. The remaining alternatives would cause adverse effects to one or more built environment historic properties. There are no previously identified or newly identified historic districts within the West Seattle Junction Segment.

There is one designated Seattle landmark, the Campbell Building at 4554 California Avenue Southwest, within this segment. All resources that have been determined National Register-eligible historic properties are assumed to be eligible for Seattle landmark designation. The anticipated potential effects are also assumed to be identical.

4.16.4.7.2 Archaeological Resources

All of the West Seattle Junction Segment alternatives fall within a zone defined by the archaeological predictive model as “survey highly advised: high risk” for archaeological resources. As the segment continues north and crosses over Southwest Alaska Street, it transitions to “survey highly advised: very high risk” for archaeological resources, which continues for the remainder of the segment. There are no recorded archaeological sites within the area of potential effects or within 0.25 mile of the area of potential effects for this segment.

4.16.5 Indirect Impacts of the Build Alternatives

4.16.5.1 Historic Built Environment Resources

Construction of the West Seattle Link Extension could encourage population growth and transit-oriented development in the station areas. Potential effects could include demolition or substantial alteration of historic properties for redevelopment. However, future redevelopment in station areas would be consistent with adopted zoning and the City of Seattle’s Comprehensive Plan, which currently allows greater density in the station areas than exists today. The City’s Landmark ordinance, which would apply to the demolition or substantial alteration of resources that meet the City of Seattle’s Landmark criteria would help to reduce loss of historic properties.

4.16.5.2 Archaeological Resources

No indirect effects to archaeological sites as a result of project activities are anticipated. Archaeological sites are generally only affected by direct impacts. Potential effects from redevelopment in station areas could result in disturbance of archaeological resources in areas not previously disturbed. Future redevelopment in station areas would be subject to review under state and federal regulations that require analysis of potential impacts to archaeological resources.

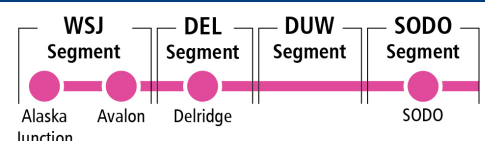
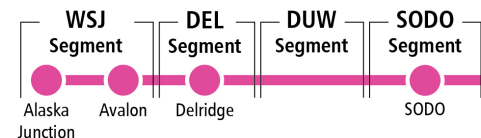


Table 4.16-6. Effects to Built Environment Historic Properties: West Seattle Junction Segment

Survey Number	WISAARD Property Number	Property Name	Address	Construction Date	National Register Eligibility Status	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
77	719318	Limcrest Apartments	3600 Southwest Genesee Street	1956	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition^a	Adversely Affected: Property Demolition^b	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
91	720871	Carlsen & Winquist Auto	4480 Fauntleroy Way Southwest	1946	Eligible (Criteria A and C)	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
92b	720875	West Seattle Brake Service	4464 37th Avenue Southwest	1948	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
97	720988	Jim's Shell Service	4457 Fauntleroy Way Southwest	1965	Eligible (Criterion A)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
103	420560	Residence	4407 38th Avenue Southwest	1924	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
177	721552	Campbell Building	4554 California Avenue Southwest	1918	Eligible (Criteria A and C); designated Seattle landmark	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
181	721486	Alaska House	4545 42nd Avenue Southwest	1979	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
236	343799	Wardrobe Cleaners	4500 Fauntleroy Way Southwest	1949	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected

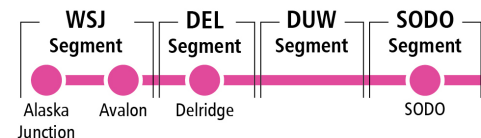
4.16 Historic and Archaeological Resources

Survey Number	WISAARD Property Number	Property Name	Address	Construction Date	National Register Eligibility Status	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
239	365276	Craftsman Bungalow	4015 Southwest Hudson Street	1906	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1215	442141	Contemporary Ranch House	3221 Southwest Genesee Street	1959	Eligible (Criterion C)	Not Adversely Affected	Adversely Affected: Property Demolition	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
1230	338613	Golden Tee Apartments	3201 Southwest Avalon Way	1967	Eligible (Criterion C)	Not Adversely Affected	Adversely Affected: Property Demolition^c	Adversely Affected: Property Demolition^c	Adversely Affected: Property Demolition^d	Adversely Affected: Property Demolition^d	Adversely Affected: Property Demolition^c	Not Adversely Affected	Not Adversely Affected
1309	303008	Single-Family Residence	4157 38th Avenue Southwest	1956	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
1984	338612	Golden Tee Apartments	3211 Southwest Avalon Way	1967	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Permanent Proximity Effects	Adversely Affected: Permanent Proximity Effects	Not Adversely Affected	Not Adversely Affected
2068	679043	Bartell Drugs	4548 California Avenue Southwest	1929	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
2110	334059	Chinook Apartments	4431 37th Avenue Southwest	1959	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
2126	365104	Residence	4446 40th Avenue Southwest	1908	Eligible (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
2150	343495	West Seattle Bowl	4505 39th Avenue Southwest	1948	Eligible (Criterion A)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



4.16 Historic and Archaeological Resources

Survey Number	WISAARD Property Number	Property Name	Address	Construction Date	National Register Eligibility Status	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
2217	343979	Venable and Wing Law Office	4826 California Avenue Southwest	1963	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
2224	721512	Residence	5011 41st Avenue Southwest	1925	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
2228	278849	Residence	4115 Southwest Hudson Street	1913	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3026	654505	Residence	4426 38th Avenue Southwest	1932	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Adversely Affected: Property Demolition	Not Adversely Affected	Not Adversely Affected
3042	721838	J.C. Penney/ Russell Building	4520 California Avenue Southwest	1926	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3043	721839	Marier Foto Studio	4528 California Avenue Southwest	1928	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3243	722760	Single-Family Residence	4714 38th Avenue Southwest	1939	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3250	722762	Single-Family Residence	4755 38th Avenue Southwest	1957	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
3251a	723076	Apartment Complex	4821 Fauntleroy Way Southwest	1957	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected



4.16 Historic and Archaeological Resources

Survey Number	WISAARD Property Number	Property Name	Address	Construction Date	National Register Eligibility Status	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
3251b	723077	Apartment Complex	4821 Fauntleroy Way Southwest	1957	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
7010	729979	Single-Family Residence	4039 36th Avenue Southwest	1953	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
7011	729980	Single-Family Residence	4045 36th Avenue Southwest	1948	Eligible (Criterion C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
7052	730016	Single-Family Residence	4109 38th Avenue Southwest	1919	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
7053	730017	Single-Family Residence	4111 38th Avenue Southwest	1919	Eligible (Criteria A and C)	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected	Not Adversely Affected
Total Number of Adversely Affected Properties	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	0	4	4	3	3	7	0	0

Notes:

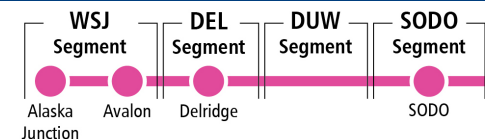
Property names correspond with the resource names documented on the Historic Property Inventory forms prepared for the Department of Archaeology and Historic Preservation. Property names typically reflect historic names of businesses or individuals that occupied the building in the past.

^a This property would be demolished as a result of Alternative WSJ-3a only if it this alternative connects to Option DEL-2b. The property would not be acquired or affected if the alternative connects to Alternative DEL-2a.

^b This property would be demolished as a result of Option WSJ-3b only if it this option connects to Option DEL-2b. The property would not be acquired or affected if the option connects to Alternative DEL-2a.

^c This property would be demolished only if it this alternative connects to Alternative DEL-1a or Alternative DEL-3.

^d This property would be demolished only if it this alternative connects to Alternative DEL-2a or Alternative DEL-4.



4.16.6 Mitigation Measures

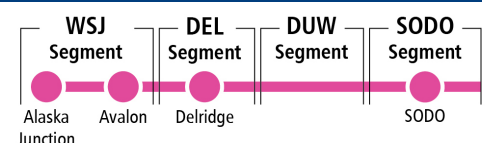
On June 28, 2024, FTA notified the Advisory Council on Historic Preservation that the West Seattle Link Extension Project will have an adverse effect on historic properties, and invited the Advisory Council on Historic Preservation to participate in the Section 106 consultation process and development of the programmatic agreement for the project. In a letter to FTA dated July 15, 2024, the Advisory Council on Historic Preservation acknowledged the notification and declined to participate in the consultation to resolve adverse effects.

FTA and Sound Transit, in consultation with the State Historic Preservation Officer, Tribes, and other consulting parties are developing a programmatic agreement to resolve adverse effects to historic properties for the project. The programmatic agreement, included in Attachment N.5G to Appendix N.5, will be executed prior to FTA issuing a Record of Decision for the West Seattle Link Extension. Sound Transit is also addressing potential impacts to previously undocumented archaeological resources through a phased archaeological survey work plan including preconstruction inventory work that will occur in coordination with Tribes and the State Historic Preservation Officer. This pre-construction inventory work will be phased to coordinate with property acquisition and project construction according to the process outlined in the Archaeological Survey and Inventory Plan and as stipulated in the Section 106 programmatic agreement. The agreement will include an Archaeological Treatment Plan to address the discovery of archaeological and historic resources during project activities. Should National Register-eligible properties be identified as the project advances, FTA will apply the adverse effect criteria to determine effects to resources. In summary, FTA, in coordination with Sound Transit and in consultation with the State Historic Preservation Officer, Tribes, and other consulting parties will implement terms of the programmatic agreement to address treatment of cultural resources and resolve adverse effects as the project moves forward.

Typical mitigation measures that are included in the programmatic agreement are listed below.

- Modifying the undertaking through redesign, re-orientation, or other similar changes to avoid, minimize, or mitigate impacts
- Documenting historic properties or resources that would be impacted
- Installing interpretive/educational signage, or other options that provide a direct public benefit (e.g., exhibits, HistoryLink essays, documentaries, or historic property nominations)
- Implementing data recovery of archaeological or architectural information and materials
- Preparing a National Register nomination for an archaeological site
- Preparing City of Seattle landmark nominations for potentially eligible buildings, structures, objects, and/or sites
- Preparing an ethnographic study, historic essays, documentaries, or formal documentation
- Developing museum exhibits
- Offering lecture series, trainings, or workshops
- Performing additional consultation to ensure compatible replacement buildings or structures
- Supporting preservation non-profit organizations

Sound Transit will develop a detailed monitoring and inadvertent discovery plan, in consultation with the State Historic Preservation Officer and Tribes. The plan will outline protocols to ensure the proper treatment of archaeological resources that may be identified during construction.



4.17 Parks and Recreational Resources

4.17.1 Introduction to Resource and Regulatory Requirements

This section discusses park and recreation resources along the West Seattle Link Extension Project (the project) alternatives and potential impacts to them from the project. The project is near many parks and recreational resources in several neighborhoods in Seattle.

Section 4(f) of the United States Department of Transportation Act of 1966 and Section 6(f) of the Land and Water Conservation Act (Code of Federal Regulations Title 59) are federal regulations protecting a subset of these resources. Section 4(f) resources and potential impacts to them are discussed in Section 4.18, Section 4(f) Summary. There are no Section 6(f) resources impacted by the project; however, there are parks and recreational resources that have received Washington State Recreation and Conservation Office funding. Such resources have similar conversion and replacement requirements as Section 6(f).

Seattle Ordinance 118477, enacted in February 1997, requires that City of Seattle land or facilities used for park and recreation purposes “shall be preserved for such use; and no such land or facility shall be sold, transferred, or changed from park use to another usage, unless the City...receives in exchange land or a facility of equivalent or better size, value, location and usefulness in the vicinity, serving the same community and the same park purposes.”

4.17.2 Affected Environment

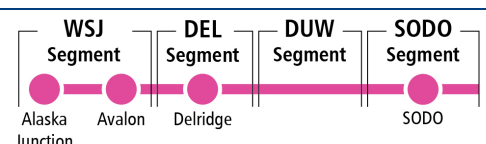
Parks and recreational resources include designated public parks, recreation sites, shoreline street-ends with improved public access, open space, greenbelts, recreational trails, playgrounds, golf courses, swimming pools, and school play areas available for public use during non-school hours. The study area for this evaluation includes resources that are:

- Within 250 feet of the project limits, including areas used for construction
- Within 0.5 mile (approximately 2,640 feet) from each station structure

The following sections summarize by segment the resources within the project study area that are closest to the project and have the potential to be directly or indirectly impacted. Figures 4.17-1 through 4.17-3 show all parks and recreational resources in the study area, and Table L4.17-1 in Appendix L4.17, Parks and Recreational Resources, contains a list of all resources in the study area.

Trails in the project study area that have recreation as a primary function are identified and analyzed in this section. Five trails in the study area have transportation as a primary function and are used by both commuters and recreationists. The potential impacts to these trails are not analyzed in this section. For a discussion of potential impacts on the following trails, refer to Section 3.7, Affected Environment and Impacts during Operation - Non-motorized Facilities, in Chapter 3, Transportation Environment and Consequences.

- **SODO Trail** is a 1-mile paved trail east of the existing light rail between South Royal Brougham Way and South Forest Street, in the SODO and Duwamish segments.
- **West Seattle Bridge Trail** is a 2-mile paved trail in the Duwamish Segment that follows Southwest Spokane Street over the East and West Duwamish waterways (also known as Duwamish River). It connects to the Elliott Bay Trail and the Alki Trail.



- **Duwamish Trail** is a 1.9-mile on-street trail on West Marginal Way, south of South Spokane Street in the Duwamish Segment. It connects to the Alki Trail.
- **Delridge Connector Trail** is a 0.4-mile paved trail in the Delridge Segment between Southwest Andover Street and the West Seattle Bridge. A portion of the trail passes through the West Duwamish Greenbelt. It connects the Delridge neighborhood to parks, Longfellow Creek, and the West Seattle Bridge Trail.
- **Alki Trail** is a 4.4-mile paved trail in the Delridge Segment that runs from Alki Beach to the Duwamish Waterway.

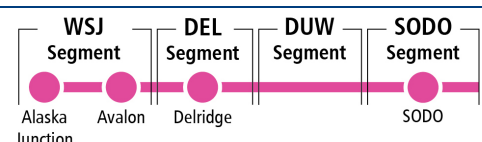
4.17.2.1 SODO Segment

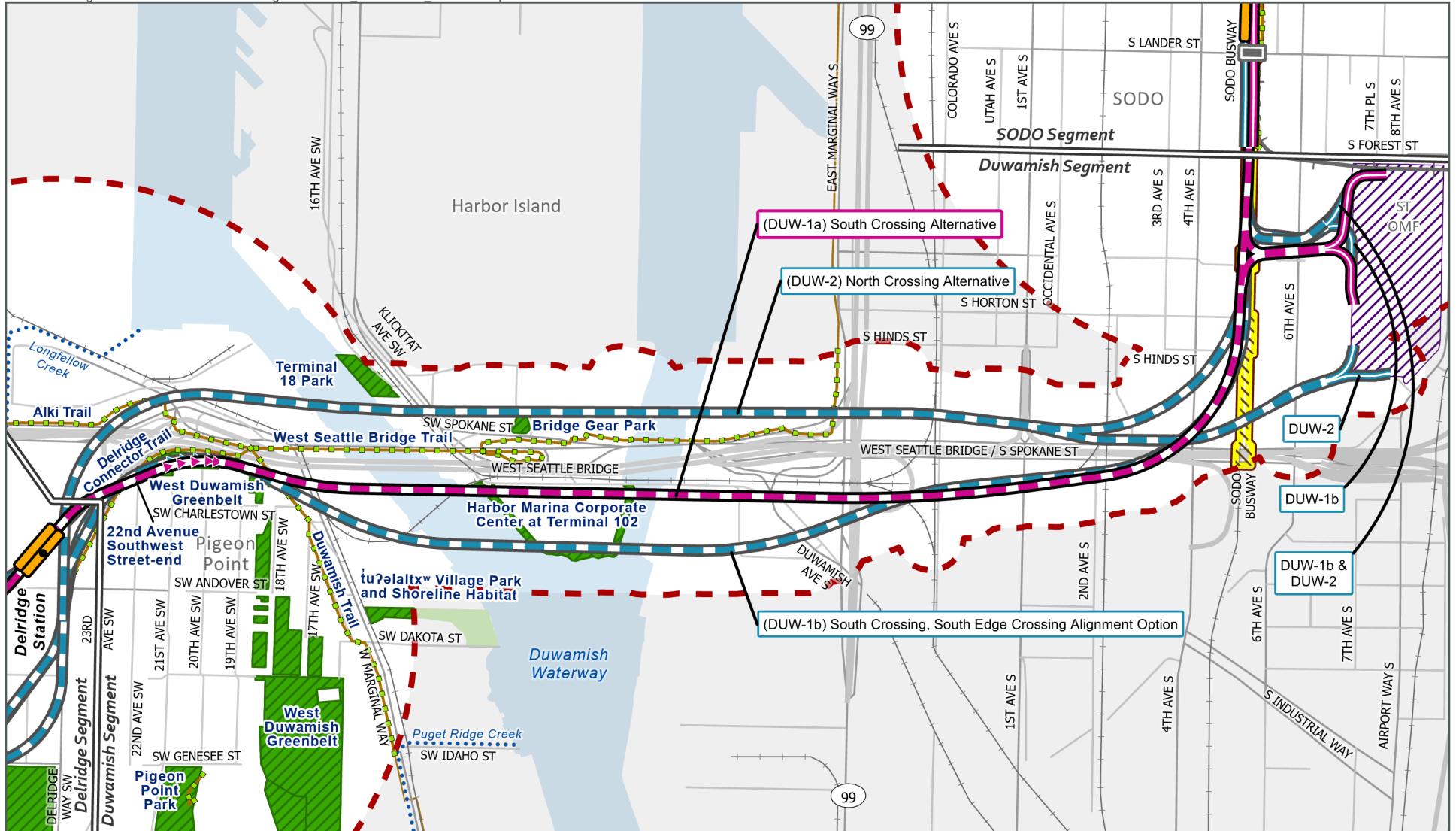
There are no parks and recreational resources in the SODO Segment study area.

4.17.2.2 Duwamish Segment

There are six parks and recreational resources in the Duwamish Segment study area. The following four resources are closest to the project (Figure 4.17-1):

- **Terminal 18 Park** is a 1.1-acre waterfront park on Harbor Island, north of the West Seattle Bridge, with a paved path that runs the length of the park. It has picnic tables, shelters, and views of shipping activity. This park is accessed by land and cannot be accessed by water.
- **Bridge Gear Park** is a 0.3-acre public park located in the southwest corner of Terminal 18 that provides public access to Harbor Island. It features a small parking lot and an interactive sign with a description of the historic Spokane Street counter-weight drawbridge with original bridge gears on display.
- **Harbor Marina Corporate Center at Terminal 102** is a 2.4-acre public shoreline access area south of the West Seattle Bridge along three sides of the south end of Harbor Island, between the shoreline and an office park. The resource provides public access to the Duwamish Waterway along 600 feet of shoreline, as well as a paved pathway, picnic tables, and a small lawn area. The pathway can be used to access Harbor Island Marina.
- **West Duwamish Greenbelt** is 197 acres, is comprised of multiple parcels, and is the largest greenbelt in Seattle. There are recreational use trails in the greenbelt; however, the portion of the greenbelt within the study area is a bluff with some wildlife habitat function, and is not designed for public access. The greenbelt also serves as a linear visual buffer for the Pigeon Point community. A paved stairway in the greenbelt connects West Marginal Place with Southwest Charlestown Street but does not provide access to the recreational trails farther south in the greenbelt. A portion of the Delridge Connector Trail passes through the greenbelt.
- **22nd Avenue Southwest Street-end** is an improved street-end with public access adjacent to the western edge of the West Duwamish Greenbelt and is less than 0.1 acre. It has landscaping and is Seattle Department of Transportation right-of-way.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Retained Cut

Station (● Indicates Preferred Alternative)

- New

Segment Line

- Existing Link Light Rail
- Railroad

SODO Busway

- Proposed Overpass

- Sound Transit Operations and Maintenance Facility (ST OMF)

Piped Stream

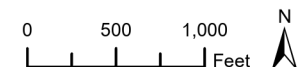
- Parks

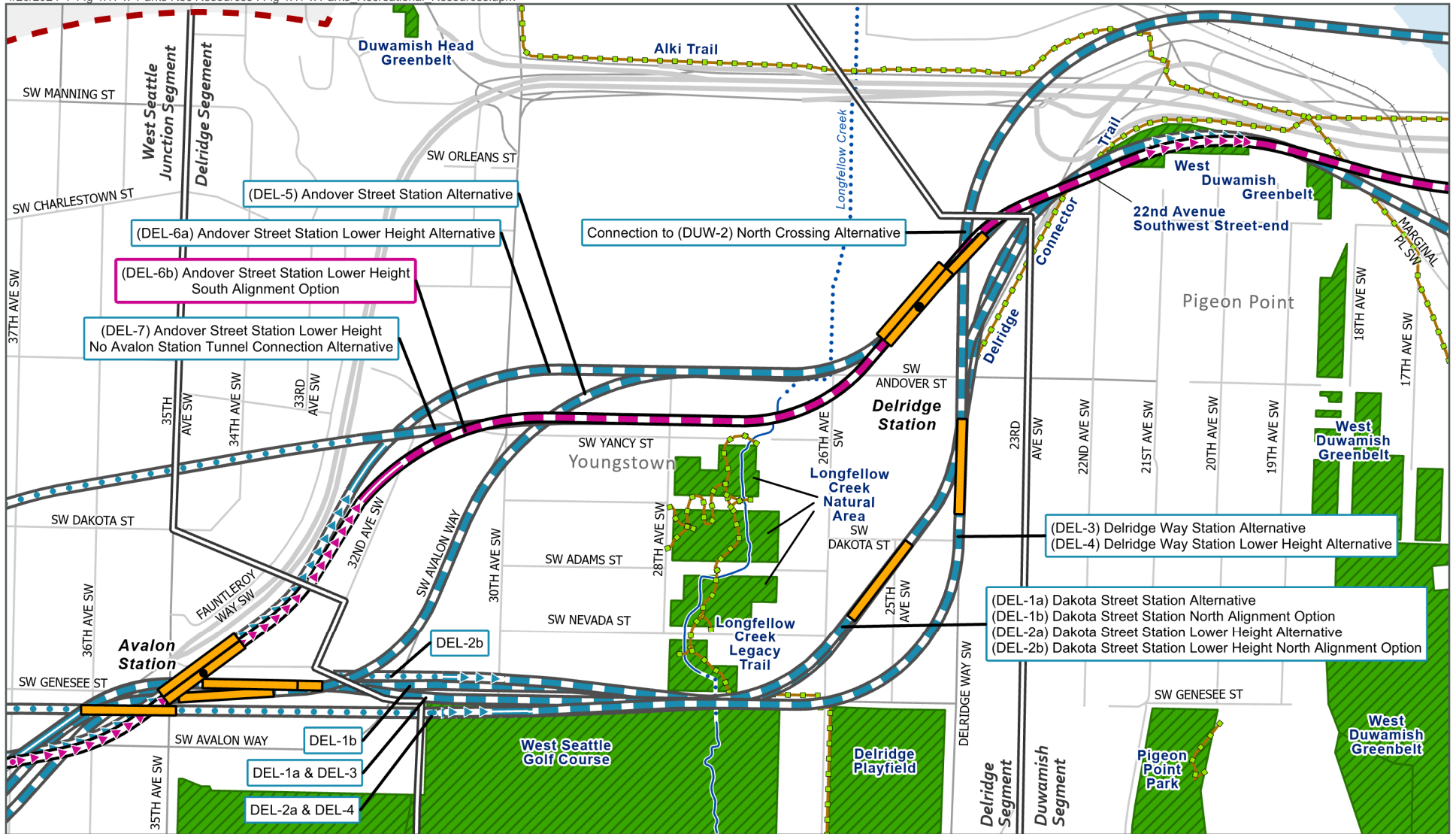
Study Area

- Parks and Recreational Resources in Study Area
- Trail

FIGURE 4.17-1
Parks and Recreational Resources in the Study Area
Duwamish Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

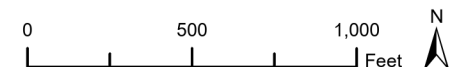
- Segment Line
- Railroad
- Stream
- Piped Stream

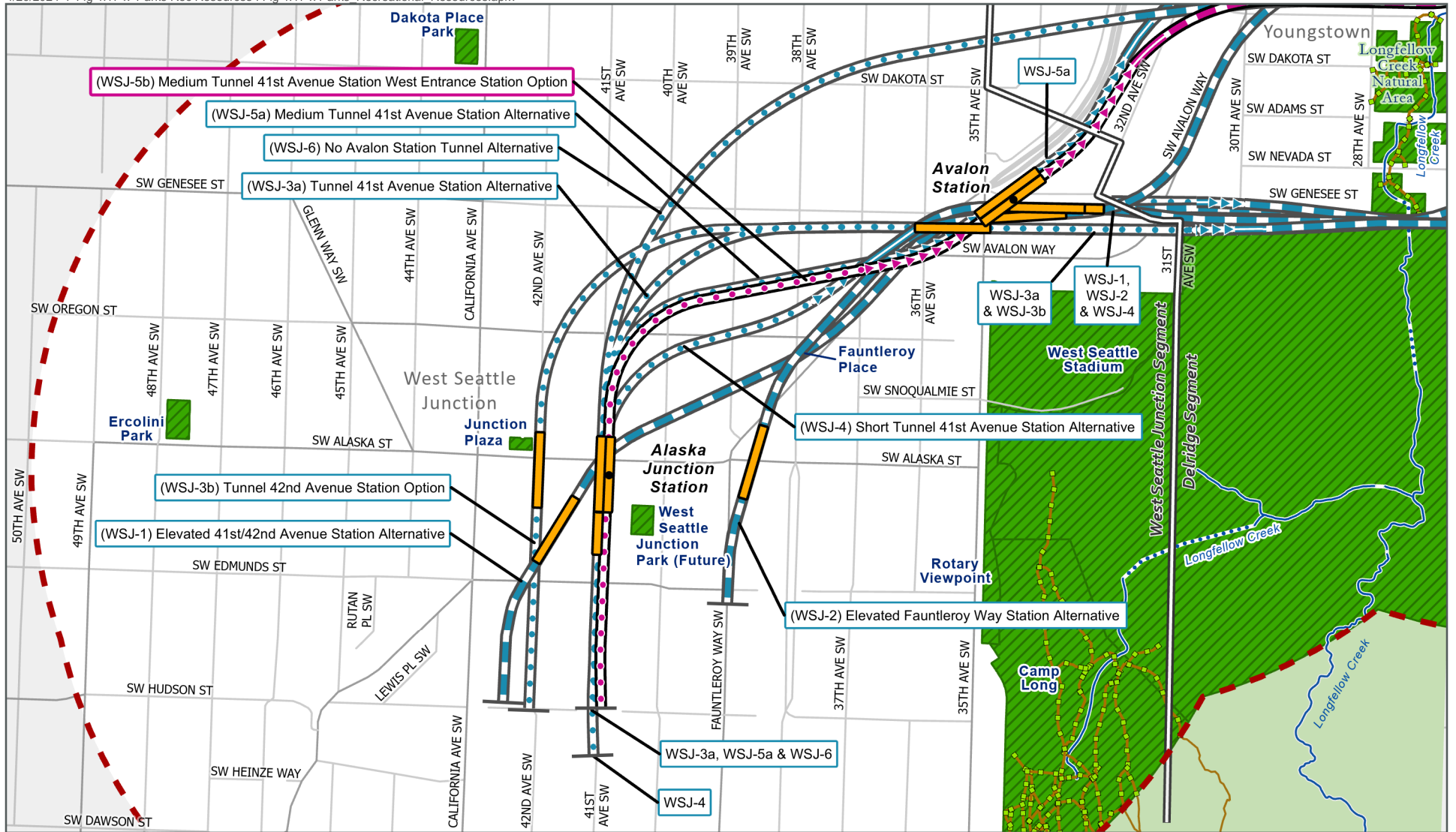
Study Area

- Parks and Recreational Resources in Study Area
- Trail

FIGURE 4.17-2
Parks and Recreational Resources in the Study Area
Delridge Segment

West Seattle Link Extension





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Other Alternatives

- Elevated
- At-Grade
- Tunnel
- Retained Cut

Station (● Indicates Preferred Alternative)

New

- Segment Line
- Stream
- Piped Stream
- Parks

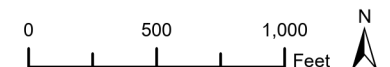
Study Area

Parks and Recreational Resources in Study Area

Trail

FIGURE 4.17-3
Parks and Recreational Resources in the Study Area
West Seattle Junction Segment

West Seattle Link Extension



4.17.2.3 Delridge Segment

There are five parks and recreational resources in the Delridge Segment study area. The following four resources are closest to the project (Figure 4.17-2):

- **Delridge Playfield** is 14 acres and features the Delridge Community Center, open space, benches, picnic amenities, tennis courts, play equipment, multi-use athletic fields, public art, a skate park, and a wading pool.
- **Longfellow Creek Natural Area** is a 5.9-acre protected greenspace in the Longfellow Creek watershed that features the Longfellow Creek Legacy Trail. In the natural area there is a garden, sculpture, and pavilion in the Dragonfly Garden area; salmon habitat; and a bridge with an overhead wishbone structure.
- **Longfellow Creek Legacy Trail** is a 4.2-mile recreational trail connecting the Delridge and Westwood neighborhoods and multiple parks. In the study area, the trail is located on 26th Avenue Southwest and Southwest Genesee Street and connects via a staircase to the Longfellow Creek Natural Area, where the trail is gravel and dirt. It can be accessed from the Dragonfly Garden Pavilion and along Southwest Genesee Street or from 28th Avenue Southwest.
- **West Seattle Golf Course**, designed in 1936, is 138 acres and one of five public golf courses in the City of Seattle. This historic 18-hole course (refer to Section 4.16, Historic and Archaeological Resources) features hills with scenic views of Downtown Seattle and Elliott Bay. The West Seattle Golf Course has many mature trees that line much of the north side of the property along the south edge of Southwest Genesee Street. These trees form the northern backdrop of the golf course. This resource is also in the West Seattle Junction Segment study area.

4.17.2.4 West Seattle Junction Segment

There are nine existing parks and recreational resources and one planned resource in the West Seattle Junction Segment study area. The following three resources are closest to the project (Figure 4.17-3):

- **Fauntleroy Place** is a street triangle greenspace that is less than 0.1 acre with grass, trees, and a bench. It is surrounded by street right-of-way.
- **Junction Plaza Park** is a 0.2-acre neighborhood park purchased with King County Conservation Futures grant funds that is primarily used for passive use and festivals. It has landscaping, benches, hardscape, and art.
- **West Seattle Junction Park** is a planned 0.4-acre park in development. The new park design includes landscaping, hardscape, a play area, and a picnic area.

4.17.3 Environmental Impacts of the No Build Alternative

The No Build Alternative would not affect any parks or recreational resources in the study area. Unlike the Build Alternatives, the No Build Alternative would not improve access to such resources.

4.17.4 Environmental Impacts of the Build Alternatives during Operation

Sound Transit analyzed the potential long-term impacts of operation of the project Build Alternatives on parks and recreational resources in the study area. If a recreational resource or alternative is not mentioned, no impacts would occur for that resource or alternative.

Long-term impacts would include permanent changes to parks and recreational resources from the project operations. Impacts could include permanent property acquisition or easements; and changes to resource amenities, activities, parking, or access; or and substantial change in the experience of users due to changes in visual conditions and noise levels adjacent to the resource.

The visual and aesthetic resource analysis approach is based upon the Federal Highway Administration methodology for assessing visual impacts related to transportation projects (Federal Highway Administration 1988), along with more recent guidelines (Federal Highway Administration 2015). Further detail on the methods and analysis, including additional and larger visual simulations, is provided in Appendix N.2, Visual and Aesthetics Technical Report. The noise sensitivity analysis was conducted according to the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). Noise-sensitive parks and recreational resources are those where quiet is an essential element in their intended purpose or where it is important to avoid interference with activities such as speech, meditation, and reading. Longfellow Creek Natural Area, in the Delridge Segment, is the one noise-sensitive park and recreational resource in the project study area.

4.17.4.1 SODO Segment

The SODO Segment study area does not contain any parks or recreational resources; therefore, there are no impacts in this segment.

4.17.4.2 Duwamish Segment

Two Duwamish Segment alternatives would have long-term impacts on the Harbor Marina Corporate Center at Terminal 102, West Duwamish Greenbelt, and the 22nd Avenue Southwest Street-end (Table 4.17-1). Alternative DUW-2 would avoid permanent impacts to parks and recreational resources and designated open space areas.

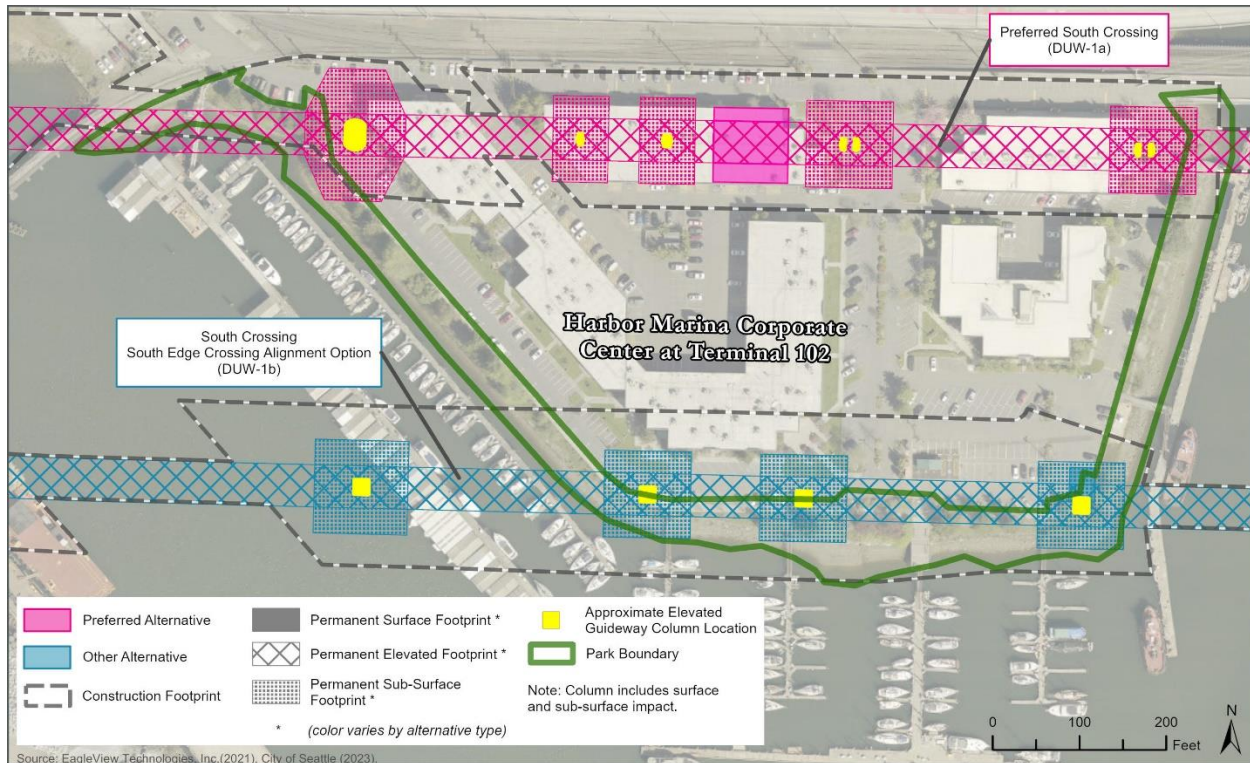
Table 4.17-1. Permanent Impacts to Parks and Recreational Resources in the Duwamish Segment

Alternative	Harbor Marina Corporate Center at Terminal 102	West Duwamish Greenbelt	22nd Avenue Southwest Street-end
Preferred South Crossing Alternative (DUW-1a)	None	1.0 to 1.2 acres	<0.1 acre
South Crossing South Edge Crossing Alignment Option (DUW-1b)	<0.1 acre	1.0 acre	<0.1 acre
North Crossing Alternative (DUW-2)	None	None	None

4.17.4.2.1 Harbor Marina Corporate Center at Terminal 102

Figure 4.17-4 shows the permanent impacts to this resource from the Duwamish Segment alternatives.

Figure 4.17-4. Harbor Marina Corporate Center at Terminal 102 Permanent and Construction Impacts – Duwamish Segment



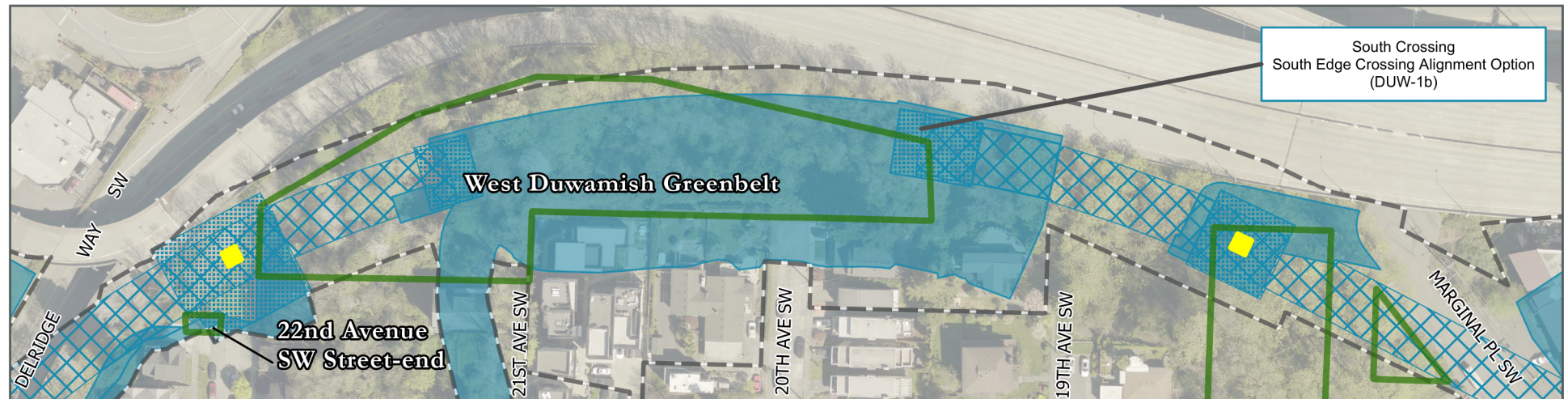
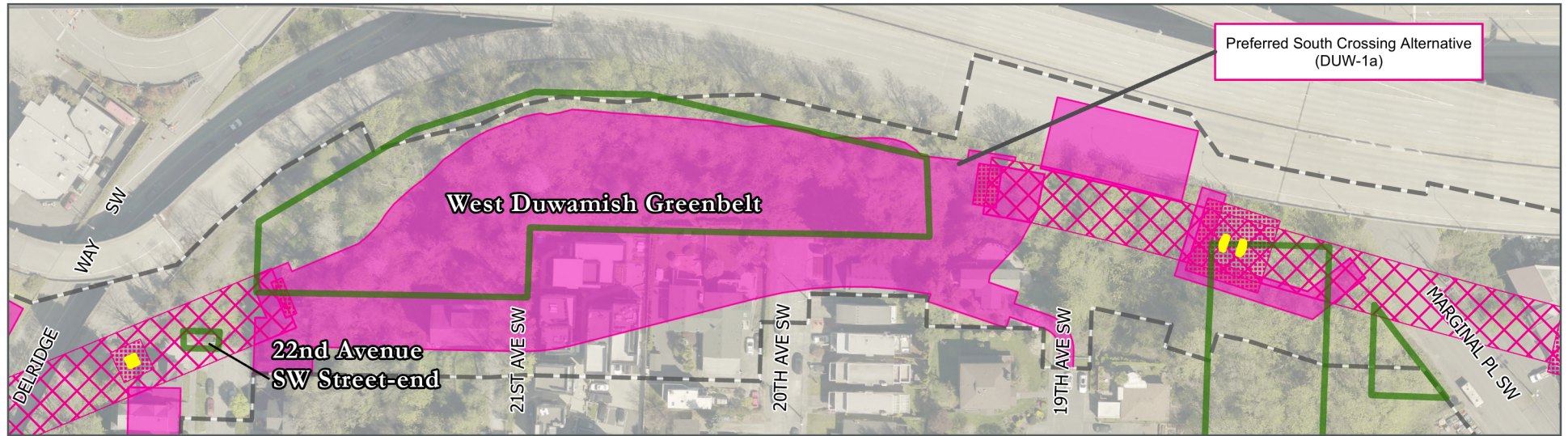
Preferred Alternative DUW-1a would have guideway columns adjacent to the Harbor Marina Corporate Center at Terminal 102 and would not permanently impact the walking path or access to the Harbor Island Marina.

Option DUW-1b would pass directly above Harbor Island Marina and would have guideway columns constructed along the walkway that accesses the marina from the Harbor Marina Corporate Center at Terminal 102. The guideway columns would permanently displace the walking path, which would be relocated.

4.17.4.2.2 West Duwamish Greenbelt

Figure 4.17-5 shows the permanent impacts to this resource from the Duwamish Segment alternatives.

Preferred Alternative DUW-1a and Option DUW-1b would have similar permanent impacts to the north end of the West Duwamish Greenbelt. Both alternatives would remove existing trees for the guideway, which would be either elevated or in a retained cut depending on the alternative it would connect to in the adjacent Delridge Segment. The impacted area would also include a maintenance access road and slope stabilization features. Permanent conditions may allow limited revegetation of the areas adjacent to the guideway and maintenance road. Trees would not likely be allowed due to restrictions on tall vegetation near the guideway.



Source: EagleView Technologies, Inc.(2021), City of Seattle (2023).

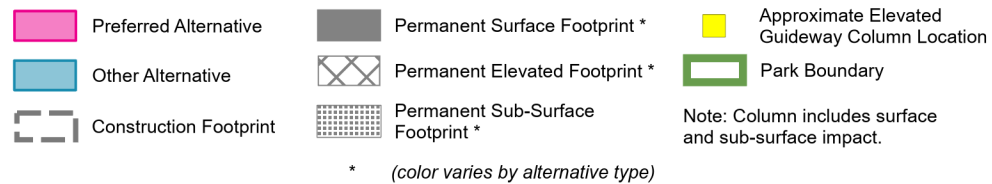
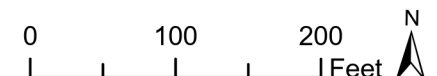


FIGURE 4.17-5
West Duwamish Greenbelt and 22nd Avenue Southwest Street-end Permanent and Construction Impacts Duwamish Segment

West Seattle Link Extension



This area of the greenbelt has a steep grade and does not contain recreational activities, nor is it designed for public access. Preferred Alternative DUW-1a and Option DUW-1b would not affect the greenbelt's recreational trails, which are south of the study area, or the stairway from West Marginal Place to Southwest Charlestown Street in the greenbelt. Selective removal of hazard trees near the guideway could occur. Removal of trees and other vegetation could degrade the current wildlife habitat, which includes a nearby great blue heron rookery (refer to Section 4.9, Ecosystems).

4.17.4.2.3 22nd Avenue Southwest Street-end

Figure 4.17-5 shows the permanent impacts to this resource from the Duwamish Segment alternatives. Preferred Alternative DUW-1a and Option DUW-1b would displace the 22nd Avenue Southwest Street-end. Alternative DUW-2 would avoid impacts to this resource.

4.17.4.3 Delridge Segment

The Delridge Segment alternatives would have long-term impacts on three parks and recreational resources in the study area (Table 4.17-2): Delridge Playfield, Longfellow Creek Natural Area, and West Seattle Golf Course. A summary of the visual impacts to parks and recreational resources in the Delridge Segment is presented in Table L4.17-2 in Appendix L4.17. A detailed discussion of the visual impact analysis and findings is in Section 4.5, Visual and Aesthetic Resources.

4.17.4.3.1 Delridge Playfield

Figure 4.17-6 shows the permanent impacts to this resource from the Delridge Segment alternatives.

Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, and Option DEL-2b would have all project elements outside the Delridge Playfield. Alternative DEL-1a and Option DEL-1b would reduce the quality of views from the park (represented in KOP WS-13; see Appendix N.2); this would be a visual impact. Alternative DEL-2a and Alternative DEL-2b would change the character of the views and would result in a visual impact.

Alternative DEL-3 and Alternative DEL-4 would have the elevated guideway and guideway column permanently impacting a small, vegetated portion of the northwest corner of the Delridge Playfield; this would result in a visual impact to sensitive viewers at Delridge Playfield (represented in KOP WS-13; see Appendix N.2). Both Alternative DEL-3 and Alternative DEL-4 would avoid impacts to all built amenities and active-use areas in the park, whereas Alternative DEL-5, Alternative DEL-6a, Preferred Option DEL-6b, and Alternative DEL-7 would avoid impacts.

4.17.4.3.2 Longfellow Creek Natural Area

Figure 4.17-7 shows the view of the alternatives from the Longfellow Creek Natural Area. All Delridge Segment alternatives would avoid placement of guideway columns in the Longfellow Creek Natural Area. These alternatives would also avoid permanent impacts to the Longfellow Creek Legacy Trail access from Southwest Genesee Street.

Both Option DEL-1b and Option DEL-2b would require minor property acquisition from the Longfellow Creek Natural Area to relocate the sidewalk to the north around the guideway columns. Both would remove vegetated landscaping in the area needed for sidewalk relocation.

The features, access, and functions of the Longfellow Creek Natural Area would not be adversely affected. No noise impacts are predicted for any of the alternatives.

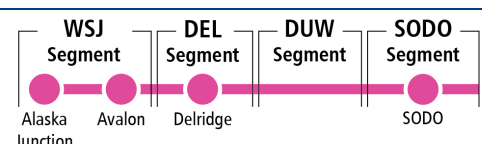
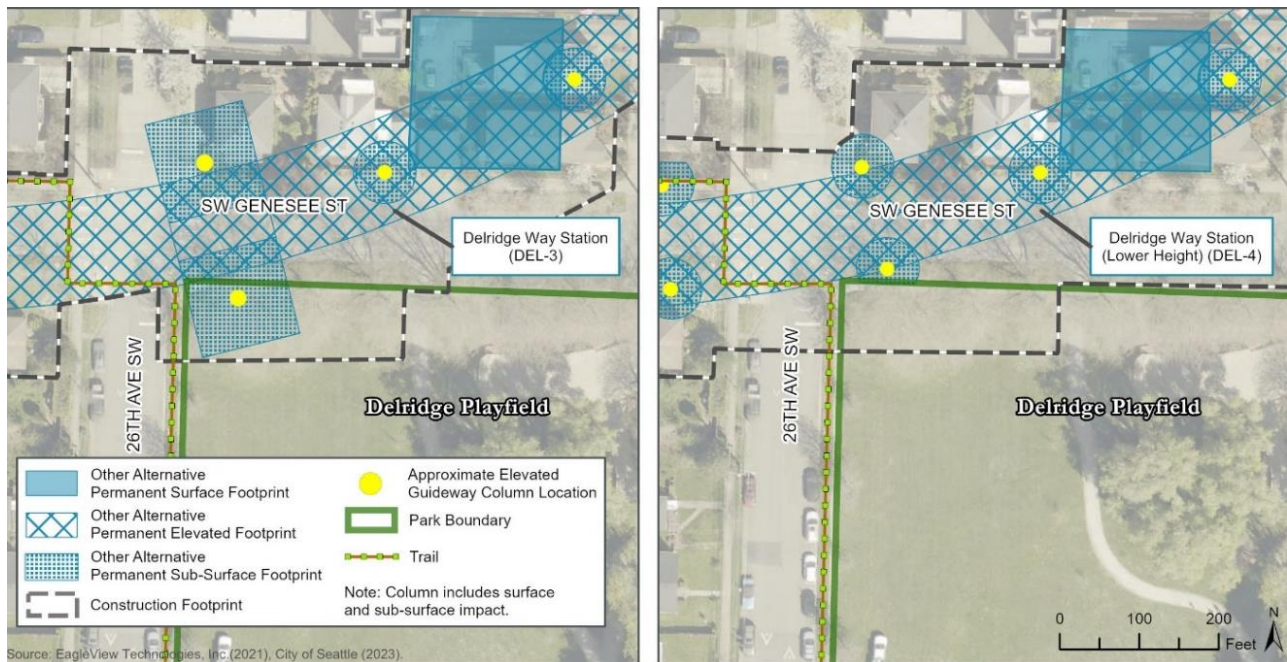


Table 4.17-2. Permanent Impacts to Parks and Recreational Resources in the Delridge Segment

Alternative	Delridge Playfield	Longfellow Creek Legacy Trail	Longfellow Creek Natural Area	West Seattle Golf Course
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	None	None	None	None
Dakota Street Station Alternative (DEL-1a)	None	None	None	None
Dakota Street Station North Alignment Option (DEL-1b)	None	20 linear feet	0.1 acre	None
Dakota Street Station Lower Height Alternative (DEL-2a)	None	None	None	0.7 acre
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	None	<20 linear feet	None	None
Delridge Way Station Alternative (DEL-3)	<0.1 acre	None	None	None
Delridge Way Station Lower Height Alternative (DEL-4)	None	None	None	0.8 acre
Andover Street Station Alternative (DEL-5)	None	None	None	None
Andover Street Station Lower Height Alternative (DEL-6a)	None	None	None	None
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	None	None	None	None

Figure 4.17-6. Delridge Playfield Permanent and Construction Impacts – Delridge Segment



The elevated guideway of Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would be seen by Longfellow Creek Natural Area park users at Dragonfly Garden and Pavilion near 28th Avenue Southwest (represented by KOP WS-17; see Appendix N.2). Visual quality would decrease from average to low-average, but this decrease would not be enough to be considered a visual impact.

Figure 4.17-8 shows the permanent impacts to this resource from the Delridge Segment alternatives.

Figure 4.17-7. View from Longfellow Creek Natural Area

Existing Conditions



Andover Street Station Lower Height (DEL-5); Andover Street Station Alternative (DEL-6a)



Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b); Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)



4.17.4.3.3 Longfellow Creek Legacy Trail

Figure 4.17-8 shows the permanent impacts to this resource from the Delridge Segment alternatives.

Alternative DEL-1a, Option DEL-1b, Alternative DEL-2a, Option DEL-2b, Alternative DEL-3, and Alternative DEL-4 would all construct an elevated guideway over portions of Southwest Genesee Street in the vicinity of the Longfellow Creek Trail but would avoid placement of guideway columns on the trail inside the Longfellow Creek Natural Area. Alternative DEL-5 and Alternative DEL-6a would not impact the trail. Preferred Option DEL-6b and Alternative DEL-7 would construct an elevated guideway over portions of private property north of Southwest Yancy Street in the vicinity of the Longfellow Creek Legacy Trail but would not impact the trail.

Option DEL-1b and Option DEL-2b would permanently encroach upon about 20 feet of the Longfellow Creek Legacy Trail near its access point off Southwest Genesee Street. After construction, the trail connection stairway to the sidewalk on Southwest Genesee Street would need to be relocated slightly northward due to road widening to accommodate placement of guideway columns. However, the relocated trail access would provide the same function as the current trail access, and trail users would be able to use the same trail in the same manner they do today.

Alternative DEL-1a and Option DEL-1b would also permanently reduce the quality of views along a few other sections of the trail (represented by KOP WS-17; see Appendix N.2); this would be a visual impact. The elevated guideway of Preferred Option DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would be seen by park users at the trailhead of the Longfellow Creek Legacy Trail at Southwest Yancy Street; for these alternatives, the visual quality at the trailhead would decrease from average to low average and would be not a visual impact.

4.17.4.3.4 West Seattle Golf Course

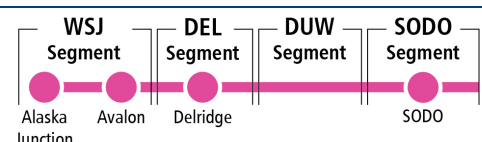
Figure 4.17-8 shows the permanent impacts to this resource from the Delridge Segment alternatives.

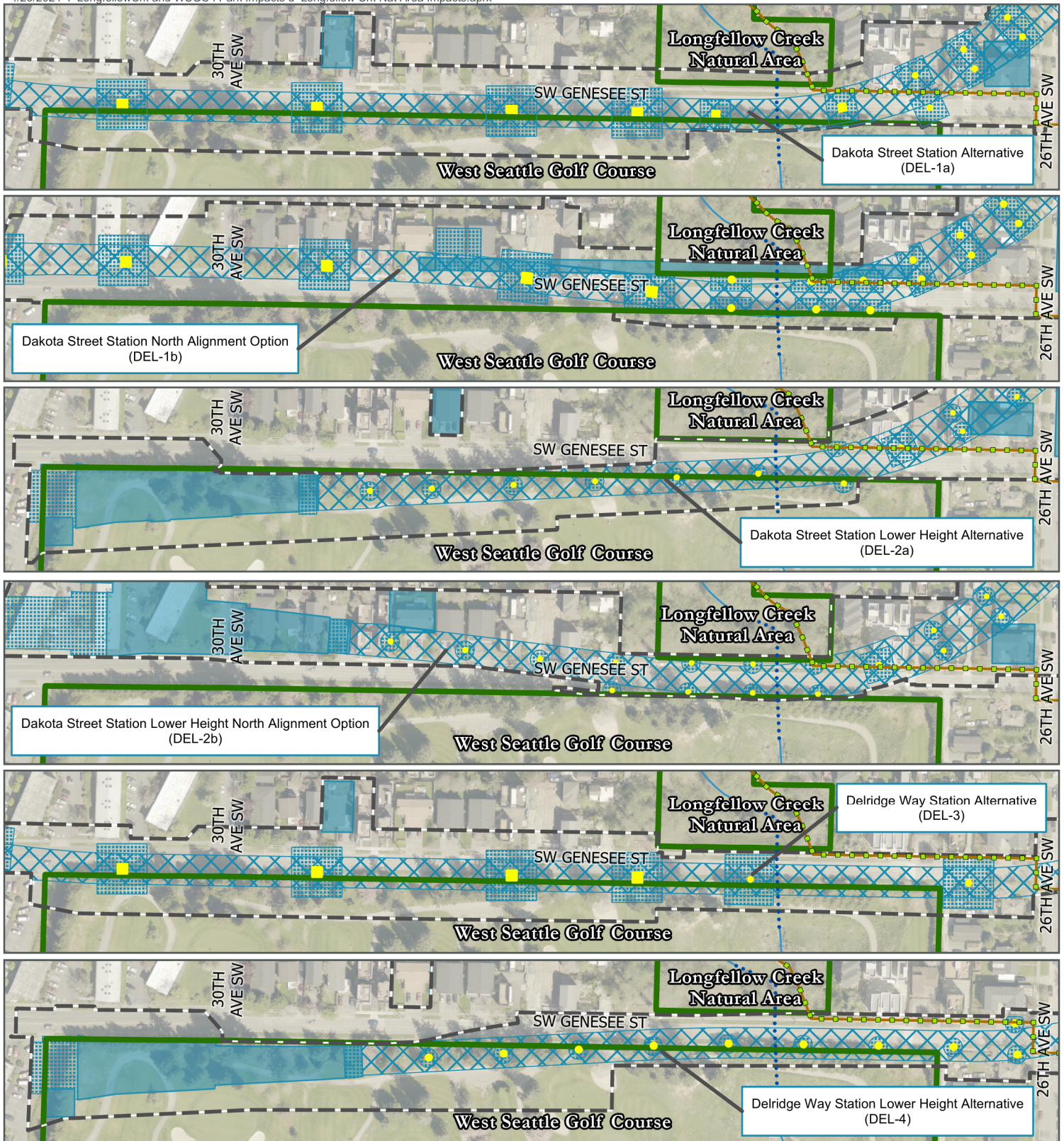
All Delridge Segment alternatives except Preferred Alternative DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have a permanent impact to the West Seattle Golf Course (Table 4.17-2). The alternatives vary in height and the extent to which they would remove trees at the north end of the West Seattle Golf Course property. All Delridge Segment alternatives except Preferred Alternative DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would change either or both the character or quality of views from the West Seattle Golf Course (represented by KOP WS-20; see Appendix N.2); this would be a visual impact. Figure 4.17-9 shows the view of the alternatives from the golf course.

Alternative DEL-1a and Alternative DEL-3 would impact a small area along the north end of the golf course property and would require vegetation and tree removal. Guideway columns would be on the south side of the Southwest Genesee Street right-of-way, outside of park property, with the foundations requiring an underground easement along the north edge of the golf course property. Both of these alternatives would also require aerial easements where the guideway would overhang the property. This would not result in a permanent change to the playable area. Due to the height of the elevated guideway, no permanent impacts on golf course operations are anticipated.

Option DEL-1b and Option DEL-2b would be on the north side of Southwest Genesee Street, with fewer impacts to the West Seattle Golf Course than the alternatives on the south side of Southwest Genesee Street. Both would construct an elevated guideway with straddle bents at the northeast end of the golf course before crossing to the north side of the street. The impact would consist of an underground easement for column foundation, but the column would be outside of park property. Neither alternative would permanently impact the playable area of the golf course.

Both Alternative DEL-2a and Alternative DEL-4 would have the greatest impact on the West Seattle Golf Course. These alternatives are aligned on the south side of Southwest Genesee Street, removing some playable area along the north property boundary. Both alternatives transition from an elevated guideway to a tunnel at the northwest end of the golf course and would permanently alter at least five holes and require shortening or reconfiguring of these holes. Changes to these holes could potentially affect the United States Golf Association Handicap System rating of the West Seattle Golf Course, which could make this course less desirable to play. Protective fencing would need to be installed for these alternatives between the course and the guideway to prevent golf balls from falling on the guideway or hitting passing trains.





Source: EagleView Technologies, Inc.(2021), City of Seattle (2023).

- Other Alternative Permanent Surface Footprint
- Other Alternative Permanent Elevated Footprint
- Other Alternative Permanent Sub-Surface Footprint
- Construction Footprint
- Approximate Elevated Guideway Column Location
- Park Boundary
- Trail
- Stream
- Piped Stream

Note: Column includes surface and sub-surface impact.

FIGURE 4.17-8
Longfellow Creek Natural Area, Longfellow Creek
Legacy Trail and West Seattle Golf Course
Permanent and Construction Impacts
Delridge Segment

West Seattle Link Extension



Figure 4.17-9. View from West Seattle Golf Course

Existing Conditions



Dakota Street Station Alternative (DEL-1a); Delridge Way Station Alternative (DEL-3)



Dakota Street Station Lower Height Alternative (DEL-2a); Delridge Way Station Lower Height Alternative (DEL-4)



4.17.4.4 West Seattle Junction Segment

The West Seattle Junction Segment alternatives would have long-term impacts on two parks and recreational resources in the study area: Fauntleroy Place and Junction Plaza Park.

4.17.4.4.1 Fauntleroy Place

Alternative WSJ-1 and Alternative WSJ-2 would fully acquire and permanently displace Fauntleroy Place. Both alternatives would have a guideway column within the park area.

4.17.4.4.2 Junction Plaza Park

Option WSJ-3b would fully acquire and displace Junction Plaza Park. This area would be used for a station entrance.

Other alternatives in the West Seattle Junction Segment would not have long-term impacts on parks and recreational resources.

4.17.5 Environmental Impacts of the Build Alternatives during Construction

Sound Transit analyzed the potential construction impacts of the project Build Alternatives on parks and recreational resources in the study area. If a recreational resource or alternative is not mentioned, no impacts would occur for that resource or alternative.

Construction effects in the study area would include construction activities and easements, road or lane closures and detours, construction traffic, visual impacts, light, glare, dust, noise, and trail closures and detours that could temporarily alter the resources, impact their function, or reduce or modify access to the resources.

4.17.5.1 Impacts Common to All Build Alternatives

Where construction would be adjacent to or on park property, park users might experience minor proximity effects, including increased noise, dust, and temporary use and access restrictions. Construction best management practices would be used to minimize these effects, and these effects are not likely to substantially affect the use of these resources.

For all alternatives, there is potential for temporary construction-related increases in noise levels at nearby parks. However, construction noise levels are not anticipated to substantially affect the use of these resources. Section 4.7, Noise and Vibration, and Appendix N.3, Noise and Vibration Technical Report, provide additional information on the potential construction-period noise levels.

4.17.5.2 SODO Segment

The SODO Segment does not contain any park or recreational resources and therefore there are no construction impacts in this segment.

4.17.5.3 Duwamish Segment

The Duwamish Segment alternatives would temporarily impact three parks and recreation resources in the study area (Table 4.17-3).

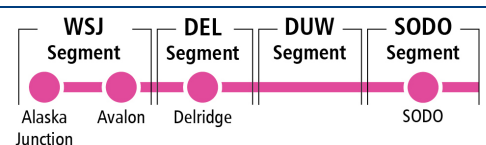
Table 4.17-3. Temporary Impacts to Parks and Recreational Resources in the Duwamish Segment

Alternative	Harbor Marina Corporate Center at Terminal 102	West Duwamish Greenbelt	Terminal 18 Park
Preferred South Crossing Alternative (DUW-1a)	0.5 acre	0.2 to 0.4 acre	None
South Crossing South Edge Crossing Alignment Option (DUW-1b)	1.1 acres	0.5 acre	None
North Crossing Alternative (DUW-2)	None	None	None ^a

^a No impact beyond minor proximity effects.

4.17.5.3.1 Harbor Marina Corporate Center at Terminal 102

Figure 4.17-4 shows the temporary construction impacts to this resource from the Duwamish Segment alternatives.



Preferred Alternative DUW-1a would temporarily impact the Harbor Marina Corporate Center at Terminal 102. Construction of this alternative would place column foundations under the resource and would require temporary closure of the waterfront walkway on the northwest end of Harbor Island for up to 1.5 years. The impacted area of the resource would be restored for public access following construction.

Option DUW-1b would construct the elevated guideway and bridge foundations within the Harbor Marina Corporate Center at Terminal 102 property. Construction of this alternative would require temporary closure of the waterfront walkway on the south end of Harbor Island for up to 4 years.

Alternative DUW-2 would avoid temporary impacts to the Harbor Marina Corporate Center at Terminal 102 during construction.

4.17.5.3.2 West Duwamish Greenbelt

Figure 4.17-5 shows the temporary construction impacts to the greenbelt from the Duwamish Segment alternatives.

Preferred Alternative DUW-1a and Option DUW-1b would, in addition to the permanent impacts to the north end of the greenbelt, temporarily impact the West Duwamish Greenbelt, depending on the connection to the Delridge alternatives. Connections to Preferred Alternative DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have less impact than connections to other Delridge Segment alternatives. Both Preferred Alternative DUW-1a and Option DUW-1b would clear vegetation from the area needed for construction and use it for staging and equipment movement. Both alternatives propose temporary work trestles to minimize slope disturbance during construction. As discussed in Chapter 3, Transportation, construction activities for both alternatives would require temporary closure of the stairway in the greenbelt that connects West Marginal Place with Southwest Charlestown Street for up to 3 years while construction occurs across it. A portion of the Delridge Connector Trail in the West Duwamish Greenbelt property will be detoured during construction for up to 4 years. Refer to Chapter 3 for more information about impacts to multi-use trails.

4.17.5.3.3 Terminal 18 Park

Alternative DUW-2 could have minor temporary proximity effects at Terminal 18 Park during construction. This alternative could affect access to the park due to temporary roadway lane closures during the construction period. This park is not accessible by water, and therefore in-water work would not affect park access.

4.17.5.4 Delridge Segment

All Delridge Segment alternatives except Preferred Alternative DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have temporary impacts to parks and recreational resources in the study area (Table 4.17-4).

4.17.5.4.1 Delridge Playfield

Figure 4.17-6 shows the temporary construction impacts to this resource from the Delridge Segment alternatives.

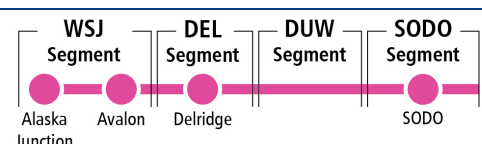


Table 4.17-4. Temporary Impacts to Parks and Recreational Resources in the Delridge Segment

Alternative	Delridge Playfield	Longfellow Creek Legacy Trail	Longfellow Creek Natural Area	West Seattle Golf Course
Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	None	None	None ^a	None
Dakota Street Station Alternative (DEL-1a)	None	None	0.1 acre	1 acre
Dakota Street Station North Alignment Option (DEL-1b)	<0.1 acre	600 linear feet	0.1 acre	0.2 acre
Dakota Street Station Lower Height Alternative (DEL-2a)	None	None	None	1.2 acre
Dakota Street Station Lower Height North Alignment Option (DEL-2b)	None	600 linear feet	<0.1 acre	0.2 acre
Delridge Way Station Alternative (DEL-3)	0.1 acre	None	None	1.2 acre
Delridge Way Station Lower Height Alternative (DEL-4)	0.1 acre	None	None ^a	0.8 acre
Andover Street Station Alternative (DEL-5)	None	None	None	None
Andover Street Station Lower Height Alternative (DEL-6a)	None	None	None	None
Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)	None	None	None ^a	None

^a No impact beyond minor proximity effects.

Alternative DEL-3 and Alternative DEL-4 would have temporary construction impacts to Delridge Playfield. Both alternatives would use the northwest corner of the Delridge Playfield to construct the elevated guideway. There are no built park amenities in the affected area. Trees and grass would be cleared from the corner of the playfield affected by construction. Although the temporary effects of construction activity would not prohibit use of the playfield, both alternatives could temporarily impact access to the pathway within the park from Southwest Genesee Street for short periods of time. The pathway in the park would remain open during construction (approximately 1.5 years). These alternatives would not impact the alternate pathway, which accesses the resource from the east on Delridge Way Southwest.

4.17.5.4.2 Longfellow Creek Natural Area

Figure 4.17-8 shows the temporary construction impacts to this resource from the Delridge Segment alternatives.

Alternative DEL-1a, Option DEL-1b, and Option DEL-2b would temporarily encroach upon the southern boundary of the Longfellow Creek Natural Area along Southwest Genesee Street (approximately 2 years). These alternatives would use a temporary work trestle to move equipment above the Longfellow Creek Natural Area and to minimize disturbance of this resource. Trees would be removed in the area of the temporary work trestle, and columns would be placed within the boundary of the resource.

Preferred Option DEL-6b and Alternative DEL-7 would involve construction on a private parcel on Southwest Yancy Street across from Longfellow Creek Natural Area, but access would be maintained during construction and visual and noise impacts would be minimal (see Figure 4.17-7). Both Preferred Option DEL-6b and Alternative DEL-7 would have minor temporary proximity effects at the Longfellow Creek Natural Area.

4.17.5.4.3 Longfellow Creek Legacy Trail

Figure 4.17-8 shows the temporary construction impacts to this resource from the Delridge Segment alternatives.

Preferred Alternative DEL-6b and Alternative DEL-7 would involve construction on a private parcel on Southwest Yancy Street across from the northern trailhead of the Longfellow Creek Legacy Trail, but access would be maintained during construction.

4.17.5.4.4 West Seattle Golf Course

Figure 4.17-8 shows the temporary construction impacts to this resource from the Delridge Segment alternatives.

All alternatives except Preferred Alternative DEL-6b, Alternative DEL-5, Alternative DEL-6a, and Alternative DEL-7 would have additional impacts during construction at the West Seattle Golf Course. Temporary fencing along the north side of the golf course would be installed to prevent golf balls going into the construction area for all of these alternatives.

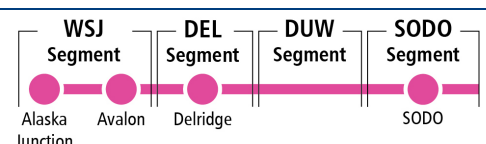
Alternative DEL-1a and Alternative DEL-3 would encroach on up to three greens and the golf cart path on the north end of the golf course. Alternative DEL-3 would have additional impacts on the golf course property but would not impact additional playable area. Some guideway construction activities that involve large cranes (such as girder placement) might affect use of the golf course nearby. In general, these construction activities have short time durations of less than an hour but could restrict play on nearby holes during that time.

Both Option DEL-1b and Option DEL-2b would largely avoid additional construction impacts to the West Seattle Golf Course. A small construction area at the northeast corner of the golf course property would temporarily re-align the golf cart path for a short distance for the duration of the guideway construction, which would be between 2 and 3 years. These alternatives would use the least additional amount of golf course property since construction would mostly occur on the north side of Southwest Genesee Street, across from the golf course.

Alternative DEL-2a and Alternative DEL-4 would have the greatest overall construction impacts to the West Seattle Golf Course and could include additional temporary impacts to greens that have permanent impacts. Alternative DEL-4 would have slightly greater impacts because it would enter the West Seattle Golf Course property farther to the east, but it would not impact any additional playable area. Both alternatives would construct an elevated guideway that transitions into a tunnel along the north side of the golf course, and the temporary encroachment would extend farther into the playable area of the golf course than either Alternative DEL-1a or Alternative DEL-3. The duration of the impacts for Alternative DEL-2a and Alternative DEL-4 would be about 2 years.

4.17.5.5 West Seattle Junction Segment

The construction of Preferred Option WSJ-5b, Alternative WSJ-3a, Alternative WSJ-4, Alternative WSJ-5a, and Alternative WSJ-6 would have minor temporary proximity effects at the West Seattle Junction Park.



4.17.6 Indirect Impacts of the Build Alternatives

Sound Transit analyzed the potential indirect impacts of the project Build Alternatives on parks and recreational resources in the study area. If a recreational resource or alternative is not mentioned, no impacts would occur for that resource or alternative.

Potential indirect impacts during operation could include changed or reduced access, changes in the nature of surrounding land uses, increased noise and/or vibration, or a general increase in the level of activity near stations that could affect the continued use of the specific park or recreational facility.

4.17.6.1 Impacts Common to All Build Alternatives

Parks and recreational resources within 0.5 mile of light rail stations along the project corridor are listed in Appendix L4.17 (Table L4.17-1). The project would improve public access to most of these resources, particularly those closest to new stations. Underutilized parks could experience activation as the parks continue to see increasing numbers of visitors. The resources most likely to experience increased accessibility due to people walking to the parks from the stations are described for each segment below. If a physical barrier such as a freeway (for example, Interstate 5) would prevent park or recreational resource users from readily accessing a new station, this benefit to the resource is not described.

Transit-oriented development (TOD) that could occur around station areas is described in Section 4.2, Land Use. Development around station areas would be consistent with City of Seattle planning and zoning. TOD near station areas could increase use of the parks near the stations. TOD could also increase ambient noise heard in nearby parks. However, the parks are urban in nature and their use is not anticipated to be affected by increases in ambient noise.

4.17.6.2 SODO Segment

The SODO Segment does not contain any park or recreational resources, and therefore there would be no indirect impacts in this segment.

4.17.6.3 Duwamish Segment

Indirect effects from the Duwamish Segment Build Alternatives would not impact parks and recreational resources in the Duwamish Segment. There are no stations in this segment to provide increased access or that would spur TOD.

4.17.6.4 Delridge Segment

Indirect effects of the Delridge Segment Build Alternatives would not impact parks and recreational resources in the Delridge Segment. Resources most likely to benefit from increased accessibility from all Delridge Segment alternatives are the Longfellow Creek Natural Area and Delridge Playfield.

4.17.6.5 West Seattle Junction Segment

Indirect effects of the West Seattle Junction Segment Build Alternatives would not impact parks and recreational resources. The Rotary Viewpoint, West Seattle Stadium, Camp Long, and West Seattle Golf Course are the resources most likely to benefit from increased accessibility and potential activation from one or more of the new stations. The Avalon Station (for all alternatives) and the Alaska Junction Station (for Alternative WSJ-2) would likely increase use of these parks due to improved access.

All West Seattle Junction alternatives except Alternative WSJ-2 and Option WSJ-3b would be close to the West Seattle Junction Park and the Junction Plaza Park. The proximity of these resources to the new station locations could result in increased use. Option WSJ-3b would remove Junction Plaza Park, and therefore the station location would not improve access.

4.17.7 Mitigation Measures

According to City of Seattle Ordinance 118477, City park land acquired by the project would need to be replaced with land of equivalent or better size, value, location, and usefulness. Sound Transit would continue to work with the City to identify appropriate replacement property for mitigation where park property would be permanently acquired for the project consistent with Ordinance 118477.

Restoration of park facilities is assumed to be part of the project, and Sound Transit would coordinate with the resource owner to restore temporarily disturbed parks and recreational resources after construction, consistent with clear zone requirements for trees near the guideway. During construction, pedestrian access to parks and trails would be routed to the remaining open portions of the facilities.

Sound Transit would coordinate with the Washington State Recreation and Conservation Office regarding mitigation for parks and recreation resources they have funded. Up to two parcels in the West Duwamish Greenbelt that could be affected received funding from this office. Portions of the Longfellow Creek Natural Area that received funding from this office would not be affected. If Junction Plaza Park were displaced, an equivalent replacement property would be agreed to with the City to meet grant requirements.

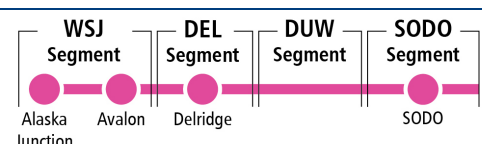
Potential mitigation for visual impacts in parks is described in Section 4.5. Additional potential site-specific mitigation is described below. Other measures to mitigate affected resources could include financial compensation or park enhancement, where appropriate.

4.17.7.1 Duwamish Segment

There would be no further mitigation for Harbor Marina Corporate Center at Terminal 102 or Terminal 18 Park beyond the mitigation described for all resources in Section 4.17.7.

4.17.7.1.1 West Duwamish Greenbelt

It is assumed that replacement park land would be purchased by Sound Transit and conveyed to the City of Seattle as agreed to by the City. However, if agreed to by the City of Seattle and consistent with Ordinance 118477, Sound Transit would provide funds for purchase of replacement property.



Sound Transit would also coordinate with the Washington State Recreation and Conservation Office regarding mitigation for parks and recreation resources they have funded. Two parcels in the West Duwamish Greenbelt that could be affected received funding from this office.

4.17.7.1.2 22nd Avenue Southwest Street-end

Sound Transit would work with the Pigeon Point community and the City of Seattle to identify opportunities to replace the 22nd Avenue Street-end for Preferred Alternative DUW-1a and Option DUW-1b, which would displace this resource.

4.17.7.2 Delridge Segment

There would be no further mitigation for Delridge Playfield, Longfellow Creek Natural Area, or Longfellow Creek Legacy Trail beyond the mitigation is described for all resources in Section 4.17.7.

4.17.7.2.1 West Seattle Golf Course

Sound Transit would coordinate with the City of Seattle to minimize effects to the West Seattle Golf Course to the extent possible if a Delridge Segment alternative that affects this resource is selected as the project to be built.

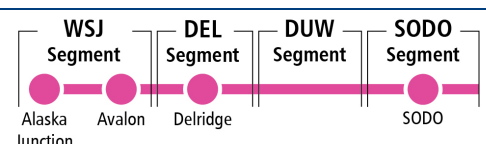
For Alternative DEL-1a and Alternative DEL-3, the playable area impacted could be reconfigured to minimize some of the construction impacts. This reconfiguration is not expected to close holes for an extended period of time, and modifications to holes and the pathway are expected to be temporary changes. The current configuration of holes and the pathway would be restored following guideway construction. Restoration could take up to a year for construction and growing of turf.

For Alternative DEL-2a and Alternative DEL-4, Sound Transit would work with the City to reconfigure the playable area of at least the holes impacted by long-term operation and construction or make other improvements deemed appropriate to restore the function of the golf course. For these alternatives, design of the reconfigured holes could take 1 to 2 years. It could take an additional 18 months to 2 years for construction and growing of turf.

4.17.7.3 West Seattle Junction Segment

There would be no further mitigation for Fauntleroy Place beyond what is described in Section 4.17.7.

Sound Transit would coordinate with the King County regarding mitigation for impacts to parks acquired using Conservation Futures grant funds. If Junction Plaza Park were displaced, an equivalent replacement property would be agreed to with the City of Seattle to meet grant requirements.



4.18 Section 4(f) Summary

4.18.1 Introduction to Resource and Regulatory Requirements

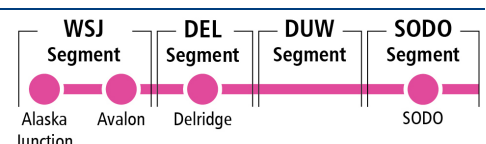
This section summarizes potential West Seattle Link Extension Project (the project) effects on Section 4(f) resources from project alternatives. Section 4(f) of the United States Department of Transportation Act of 1966 (United States Code Title 49 Section 303[c]) protects publicly owned parks, recreation areas, and wildlife and waterfowl refuges, as well as historic sites. Section 4(f) requires consideration of the following:

- Parks and recreational areas of national, state, or local significance that are both publicly owned and open to the public.
- Wildlife and waterfowl refuges of national, state, or local significance that are publicly owned and open to the public to the extent that public access does not interfere with the primary purpose of the refuge.
- Historic sites of national, state, or local significance in public or private ownership, regardless of whether they are open to the public, that are listed in, or eligible for, the National Register of Historic Places (National Register) as identified according to Section 106 of the National Historic Preservation Act. Within a National Register-listed or eligible historic district, Section 4(f) applies to those properties that are considered contributing to the eligibility of the historic district, as well as any individually eligible property within the district.
- In addition, Section 4(f) applies to all archaeological sites in or eligible for inclusion in the National Register, including those discovered during construction, except when Federal Transit Administration (FTA) concludes that the archaeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place, and the official(s) with jurisdiction over the Section 4(f) resource have been consulted and have not objected (Section 774.13(b)).

Under Section 4(f), the FTA cannot approve the “use” of a Section 4(f) resource unless it determines that:

- There is no feasible and prudent avoidance alternative to the use of land from the property; and the action includes all possible planning to minimize harm to the property resulting from such use; or
- The use of the property, including any measure(s) to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures) committed to by the applicant, will have a *de minimis* impact on the property.

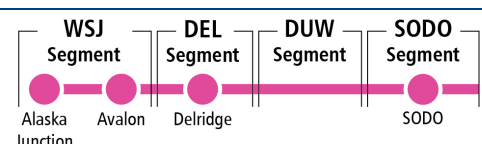
The potential Section 4(f) resources in the study area were identified first. These resources are described in detail in Section 3.1, Section 4(f) Resources in the Study Area, of Appendix H, Final Section 4(f) Evaluation, and summarized in Section 4.18.2, Affected Environment, of this section. The FTA and Sound Transit then proposed determinations that some park and recreational resources are not significant and, therefore, are not Section 4(f) resources. The FTA and Sound Transit have requested and received concurrence on the significance of resources from the officials with jurisdiction. For the remaining significant resources, FTA and Sound Transit have made determinations about the extent to which the project would use each property. Attachment H.1, Section 4(f) Status of Parks and Recreational Resources in the Study Area, to Appendix H lists the parks and recreational resources in the study area and identifies which are Section 4(f) resources.



All the historic resources in the study area that are included in or eligible for inclusion in the National Register are Section 4(f) resources. There are no known archaeological sites that would be affected by the project, but sites discovered during construction and determined eligible for the National Register would be evaluated pursuant to Sections 774.9(e) and 774.11(f). The Section 106 findings in the project Section 4(f) evaluation are described in Appendix N.5, Historic and Archaeological Resources Technical Report. The proposed type of Section 4(f) use was determined for each resource as one of the following Section 4(f) use types:

- **Permanent Use.** A permanent use occurs when land from a Section 4(f) property is permanently incorporated by a transportation project.
- **Temporary Occupancy.** A temporary occupancy occurs when the project temporarily uses Section 4(f) property during construction. Temporary occupancy is not a Section 4(f) use, known as a temporary use exception, if the following criteria, as outlined in Code of Federal Regulations Title 23 Section 774.13(d), are met:
 - “Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;
 - Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
 - There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
 - The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
 - There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.”
- **Constructive Use.** A constructive use occurs when a transportation project does not incorporate a Section 4(f) property, but the project’s proximity impacts are so severe that the protected activities, features, or attributes that qualify a property for protection under Section 4(f) are substantially impaired (Code of Federal Regulations Title 23 Section 774.15(a)).
- **De minimis Use.** A determination of *de minimis* use can be made if the project would not adversely affect the features, attributes, or activities that make the Section 4(f) property significant based on a consideration of impacts and mitigation measures. A *de minimis* determination for a park, recreation area, wildlife, or waterfowl refuge can only be made after receipt and consideration of public comment, and after FTA receives written concurrence from the official(s) with jurisdiction. A *de minimis* determination for a historic resource necessitates prior written concurrence from the applicable State Historic Preservation Officer (or Tribal Historic Preservation Officer) of “no adverse effect” or “no historic properties affected” under Section 106.

A permanent use where impacts would be greater than *de minimis*, temporary occupancy that does not qualify as a temporary use exception, and constructive use are considered uses and require an evaluation of whether there would be a feasible and prudent avoidance alternative.



4.18.2 Affected Environment

This section summarizes the Section 4(f) analysis completed in compliance with Section 4(f) of the United States Department of Transportation Act of 1966 (United States Code Title 49 Section 303[c]). The full Section 4(f) analysis can be found in Appendix H. The study area for the project Final Section 4(f) evaluation, shown on Figure 4.18-1, includes both the direct impact study area used for the parks and recreational resources analysis (which is 250 feet around the alternatives, construction staging areas, and ancillary facilities) and the area of potential effects for historic and archaeological resources, which was established in accordance with Section 106 of the National Historic Preservation Act. As the project advances, FTA and Sound Transit will continue to consult with the State Historic Preservation Officer and other consulting parties on the area of potential effects to address specific concerns regarding historic districts and individual resources. See Section 4.16.2, Affected Environment, in Section 4.16, Historic and Archaeological Resources, for a description of the area of potential effects for the project.

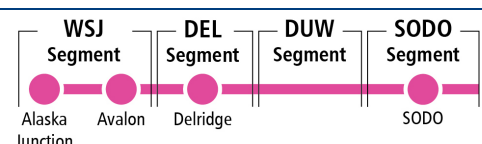
The Section 4(f) resources in the project study area are mapped on Figures 3-1a through 3-1 of Appendix H and are summarized in Table 4.18-1 through Table 4.18-4. Attachment H.1 lists the parks and recreational facilities in the study area and identifies those which are not Section 4(f) resources and why. More information about the parks and recreational resources in the study area can be found in Section 4.17, Parks and Recreational Resources. More information about historic and archaeological resources can be found in Section 4.16 and Appendix N.5.

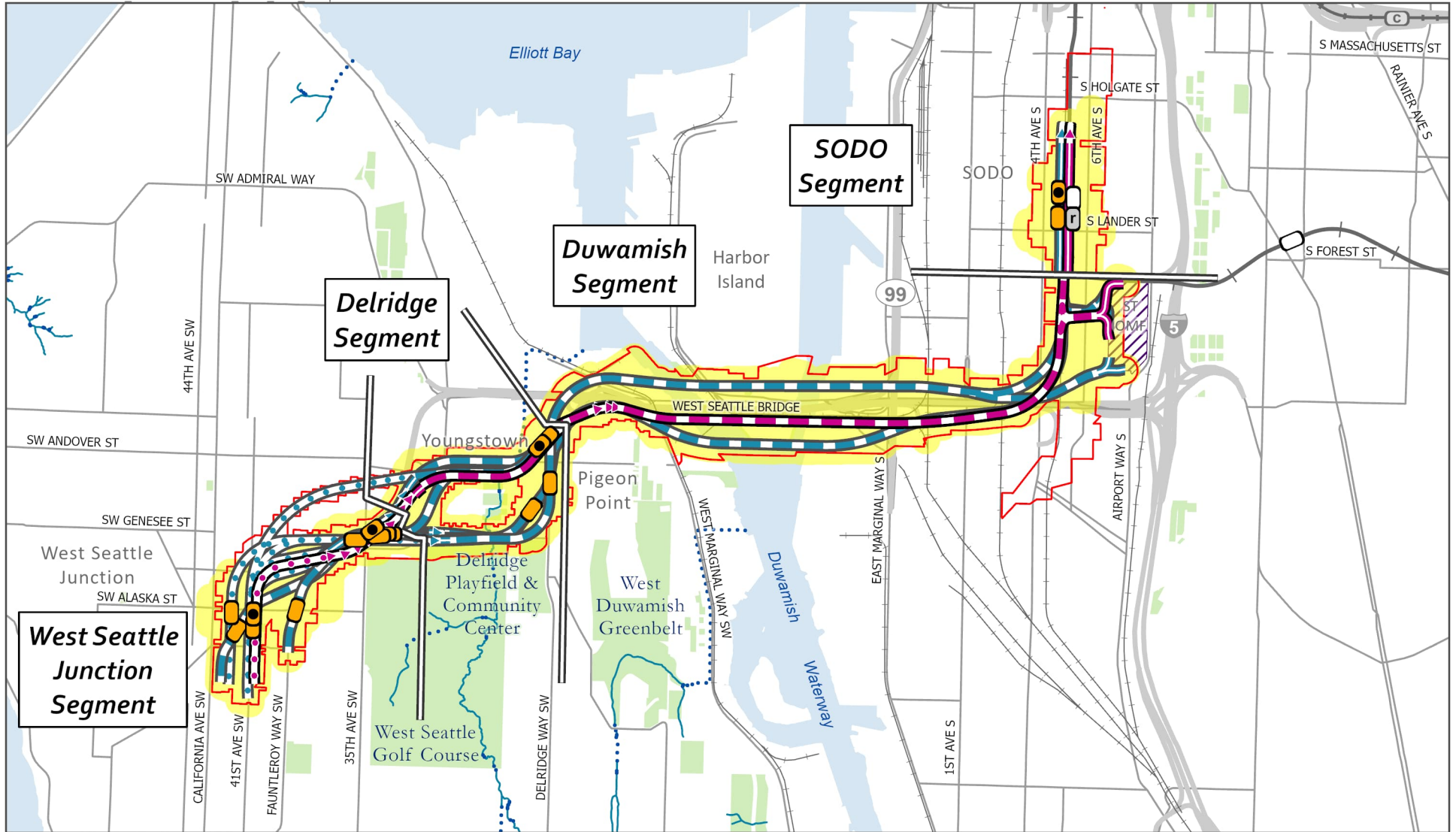
There are five trails in the study area that are used by both commuters and recreationists:

- SODO Trail
- West Seattle Bridge Trail
- Duwamish Trail
- Delridge Connector Trail
- Alki Trail

FTA has determined that these trails are part of the transportation system and function primarily for transportation based on the Seattle Department of Transportation's inclusion of these trails in its Bicycle Master Plan (City of Seattle 2014). These multi-use, paved trails are entirely or mostly within public right-of-way, and are part of the existing bicycle network, which is considered an extension of the City's transportation network by the City of Seattle. Therefore, these trails are not subject to Section 4(f) protection in accordance with Code of Federal Regulations Title 23 Section 774.13(f)(4). Potential impacts to these trails are discussed in Section 3.7, Affected Environment and Impacts During Operation – Non-motorized Facilities, in Chapter 3, Transportation Environment and Consequences.

The official with jurisdiction for each Section 4(f) park and recreational resource is the resource owner identified in Section 3.1 of Appendix H; the official with jurisdiction for Section 4(f) historic resources is the State Historic Preservation Officer. For individual properties that are eligible for Section 4(f) protection as both a park resource and a historic resource, Sound Transit has consulted with the official with jurisdiction for that resource as well as the State Historic Preservation Officer.





Source: City of Seattle, King County (2023).

Preferred Alternative

- Elevated
- At-Grade
- Tunnel
- Retained Cut
- Other Alternatives**
- Elevated
- At-Grade
- Tunnel
- Retained Cut
- Station** (● Indicates Preferred Alternative)
- New
- Relocated
- Existing

- Segment Line
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park

- Area of Potential Effects
- Parks Study Area

FIGURE 4.18-1
West Seattle Link Extension
Section 4(f) Study Area

West Seattle Link Extension

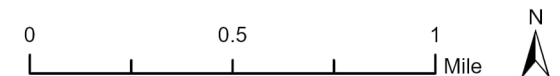


Table 4.18-1. Summary of Section 4(f) Resources in the Study Area

Segment	Number of Park/Recreation Resources	Number of Historic Resources
SODO	0	7
Duwamish	3	58
Delridge	4	14
West Seattle Junction	3	31
Linear resources spanning multiple segments	0	1

4.18.3 Section 4(f) Uses

If a Section 4(f) resource is not mentioned in this section (including Tables 4.18-2 through 4.18-4), there is no use of that resource under any alternative. The full Section 4(f) analysis can be found in Appendix H.

4.18.3.1 SODO Segment

There would be one Section 4(f) use associated with SODO Segment alternatives: the Graybar Electric Company Building historic resource would incur a use under all SODO Segment alternatives.

4.18.3.2 Duwamish Segment

Table 4.18-2 provides a summary of the Section 4(f) use determinations for the Duwamish Segment alternatives.

4.18.3.3 Delridge Segment

Table 4.18-3 provides a summary of the Section 4(f) uses for the Delridge Segment alternatives.

4.18.3.4 West Seattle Junction Segment

Table 4.18-4 provides a summary of the Section 4(f) use determinations for the West Seattle Junction Segment alternatives.

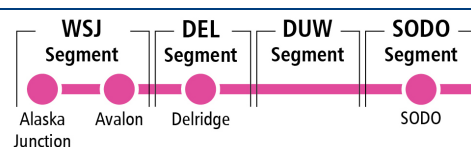


Table 4.18-2. Summary of Section 4(f) Use Determinations by Alternative for the Duwamish Segment

Resource	Preferred South Crossing Alternative (DUW-1a)	South Crossing South Edge Crossing Alignment Option (DUW-1b)	North Crossing Alternative (DUW-2)
West Duwamish Greenbelt	<i>de minimis</i>	<i>de minimis</i>	No use
Terminal 25 Wildlife Refuge	No use	No use	Use
Viking Automatic Sprinkler Company	No use	No use	Use
Pacific Forge Company/Bethlehem Steel Nut and Bolt Factory Historic District	Use	Use	No use
Fire Station 14	<i>de minimis</i>	No use	<i>de minimis</i>
Pacific Hoist and Warehouse Company	No use	No use	<i>de minimis</i>
Langendorf United Bakeries	<i>de minimis</i>	<i>de minimis</i>	<i>de minimis</i>
Langendorf United Bakeries Repair Garage	<i>de minimis</i>	<i>de minimis</i>	<i>de minimis</i>
A.M. Castle and Company	No use	Use	No use
Alaskan Copper Co. Employment Office	Use	Use	Use
Auto Repair Garage	Use	Use	No use
Department of Highway District No. 1 Headquarters/Maintenance Facility – Office/Administrative Building	No use	No use	Use
Department of Highway District No. 1 Headquarters/Maintenance Facility – Maintenance Building	No use	No use	Use
Department of Highway District No. 1 Headquarters/Maintenance Facility – Storage Building	No use	No use	Use
Department of Highway District No. 1 Headquarters/Maintenance Facility – Car/Paint Building	No use	No use	Use
Department of Highway District No. 1 Headquarters/Maintenance Facility – Maintenance/Garage Building	No use	No use	Use
Spokane Street Manufacturing Historic District	Use	Use	No use
Acme Tool Works	Use	Use	No use
Transportation Equipment Rentals Office Building	No use	No use	Use
Transportation Equipment Rentals Maintenance Warehouse	No use	No use	Use

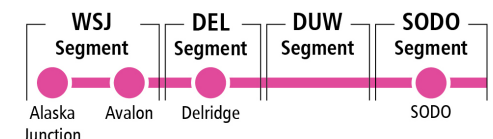
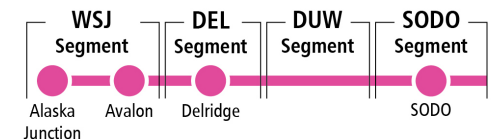


Table 4.18-3. Summary of Section 4(f) Use Determinations by Alternative for the Delridge Segment

Resource	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6a)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
Delridge Playfield	No use	No use	No use	No use	No use	<i>de minimis</i>	No use: Temporary Occupancy	No use	No use	No use
Longfellow Creek Natural Area	No use	No use: Temporary Occupancy	<i>de minimis</i>	No use	No use: Temporary Occupancy	No use	No use	No use	No use	No use
Longfellow Creek Legacy Trail	No use	No use	<i>de minimis</i>	No use	<i>de minimis</i>	No use	No use	No use	No use	No use
West Seattle Golf Course (park)	No use	No use: Temporary Occupancy	No use: Temporary Occupancy	Use	No use: Temporary Occupancy	No use: Temporary Occupancy	Use	No use	No use	No use
West Seattle Golf Course (historic property)	No use	No use	No use	Use	No use	No use	Use	No use	No use	No use
Bethlehem Pacific Coast Steel Company Office Building	No use	Use	Use	Use	Use	Use	Use	No use	No use	No use
Residence, 4030 Delridge Way Southwest	No use	Use	Use	Use	Use	Use	Use	No use	No use	No use
Seattle Steel Company/ Bethlehem Pacific Coast Steel Corporation	No use	No use	No use	No use	No use	No use	No use	<i>de minimis</i>	<i>de minimis</i>	No use



Resource	Preferred Andover Street Station Lower Height South Alignment Option (DEL-6b)	Dakota Street Station Alternative (DEL-1a)	Dakota Street Station North Alignment Option (DEL-1b)	Dakota Street Station Lower Height Alternative (DEL-2a)	Dakota Street Station Lower Height North Alignment Option (DEL-2b)	Delridge Way Station Alternative (DEL-3)	Delridge Way Station Lower Height Alternative (DEL-4)	Andover Street Station Alternative (DEL-5)	Andover Street Station Lower Height Alternative (DEL-6a)	Andover Street Station Lower Height No Avalon Station Tunnel Connection Alternative (DEL-7)
Mrachke & Son	No use	Use	Use	Use	Use	Use	Use	No use	No use	No use
Single-family Craftsman Residence, 4108 25th Avenue Southwest	No use	Use	Use	Use	Use	No use	No use	No use	No use	No use
Single-family Craftsman Residence, 4139 25th Avenue Southwest	No use	Use	Use	Use	Use	No use	No use	No use	No use	No use
Contemporary Ranch House, 4150 32nd Avenue Southwest	No use	No use	Use	No use	No use	No use	No use	Use	No use	No use
Kirlow Four-Plex	No use	No use	No use	No use	No use	No use	No use	Use	No use	No use

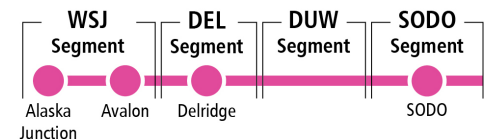


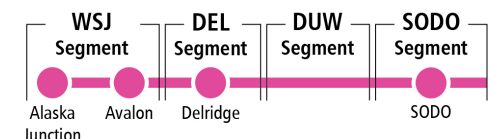
Table 4.18-4. Section 4(f) Use Determinations by Alternative for the West Seattle Junction Segment

Resource	Preferred Medium Tunnel 41st Avenue Station West Entrance Station Option (WSJ-5b)	Elevated 41st/42nd Avenue Station Alternative (WSJ-1)	Elevated Fauntleroy Way Station Alternative (WSJ-2)	Tunnel 41st Avenue Station Alternative (WSJ-3a)	Tunnel 42nd Avenue Station Option (WSJ-3b)	Short Tunnel 41st Avenue Station Alternative (WSJ-4)	Medium Tunnel 41st Avenue Station Alternative (WSJ-5a)	No Avalon Station Tunnel Alternative (WSJ-6)
Junction Plaza Park	No use	No use	No use	No use	Use	No use	No use	No use
Limcrest Apartments	No use	No use	No use	Use ^a	Use ^a	No use	No use	No use
Carlsen & Winquist Auto	No use	Use	No use	No use	No use	No use	No use	No use
West Seattle Brake Service	No use	<i>de minimis</i>	No use	No use	No use	No use	No use	No use
Contemporary Ranch House, 3221 Southwest Genesee Street	No use	Use	Use	No use	No use	Use	No use	No use
Golden Tee Apartments (3201 Avalon Way Southwest)	No use	Use ^b	Use ^b	Use ^c	Use ^c	Use ^b	No use	No use
Chinook Apartments	No use	No use	Use	No use	No use	Use	No use	No use
Residence, 5011 41st Avenue Southwest	No use	No use	No use	No use	No use	Use	No use	No use
Residence, 4426 38th Avenue Southwest	No use	No use	No use	No use	No use	Use	No use	No use
Jim's Shell Service	No use	Use	Use	No use	No use	Use	No use	No use

^a Use would only occur when connecting to Option DEL-2b only. No use would occur with other connectors.

^b Use would only occur when connecting to Alternative DEL-1a or Alternative DEL-3 in the Delridge Segment. No use would occur with other connectors.

^c Use would only occur when connecting to Alternative DEL-2a. No use would occur with other connectors.



4.18.4 Avoidance Alternatives

The *Section 4(f) Policy Paper* (Federal Highway Administration 2012) states that, along with the No Build Alternative, potential alternatives to avoid the use of a Section 4(f) resource must be considered and may include one or more of the following avoidance categories: location alternatives, alternative actions, alignment shifts, and design changes.

All alternatives in the SODO and Duwamish segments would result in the use of at least one Section 4(f) resource. The Final Section 4(f) Evaluation in Appendix H includes a discussion of feasible and prudent avoidance alternatives for the SODO and Duwamish segments. Based on the analysis of potential Section 4(f) resource avoidance alternatives, there are no prudent and feasible avoidance alternatives for either the SODO or Duwamish segments.

The Build Alternatives represent Sound Transit's best attempt to avoid and/or minimize Section 4(f) resources in the densely developed project corridor. The Build Alternatives balance the purpose and need of the project against potential impacts, while providing a range of alternatives for the public to consider and from which FTA and Sound Transit can choose. As design for the project progresses, Sound Transit continues to look for opportunities to reduce project impacts, including impacts on Section 4(f) resources.

Types of Avoidance Alternatives

Location Alternatives: A location alternative refers to rerouting the entire project along a different alignment.

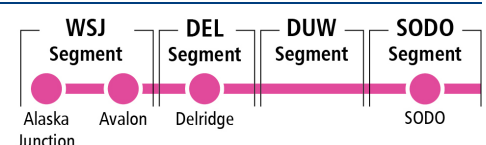
Alternative Actions: An alternative action could be a different mode of transportation, such as rail transit or bus service, or some other action that does not involve construction such as the implementation of transportation management systems or similar measures.

Alignment Shifts: An alignment shift is rerouting a portion of the project to a different alignment to avoid a specific resource. An example of an alignment shift alternative would be redesigning a proposed freeway exit ramp so that it loops around a Section 4(f) resource (such as a park) on a revised alignment footprint rather than intersecting with the park itself as a way of attempting to avoid a Section 4(f) use of the park.

Design Changes: A design change is a modification of the proposed design in a manner that would avoid impacts, such as reducing the planned median width, building a retaining wall, or incorporating design exceptions. To differentiate from the alignment shift alternative while using the previous freeway exit ramp example, a design change alternative would stay in the same proposed exit ramp footprint but would fly over the park (via an elevated structure) as a way of attempting to avoid a Section 4(f) use of the park.

4.18.5 Measures to Minimize Harm

Under Section 4(f), after determining there is no feasible and prudent avoidance alternative to the use of land from a Section 4(f) resource that does not meet the temporary occupancy or *de minimis* exceptions, the action must include all possible planning to minimize harm to the property resulting from such use. The Final Section 4(f) Evaluation in Appendix H includes a detailed discussion of measures to minimize harm. In addition to the mitigation measures for resource impacts identified in Section 4.16 and Section 4.17, methods of minimization and avoidance include adjustments to the horizontal alignment, vertical profile, and placement of stations and support facilities. These design adjustments are included in the Build Alternatives that are being evaluated. Typical mitigation measures for visual effects and noise and vibration impacts that could apply to both parks and historic resources are described in Sections 3.5.1, Minimization of Visual Effects, and 3.5.2, Minimization of Noise and Vibration Effects of Appendix H. Section 3.5.3, Parks and Recreation Measures to Minimize Harm, describes measures to minimize harm specific to parks, and Section 3.5.4, Historic Resources Measures to Minimize Harm, describes measures specific to historic resources.



4.18.5.1 Parks and Recreation Facilities Measures to Minimize Harm

According to City of Seattle Ordinance 118477, any City park land permanently acquired by the project must be replaced with land of equivalent or better size, value, location, and usefulness. Sound Transit would coordinate with Seattle Parks and Recreation to find suitable replacement property for acquired park land and displaced parks. Appendix H summarizes the resource-specific measures to minimize harm to Section 4(f) park resources. Mitigation for all park and recreational resources is described in Section 4.17.7, Mitigation Measures, of the Parks and Recreational Resources section.

4.18.5.2 Historic Resources Measures to Minimize Harm

Sound Transit has made design changes during the design process for the project alternatives and will continue to do so throughout project design to minimize impacts on historic properties. Measures to minimize or mitigate harm to Section 4(f) historic resources, beyond the design measures already included in the project, are not known at this time as Sound Transit and FTA continue to consult with the State Historic Preservation Officer, Tribes, and other consulting parties. These measures will be coordinated with the Washington State Department of Archaeology and Historic Preservation, local jurisdictions, and interested parties. They will also be memorialized in the Section 106 programmatic agreement for this project, consistent with Section 106 of the National Historic Preservation Act.

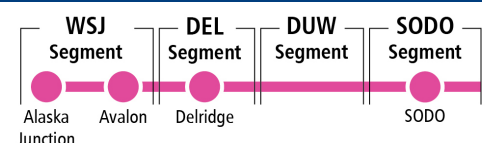
The specific mitigation measures for each affected historic resource will be developed in consultation with the State Historic Preservation Officer, Tribes, and other consulting parties under Section 106. Typical mitigation measures for impacts to historic resources are found in Section 4.16.6, Mitigation Measures, of Section 4.16.

Designated Seattle landmarks and districts that would be directly modified would be subject to review and issuance of a certificate of approval from the Landmarks Board and/or District Review Boards.

4.18.6 Least Harm Analysis

When there is no feasible and prudent avoidance alternative, FTA may approve only the alternative(s) that cause the least overall harm based on an assessment of the seven factors listed in Code of Federal Regulations Title 23 Section 774.3(c)(1):

- 1) The ability of the alternative to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property).
- 2) The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection.
- 3) The relative significance of each Section 4(f) property.
- 4) The views of the official(s) with jurisdiction over each Section 4(f) property.
- 5) The degree to which each alternative meets the purpose and need for the project.
- 6) After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f).
- 7) Substantial differences in costs among the alternatives.



Following public review of and comment on the WSBL Draft Environmental Impact Statement and the potential impacts of proposed alternatives (which included Appendix H, Draft Section 4(f) Evaluation), continued consultation with officials having jurisdiction on the proposed *de minimis* findings after public comment is received, and consultation regarding adverse effects on historic resources with the State Historic Preservation Office and consulting parties, Sound Transit will prepare a least harm analysis to be included in the Final Section 4(f) Evaluation, which will be prepared in conjunction with the Final Environmental Impact Statement for this project.

Because there is no alternative in the SODO or Duwamish segments that would avoid the use of a Section 4(f) resource, a least harm analysis is required under Section 4(f) to determine which alternative in the SODO and Duwamish segments would cause the least overall harm according to the Code of Federal Regulations Title 23 Section 774.3(c). Based on an overall assessment of all the seven factors in Code of Federal Regulations Title 23 Section 774.3 presented in Tables 3-14 and 3-15 of Appendix H, Preferred Option SODO-1c and Alternative SODO-1a are equal least harm alternatives for the SODO Segment, and Preferred Alternative DUW-1a and Option DUW-1b are equal least harm alternatives for the Duwamish Segment according to the Code of Federal Regulations Title 23 Section 774.3(c)(1).

In accordance with 23 Code of Federal Regulations Section 774.3, the project could select a full corridor alternative as shown below:

SODO Segment	Duwamish Segment	Delridge Segment	West Seattle Junction Segment
Preferred Option SODO-1c or Alternative SODO-1a	Preferred Alternative DUW-1a or Option DUW-1b	Preferred Option DEL-6b or Alternative DEL-6a or Alternative DEL-7	Preferred Option WSJ-5b or Alternative WSJ-5a or Alternative WSJ-6

When factoring in Delridge Segment and West Seattle Junction Segment alternatives whose designs connect with one another, the following three full corridor alternative scenarios could be selected per Section 4(f), as shown below:

Full Corridor Alternative Scenario #1			
SODO Segment	Duwamish Segment	Delridge Segment	West Seattle Junction Segment
Preferred Option SODO-1c or Alternative SODO-1a	Preferred Alternative DUW-1a or Option DUW-1b	Alternative DEL-6a	Preferred Option WSJ-5b or Alternative WSJ-5a
Full Corridor Alternative Scenario #2			
SODO Segment	Duwamish Segment	Delridge Segment	West Seattle Junction Segment
Preferred Option SODO-1c or Alternative SODO-1a	Preferred Alternative DUW-1a or Option DUW-1b	Preferred Option DEL-6b	Preferred Option WSJ-5b or Alternative WSJ-5a
Full Corridor Alternative Scenario #3			
SODO Segment	Duwamish Segment	Delridge Segment	West Seattle Junction Segment
Preferred Option SODO-1c or Alternative SODO-1a	Preferred Alternative DUW-1a or Option DUW-1b	Alternative DEL-7	Alternative WSJ-6

