PUGET SOUND GATEWAY PROGRAM – PHASE 1 OF THE SR 509 COMPLETION PROJECT

Noise Technical Report

Prepared for
Washington State Department of Transportation

Prepared by
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Attachments

Tables

Figures

Acronyms and Abbreviations

dBA	A-weighted decibels
Ecology	Washington State Department of Ecology
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FWLE	Federal Way Link Extension Project
HOV	high-occupancy vehicle
I-5	Interstate 5
Leq	equivalent continuous noise level
Ldn	day-night average sound level
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
ROD	Record of Decision
ROW	right-of-way

1. Introduction

This memorandum was prepared in support of the Phase 1, SR 509 Completion Project National Environmental Policy Act (NEPA) re-evaluation. It compares the changes to the project and resultant impacts (beneficial and/or adverse) against the Record of Decision (ROD) issued by the Federal Highway Administration (FHWA) in 2003 to determine if Phase 1 of the SR 509 Completion Project would result in any new significant impacts not evaluated in the *SR 509: Corridor Completion/I-5/South Access Road Final Environmental Impact Statement* (2003 FEIS). This Re-evaluation Memo makes many references to the 2003 FEIS, including the maps and mitigation measures that are still relevant to the updated analyses. The SR 509: Corridor Completion/I-5/South Access Road FEIS can be found on WSDOT's website at http://www.wsdot.wa.gov/Projects/SR509/completion/Library.htm.

1.1. Project History

The State Route (SR) 509 Completion Project is based on more than two decades of project planning and development. In 1995, Washington State Department of Transportation (WSDOT) released the *Tier I Corridor Draft Environmental Impact Statement* (DEIS), which recommended extending SR 509 from S 188th Street southward to connect with Interstate 5 (I-5) and adding a spur roadway, the South Access Road, to connect with Seattle-Tacoma International Airport (Sea-Tac Airport). Within the SR 509 corridor, three routes and a No Build Alternative were evaluated in a project level (Tier II) Draft EIS published in 2002. The Final EIS (FEIS) and Record of Decision (ROD) issued in 2003 identified a six-lane Preferred Alternative (Alternative C2) that included two general purpose (GP) lanes and one high-occupancy vehicle (HOV) lane northbound and southbound on SR 509. It also included interchange connections at S 188th Street, S 200th Street, 24th/28th Avenue, and I-5 and a new South Access Road. Since the ROD was issued, project progress has included actions such as the purchase of needed right-of-way (ROW), construction of an advanced wetland mitigation site, construction of work elements in coordination with local agencies, and refinements in preliminary design. The project area is shown in Figure 1.

With the passing of the Connecting Washington Transportation Package in 2015 by the state legislature, funding has become available for the first phase of the SR 509 Completion Project (Phase 1 Improvements) to proceed through environmental review, design, and into construction. WSDOT undertook a Practical Solutions design approach for the project which allowed a fresh look at the previous project plans to ensure that the revised project is designed according to actual demand and needs. Part of the Practical Solutions approach included reengaging stakeholders to review design and potential changes. The purpose of this document is to reevaluate the Phase 1 Improvements to determine whether they have the potential to result in any new significant environmental impacts that were not previously evaluated in the 2003 FEIS and 2003 ROD. Table 1 provides a comparison of Alternative C2 with the Phase 1 Improvements.

Figure 1 Project Vicinity

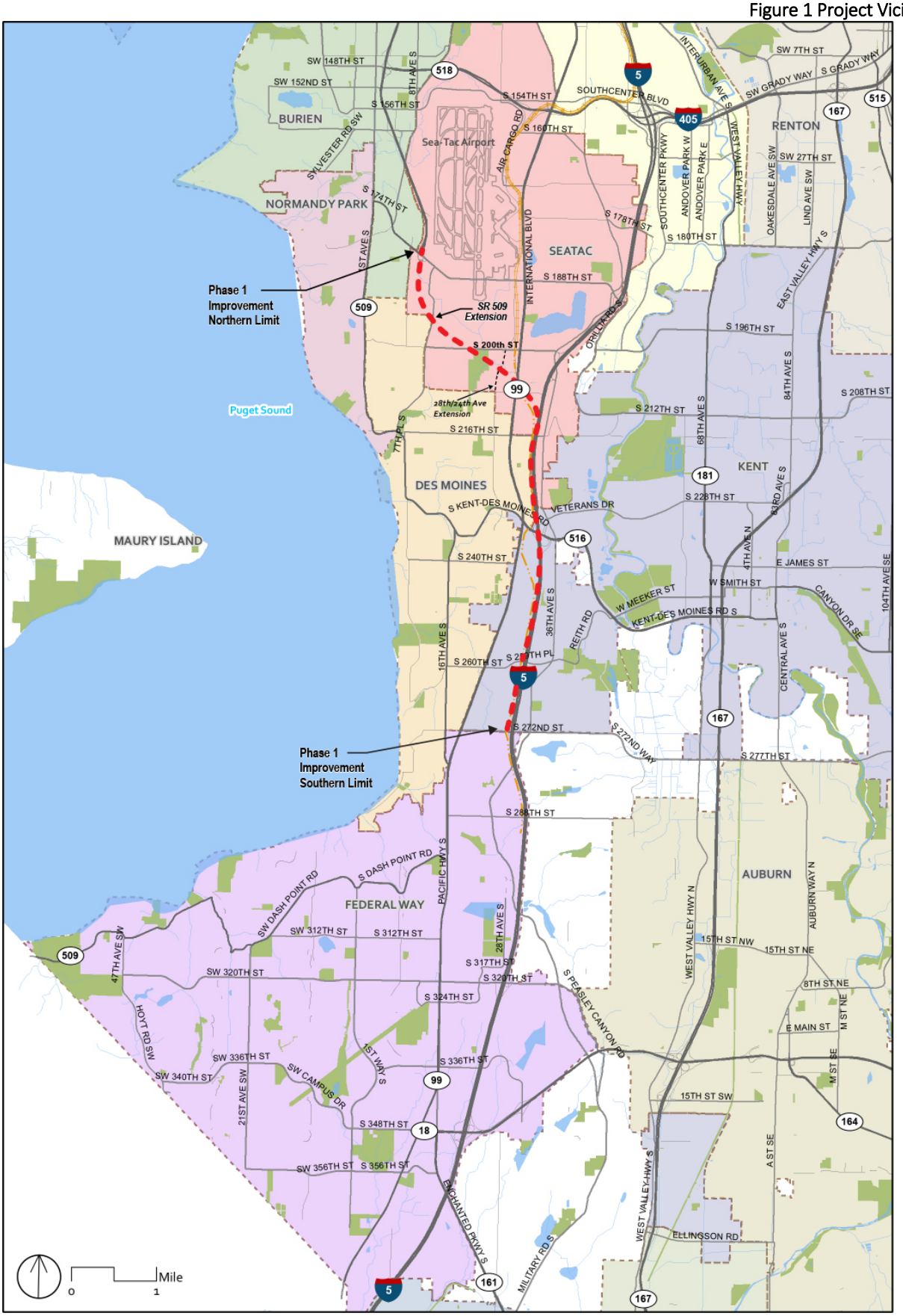


Table 1. Comparison of Design Components		
SR 509	**Alternative C2 (2003 FEIS and ROD)**	**Phase 1 Improvements (Re-evaluation)**
SR 509: I-5 to S 188th Street	Six lanes (120 feet), 60 mph – 2 GP lanes in each direction and 1 HOV lane each direction	Four lanes (78 feet), 60 mph – 2 GP lanes in each direction
S 188th Street	Full single-point urban interchange (SPUI)	1/2 diamond (ramps to/from north) – but doesn't preclude future construction of full diamond with additional funding.
S 200th Street	1/2 diamond (to/from north)[a]	None– but doesn't preclude future construction with additional funding
South Access Roadway	Four-lane limited access facility to S 200th Street	None– but doesn't preclude future construction with additional funding
24th Avenue S/28th Avenue S	1/2 diamond (to/from south)	1/2 diamond (ramps to/from south)
Tolling	None	2 GP lanes in each direction
Toll Points	None	One south of 24th Avenue S/28th Avenue S
Interstate 5	**Alternative C2 (2003 FEIS and ROD)**	**Phase 1 Improvements (Re-evaluation)**
I-5/SR 509 GP connection	60 mph	50 mph
I-5 SB: SR 516 to SR 509	Southern braid – three-lane C/D	Northern braid and two-lane C/D
I-5 NB: SR 516 to SR 509	two-lane C/D	Auxiliary lane– but doesn't preclude future construction with additional funding
I-5/SR 509 HOV Direct Connection	I-5/SR 509 center-to-center HOV direct access roadway	None – but doesn't preclude future construction with additional funding
I-5/SR 516 Interchange[b]	Full diamond and at grade intersection with Veterans Drive connector	Full diamond and at-grade intersection with Veterans Drive connector
I-5 SB: SR 516 to S 272nd Street	Two auxiliary lanes	One auxiliary lane– but doesn't preclude future construction with additional funding
I-5 SB: 272nd to S 320th Street	One auxiliary lane	None– but doesn't preclude future construction with additional funding
I-5 NB: S 272nd Street to SR 516	One auxiliary lane S 272nd Street to SR 516	None– but doesn't preclude future construction with additional funding

[a] 1/2 diamond interchange has an on and off ramp that serves traffic to and from one direction.

[b] The Phase 1 Improvements would also maintain pedestrian connections on both sides of the I-5/SR 516 interchange and construct a new pedestrian path from Veterans Drive to SR 516/Kent Des Moines Road, which would help facilitate pedestrian trips to and from the transit centers around this interchange.

C/D = collector/distributor lanes; GP = general purpose; HOV = high-occupancy vehicle; mph = miles per hour; NB = northbound; SB = southbound

2. What are the Phase 1 Improvements and how do they compare with the 2003 FEIS Alternative C2?

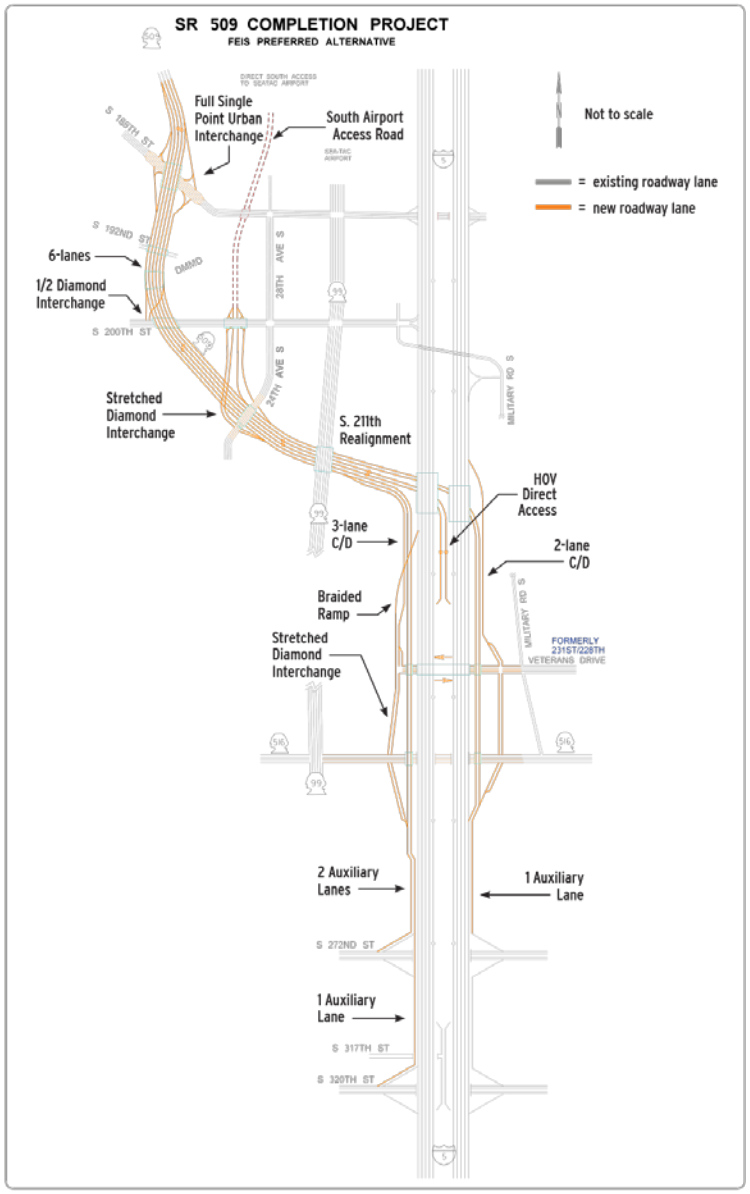
The purpose and need of the proposed action remains the same as described in the 2003 FEIS.

- The purpose of the proposed action is to improve regional highway connections with an extension of SR 509 to serve current and future transportation needs in southwest King County and to enhance southern access to Sea-Tac Airport. The project area is shown in Figure 1.
- The proposed action is needed to create system linkages, accommodate travel demand and capacity needs, and improve intermodal relationships. The SR 509 freeway currently terminates at S 188th Street and does not connect to the regional transportation highway system; this leaves a major gap in the system. As a result, local streets and major transportation routes like I-5 are at or over capacity given current travel demand. This situation is expected to worsen as travel demand for Sea-Tac Airport and major roadways increases.

FHWA issued a ROD in 2003 for the SR 509 Project FEIS that analyzed the extension of the SR 509 corridor. The 2003 SR 509 Project ROD selected Alternative C2. Alternative C2 included a six-lane extension of SR 509 from S 188th Street to I-5. New interchange improvements were proposed at four locations: S 188th Street, S 200th Street, 24th Avenue, 28th Avenue S, and I-5. A four-lane limited access roadway (South Access Road) was also proposed to connect SR 509 at 24th Avenue S/28th Avenue S with the Sea-Tac Airport Terminal Drive system, and an interchange on the South Access Road was proposed at S 200th Street. Improvements on I-5 included adding northbound and southbound collector-distributor (C/D) lanes between SR 509 and SR 516, and adding auxiliary lanes between SR 516 and S 320th Street. Interchange improvements which included a new undercrossing of I-5 to connect to Veteran's Drive were also proposed at SR 516.

The Phase 1 Improvements are essentially a subset of the improvements that were proposed in the 2003 FEIS (Table 1 and Figure 2). The Phase 1 Improvements would include a four-lane SR 509 extension (compared to six lanes as analyzed in the 2003 FEIS) from S 188th Street to I-5. Interchange improvements would occur at three locations (compared to four locations as analyzed in the 2003 FEIS): S 188th Street interchange, 24th Avenue S/28th Avenue S, and I-5. In addition, there would be no South Access Road or interchange at S 200th Street, and improvements on I-5 would be less extensive than those proposed in the 2003 FEIS (see Figure 3). The Phase 1 Improvements also assumes that the extension of SR 509 between S 188th Street and I-5 would be fully tolled. A toll point would be located on SR 509 south of the 24th Avenue S/28th Avenue S interchange. Figure 3 provides an overlay comparison of the Phase 1 Improvements and the 2003 FEIS.

Figure 2 – Design Components of FEIS Preferred Alternative (Alternative C2) and Phase 1 Improvements



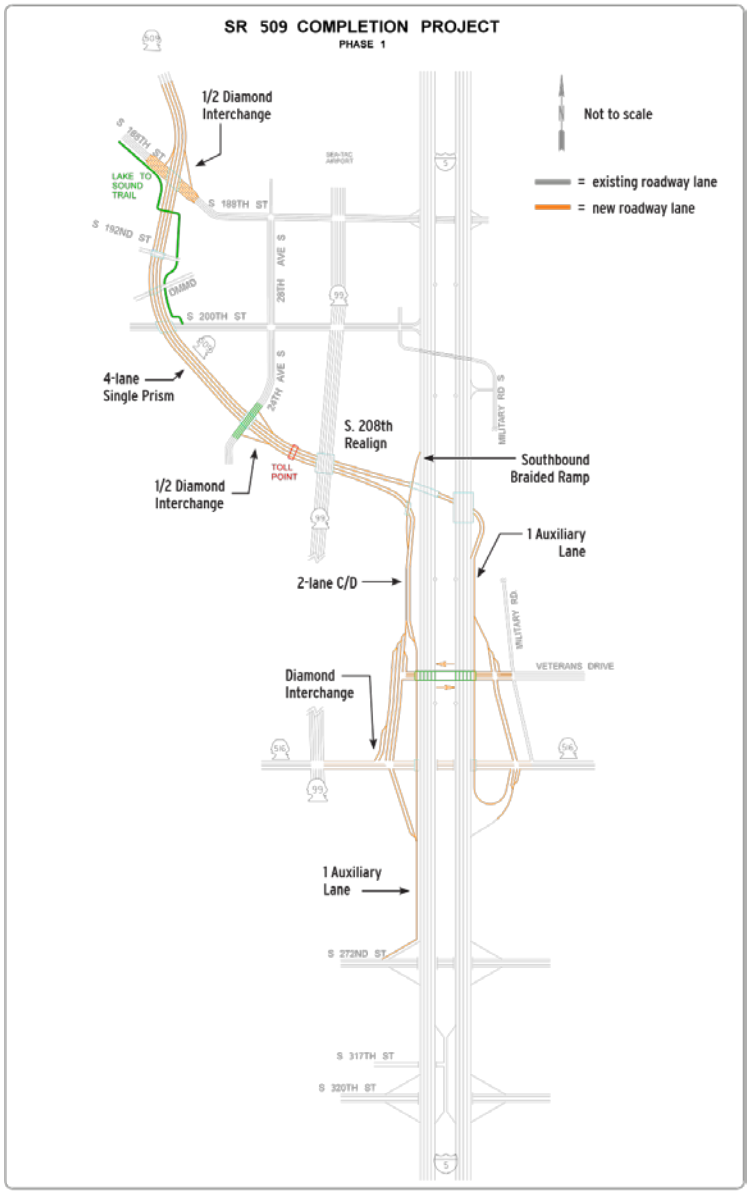
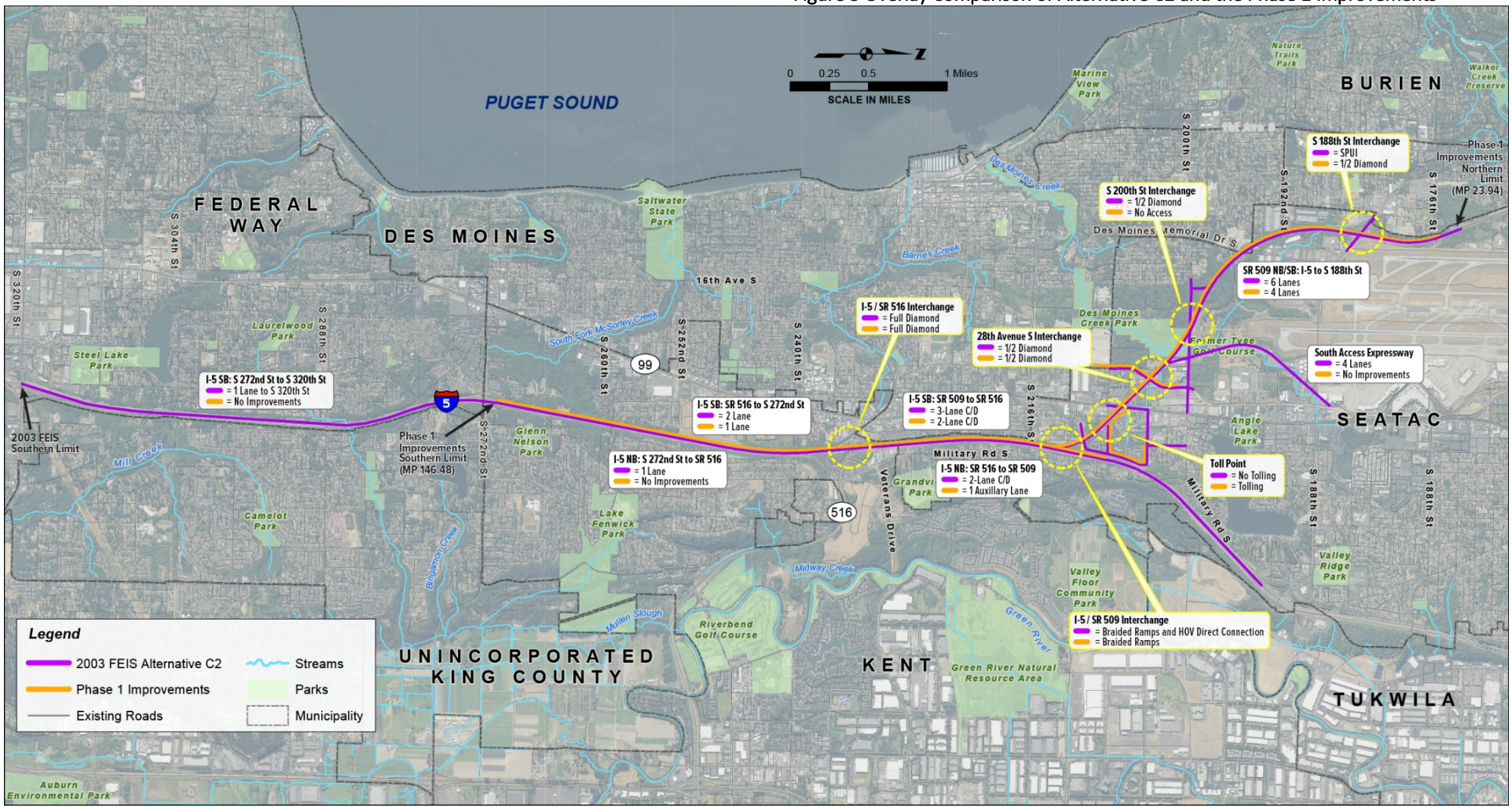


Figure 3 Overlay Comparison of Alternative C2 and the Phase 1 Improvements



3. What has changed in the affected environment since 2003?

Noise regulation and impact criteria

As described in the 2003 FEIS, applicable noise regulations and guidelines provide a basis for evaluating potential noise impacts. Noise regulations and guidelines specifying ambient indoor and outdoor sound levels are established by FHWA, Washington State Department of Ecology (Ecology), and local jurisdictions.

The Washington State Department of Transportation (WSDOT) Noise Policy was last updated in 2011 (with additional revisions in October 2012). These updates include several changes that influence the assessment of noise impacts from Type 1 projects when compared to evaluation methods used in the 2003 FEIS, and are summarized in Table 2, as applied to the current analysis:

- Category A, Leq(h) 57 (exterior): Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
    - Unchanged in 2012 policy.
- Category B, Leq(h) 67 (exterior): Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
    - Updated in 2012 policy to include only residential receptors, still named Category B.
    - Updated in 2012 policy to include active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings, and renamed Category C.
- Category C, Leq(h) 72 (exterior): Developed lands, properties, or activities not included in Categories A or B above.
    - Updated in 2012 policy to hotels, motels, offices, restaurants/bars, and renamed Category E.
- Category D: Undeveloped lands
    - Updated in 2012 policy, renamed to Category G
- Category E, Leq(h) 52 (interior): Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums
    - Updated in 2012 policy to auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios, and renamed Category D.

How is noise measured?

We use several terms to describe noise and how it is measured.

A **decibel** is a unit of measurement that indicates how loud a sound is. Humans can hear sounds between 0 and 140 decibels.

A-weighted decibels (dBA) are an expression of the relative loudness of sounds in air as perceived by the human ear.

Leq (equivalent continuous noise level) is the preferred method to describe sound levels that vary over time. Leq(h) describes the Leq over an hourly interval.

Ldn (day-night average sound level) is the average noise level over a 24-hour period.

The evaluation of abatement feasibility and reasonableness was also updated in the 2012 policy, as follows:

- Feasibility
  - 2003 FEIS: Constructible and achieve 7 to 10 dB reduction at nearby receptors.
  - 2012 policy: Constructible and achieve minimum 5 dB reduction for a majority of first-row affected receptors.
- Reasonableness
  - 2003 FEIS: Not exceed 100 lineal feet of barrier per household.
  - 2012 policy: Cost effectiveness (barrier cost based on $51.61 per square foot compared to allowed costs per receptor) and achieve at least 7 dB of reduction at one receptor. Where a barrier satisfies these requirements, WSDOT policy also calls for "a reasonable effort" to obtain 10 dB or greater of reduction for the first row of receptors. Larger barriers are also allowed if considered "highly cost effective" by achieving at least 10 dB of reduction at less than 75% of the maximum cost allowance.

Federal Highway Administration Noise Abatement Criteria

For federally funded highway projects, traffic noise impacts occur when predicted hourly traffic noise levels, defined as hourly Leq equivalent (A-weighted sound level averaged hourly) and abbreviated Leq(h), approach or exceed the noise abatement criteria (NAC) established by the FHWA, or substantially exceed existing sound levels (U.S. Department of Transportation, 2011). "Approach" is defined by WSDOT as meaning within 1 dB. "Substantially exceed" is defined by WSDOT as an increase of 10 dB or more over the existing level. The FHWA NAC for various land activity categories are presented in Table 2.

Table 2. FHWA Noise Abatement Criteria

Activity Category	Leq(h) at Evaluation Location (dBA)	**Description of Activity Category**
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential (single and multi-family units)
C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools , television studios, trails, and trail crossings
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F. Includes undeveloped land permitted for these activities.
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	-	Undeveloped lands that are not permitted

dBA = A-weighted decibels

State and Local Noise Regulations

In the 2003 FEIS, King County and the cities of SeaTac, Kent, and Federal Way regulated noise as a nuisance, absent of established property line standards specifying noise levels that could not be exceeded at receiving properties. The cities of Des Moines, Federal Way, Kent, and SeaTac did not have noise ordinances that applied to road construction or traffic noise; all deferred to Ecology limits (WAC 173-60). The same condition applies to Kent and Des Moines. Sounds from motor vehicles on public roads were and are still exempt from municipal codes and Ecology's property line regulations, although the FHWA noise criteria still apply.

Local codes that have been updated since the 2003 FEIS are summarized as follows:

- King County (KCC Chapter 12.86 – Noise)
  - Adopts Ecology sound level limits based on defined land use zoning.
  - Typical roadway construction is exempt between 7 a.m. and 7 p.m. on weekdays and 9 a.m. to 7 p.m. on weekends. Impact-type equipment (such as jackhammers) are exempt between 8 a.m. and 5 p.m. on weekdays and 9 a.m. to 5 p.m. on weekends.
- City of Burien (BMC Chapter 9.105.400 – Noise, not discussed in 2003 FEIS)
  - Nuisance only, no quantified sound level limits.
  - Construction exempt between 7 a.m. and 10 p.m. on weekdays and 9 a.m. to 10 p.m. on weekends.
- City of Federal Way
  - Construction exempt between 7 a.m. and 8 p.m. on weekdays and 9 a.m. to 8 p.m. on weekends.

Construction noise from the Phase 1 Improvements would be exempt from regulations during daytime hours, varying by the jurisdiction where work occurs. However, project contractors and WSDOT crews would need to meet Ecology and local jurisdiction property line regulations during nighttime. Ecology exempts construction noise received by residential receptors between 7 a.m. and 10 p.m., and work near commercial and industrial properties is exempt at all times. King County, Burien, and Federal Way adopt different exemption hours, as summarized above.

Based on these current municipal codes, sound level limits presented in Table 3 apply to construction equipment at receiving properties when not exempt by Ecology or local noise ordinances.

Table 3. Maximum Permissible Noise Levels for Nighttime Construction (dBA)

Noise Source	Receiving Property				
	Residential	Commercial		Industrial	
		King County and Federal Way	Burien, SeaTac, Kent, and Des Moines (Ecology)	King County and Federal Way	Burien, SeaTac, Kent, and Des Moines (Ecology)
Residential	45	57	N/A	60	N/A
Commercial	47	60	N/A	65	N/A
Industrial	50	65	N/A	70	N/A

N/A = not applicable (Ecology exempts construction at all times, except residential receptors during nighttime hours)

Have the land uses and noise-sensitive areas changed since 2003?

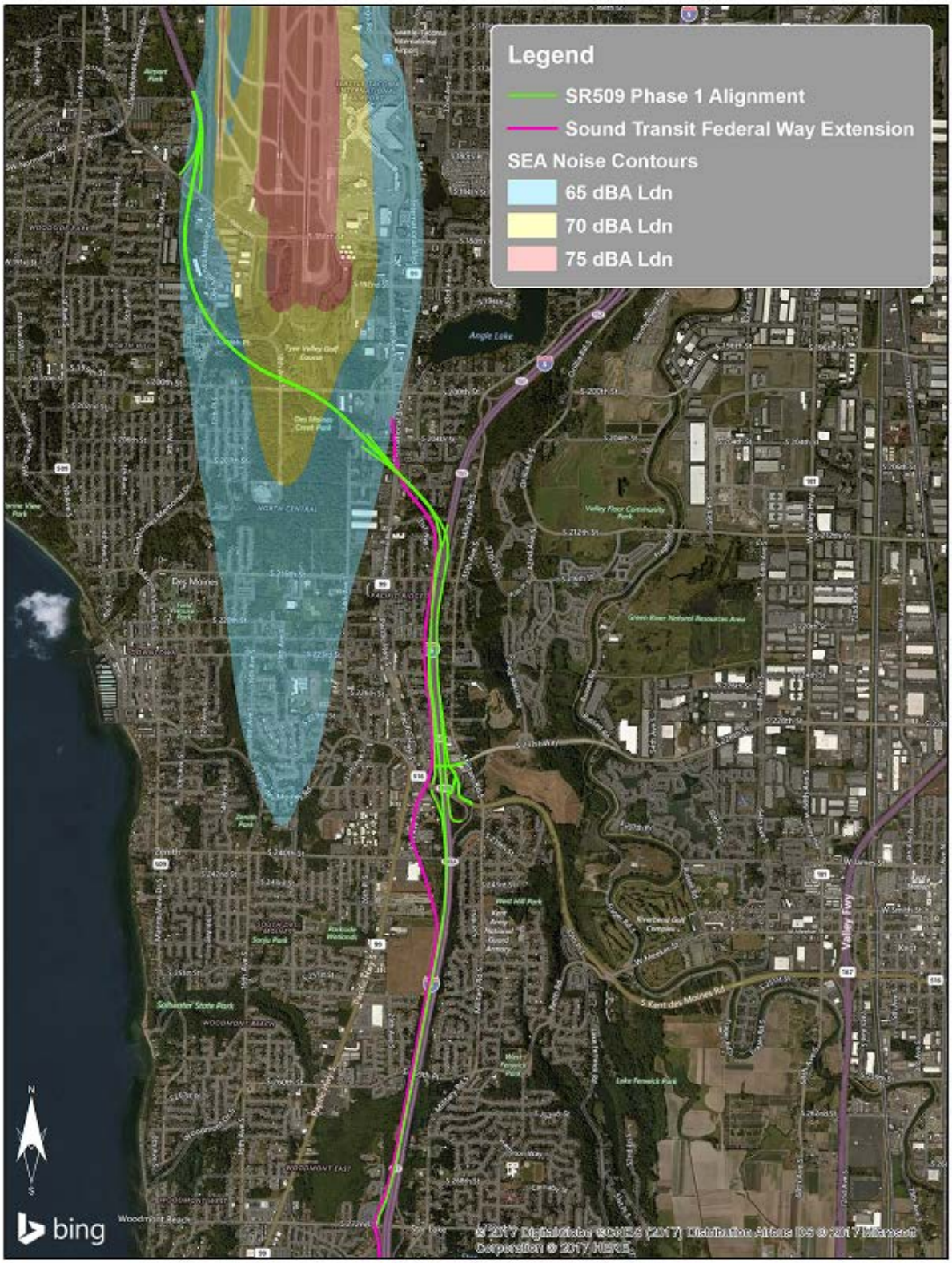
The study area is mostly residential, but includes both commercial and light industrial uses. Sea-Tac Airport is the largest traffic generator in the study area. The existing land use along the I-5 corridor

between S 216th Street and S 310th Street is primarily single- and multi-family residential. There are several small businesses mixed in the residential areas surrounding the I-5/SR 516 interchange.

A large portion of the study area is located within the Sea-Tac Airport Noise Remedy Program areas. The Port of Seattle has undertaken a series of noise mitigation programs in the area surrounding Sea-Tac Airport; these include purchasing homes and implementing sound insulation upgrades to additional homes. Figure 4 shows the airport's annual average Ldn (day-night average noise level) noise contours, boundaries of the Noise Remedy Program areas (all properties within the Ldn 65 contour), and the project alignment. The Sound Transit Federal Way Link Extension (FWLE), scheduled to begin revenue service in 2024, is also shown and will influence the noise environment prior to construction of the Phase 1 Improvements. Not only will FWLE operations contribute to the existing noise environment, but at-grade sound walls planned for FWLE will also provide reductions to the SR509 noise footprint.

There are many noise-sensitive receptors in the study area (defined as all receptors near the project corridor, within the north/south extents of the SR 509 Phase 1 alignment shown in Figure 4), including residences, apartment buildings, hospitals, libraries, parks, schools, retirement homes, and churches. We measured existing traffic noise levels at 25 representative receptor locations within the study area. Attachment A provides additional details on noise monitoring locations and measured levels. Sensitive receptors were chosen based on accessibility, proximity, and their ability to represent overall conditions in the study area.

Figure 4. Sea-Tac Airport 2018 Noise Contours, Phase 1 Improvements Alignment, and Planned Federal Way Link Extension Alignment



How have existing noise levels changed?

In preparation for the 2003 FEIS analysis, ambient sound levels were measured to describe the existing noise environment and to identify major noise sources at 38 receptor locations in the study area. Receptors were selected along the proposed project alignments at locations that would likely be affected by traffic noise. Average noise levels (Leq) at these receptors were dominated by traffic and aircraft operations, with levels ranging from 54 to 78 dBA. The measured existing sound levels included all sounds that typically occur at each location. Noise measurements were taken only when unusual sounds did not occur; however, aircraft noise was included because it is common in the study area. Other sources of noise might include, but are not limited to, industrial and commercial activities, human voices in residences, children playing, and construction.

Current WSDOT noise policy requires modeling existing traffic noise conditions in areas where a project roadway already exists. For the Phase 1 Improvements analysis, this includes SR 509 between S 176th Street and Des Moines Memorial Drive and I-5 between S 211th Street and S 272nd Street. In these areas, traffic count data were used to model existing traffic noise levels from SR 509 and I-5.

Short-term measurement data collected at 25 representative receptor locations, and concurrent traffic counts were used to validate the TNM 2.5 computer noise model prior to predicting existing traffic noise levels. Average noise levels (Leq) during these measurements were largely dominated by highway and aircraft operations, with some exceptions where local noise sources were present. Measured levels from all sources (such as traffic, aircraft, and local noise) ranged between 56 and 76 dBA, which is within 2 dB of the levels measured for the 2003 FEIS. After aircraft noise was removed from the 2017 measurement data set, sound levels ranged between 54 and 73 dBA. Adjustment factors used to remove aircraft noise from data collected at the 25 measurement sites ranged from 0 to -10 dB.

In areas where a new roadway would be added as a part of the Phase 1 Improvements (between Des Moines Memorial Drive and S 211th Street), measurements of existing sound levels were conducted at five locations for longer durations. These measured sound levels were used to estimate peak hour Leq sound levels from Sea-Tac Airport based on 24-hour day-night equivalent (Ldn) values, which is expected to be the dominant existing noise source in this area. Additional details on this approach are provided in Attachment A.

Noise in Neighborhood Parks

In the 2003 FEIS, three parks were identified as being potentially adversely affected by increased noise levels: Linda Heights Park, Midway Park, and Des Moines Creek Park. The following summarizes previous determinations and results from the updated analysis:

- Midway Park (KC parcel #2156400365) – would not be affected by Phase 1 Improvements
    - 2003 FEIS: Traffic on I-5 was the dominant noise source. Existing sound levels near the entry to the substation were about 70 dBA (350 feet from I-5), which exceeded the WSDOT/FHWA NAC. Sound levels farther west (600 feet from I-5) were 59 dBA.
    - Updated analysis: The current primary outdoor area of frequent human use is approximately 800 feet west of I-5. Existing traffic conditions for this parcel were modeled at 53 dBA, which does not exceed the WSDOT/FHWA NAC. The 2003 FEIS 70 dBA measurement location appears to be within a parcel now used by an adjacent substation.
- Linden Heights Park (KC parcel #2222049169) – would be affected by Phase 1 Improvements
    - 2003 FEIS: Traffic on I-5 was the dominant noise source. Existing average background noise levels near the west side of the park were in the 70 dBA range, which exceeds the WSDOT/FHWA NAC.

- Updated analysis: Existing traffic conditions were modeled at 67 dBA, which exceeds the WSDOT/FHWA NAC.

- Des Moines Creek Park (KC parcel #0422049031) – would not be affected by Phase 1 Improvements
  - 2003 FEIS: Aircraft departures from Sea-Tac Airport were the main sources of environmental noise, with measured noise levels in the park averaging 71 to 75 dBA when jet aircraft departures occur. Based on the 1998 aircraft noise contours in the Sea-Tac Airport Part 150 Study Update (Port of Seattle 2000), aircraft noise exposure in Des Moines Creek Park is in the range of Ldn 70 dBA.
  - Updated analysis: Sound levels with the Phase 1 Improvements would be 54 dBA, which is below the WSDOT/FHWA NAC and the predicted peak hour Leq noise level from Sea-Tac Airport (68 dBA).

4. How does the Phase 1 Improvements noise analysis differ from the 2003 FEIS?

Although the noise analysis for the Phase 1 Improvements was conducted in a similar manner to the 2003 FEIS, there are some notable differences. Noise impacts reported in the 2003 FEIS were determined based on generic noise contours calculated with a simplified version of FHWA Noise Prediction Model Stamina 2.0, assuming ideal propagation conditions. The Phase 1 Improvements noise levels were evaluated based on WSDOT's current Noise Policy using FHWA's updated TNM Version 2.5, with sound levels predicted at individual receptors to identify noise impacts. Future traffic noise levels were predicted for No Action and Phase 1 Improvements under 2045 traffic conditions compared to the 2020 traffic conditions analyzed in 2003. The updated analysis also considered more current noise contours from Sea-Tac Airport and noise from Sound Transit's Federal Way Link Extension (FWLE), including proposed transit noise abatement measures. See Attachment A for additional information on methodologies used to account for influences of these additional noise sources.

5. Would the Phase 1 Improvements result in any new significant impacts?

As was discussed in the 2003 FEIS, noise from the SR 509 Extension Project would include short-term noise during road construction and long-term operational impacts from growth in traffic volumes and changes in traffic patterns on area roadways. As shown in Table 4, the 2003 FEIS documented 2,578 noise impacts from Alternative C2 and 1,348 from the No Action Alternative. The updated analysis identifies significantly fewer noise impacts, 401 for the Phase 1 Improvements and 636 for No Action. This reduction in noise impacts compared to the 2003 FEIS is due to a number of factors, including fewer travel lanes, exclusion of the South Access Road, more detailed noise prediction methodology, and quantified accounting of contributions from other dominant noise sources (Sea-Tac Airport and FWLE). The updated analysis also includes noise reductions afforded by transit noise abatement (e.g., sound barriers/walls) planned for installation west of I-5 for the FWLE project, which were not considered in the 2003 FEIS. A comparison of noise impacts between the two analyses and traffic counts used in the updated analysis are shown in Tables 4 through 7. All traffic noise predictions in the updated analysis used forecasted PM peak hour (4:30 p.m. to 5:30 p.m.) traffic volumes traveling at 60 mph. Parcels excluded from the updated analysis due to anticipated property acquisition for Phase 1 Improvements or FWLE are shown in Attachment A.

Table 4. Estimated Number of Affected Receptors

Receptor Type	2003 FEIS		Updated Analysis	
	No Action (2020)	Alternative C2 (2020)	No Action (2045)	Phase 1 Improvements (2045)
Single-family residential	683	1,744	110	112
Multifamily residential	655	819	524 units	287 units
Schools	1	3	1	1
Libraries	0	0	0	0
Hospitals and retirement homes	3	3	0	0
Parks	2	3	1	1
Churches	4	6	0	0
Total Receptors Affected	**1,348**	**2,578**	**636**	**401**

Table 5. Hourly Traffic Volumes used in Updated Analysis – Existing (2015)

Roadway	Southbound				Northbound			
	Auto	Medium Truck	Heavy Truck	Total	Auto	Medium Truck	Heavy Truck	Total
SR 509 (existing)	1,561	54	14	**1,629**	621	10	2	**633**
I-5 – north of SR 516	7,108	164	154	**7,426**	5,830	214	191	**6,235**
I-5 – south of SR 516	7,146	157	170	**7,473**	5,577	195	190	**5,962**

Table 6. Hourly Traffic Volumes used in Updated Analysis – No Action (2045)

Roadway	Southbound				Northbound			
	Auto	Medium Truck	Heavy Truck	Total	Auto	Medium Truck	Heavy Truck	Total
SR 509 (existing)	2,091	87	25	**2,203**	1,056	12	9	**1,077**
I-5 – north of SR 516	6,939	164	153	**7,256**	6,082	236	205	**6,523**
I-5 – south of SR 516	7,417	182	164	**7,763**	6,273	231	210	**6,714**

Table 7. Hourly Traffic Volumes used in Updated Analysis – Phase 1 Improvements (2045)								
Roadway	**Southbound**				**Northbound**			
	Auto	**Medium Truck**	**Heavy Truck**	**Total**	**Auto**	**Medium Truck**	**Heavy Truck**	**Total**
SR 509 – North of S 118th St	1,826	158	81	**2,065**	1,135	44	42	**1,221**
SR 509 – S 118th St to 24th Ave S	990	114	79	**1,183**	782	39	39	**860**
SR 509 –24th Ave S to I-5	1,418	124	93	**1,635**	1,673	48	56	**1,777**
I-5 – north of SR 509	7,344	132	104	**7,580**	5,608	219	170	**5,997**
I-5 – SR 509 to SR 516	8,822	262	188	**9,272**	7,281	267	226	**7,774**
I-5 – SR 516 to S 272nd St	7,928	199	165	**8,292**	6,636	248	218	**7,102**

Traffic Noise Abatement

Pursuant to WSDOT Noise Policy, if traffic noise impacts are identified, abatement measures will be reviewed. The Phase 1 Improvements abatement analysis evaluated 18 noise wall locations, including new walls, extending existing walls, and increasing the height and/or length of noise walls planned for Sound Transit's FWLE project. The findings from this analysis are summarized below.

A noise wall was determined to be feasible if it appears that it would be physically constructible and provide at least 5 dB of noise reduction to a majority of first row affected receptors. Of these 18 noise wall areas, eleven were found to be feasible and three were found to be both feasible and reasonable, as described below. The intent of this analysis is to identify likely barrier locations based on predicted noise impacts using preliminary roadway design and traffic forecast data. WSDOT Noise Policy defers final consideration of barrier feasibility and reasonableness until the final design phase, when horizontal and vertical alignments are finalized. Listed below are proposed noise wall locations for the Phase 1 Improvements. A figure of all noise walls analyzed, including those determined to be infeasible or unreasonable, are provided in Figure A13.

- Noise Wall Area #1 (Figure 5)
    - Northern extension of existing WSDOT noise wall: east of I-5 and west of Military Road South
- Noise Wall Area #2 (Figure 6)
    - Northern extension of existing WSDOT noise wall: east of I-5 and west of 35th Avenue South
- Noise Wall Area #3 (Figure 7)
    - Northern extension of existing WSDOT noise wall: east of I-5 and west of 32nd Place South

As a point of comparison, the updated analysis includes approximately 24,000 square feet of proposed noise abatement in the form of noise walls. The 2003 FEIS identified approximately 370,000 square feet.

A summary of the noise wall analysis for all walls is shown below, note the three walls determined to be feasible and reasonable were re-numbered Noise Wall #1 through Noise Wall #3 for clarity, these naming conventions are also detailed below.

Table 8. Noise Abatement Analysis Summary							
Wall Analysis ID#	**Feasible?**	**Reasonable?**				**Analyzed Wall Maximum Height and Length (Feasible Walls Only)**	**Proposed Abatement ID#**
	Yes/No	**Achieves Design Goal?[1]**	**Allowance**	**Cost**	**Yes/No**		
1	Yes	No	N/A			20’ max, 359’ long	N/A
2	Yes	Yes	$79,273	$105,130	No	16’ max, 172’ long	N/A
3	No	N/A				N/A	N/A
4	Yes	Yes	$72,254	$111,478	No	20’ max, 120’ long	N/A
5	Yes	Yes	$631,088	$656,118	No	18’ max, 868’ long	N/A
6	Yes	Yes	$499,584	$269,920	Yes	12’ max, 604’ long	Noise Wall #1
7	No	N/A				N/A	N/A
8	Yes	Yes	$89,801	$334,020	No	20’ max, 592’ long	N/A
9	Yes	Yes	$110,858	$177,538	No	18’ max, 520’ long	N/A
10	Yes	Yes	$885,829	$877,215	Yes	14’ max, 1214’ long	Noise Wall #2
11	Yes	Yes	$252,889	$604,508	No	18’ max, 877’ long	N/A
12	Yes	Yes	$423,408	$1,459,737[2]	No	20’ max, 2039’ long	N/A
13	Yes	Yes	$125,928	$73,493	Yes	8’ max, 224’ long	Noise Wall #3
14	No	N/A				N/A	N/A
15	No	N/A				N/A	N/A
16	No	N/A				N/A	N/A
17	No	N/A				N/A	N/A
18	No	N/A				N/A	N/A

1. WSDOT Noise Policy requires that a noise wall provided at least 7 dB of reduction at one receptor for the abatement to be considered reasonable.
2. Cost of Sound Transit Federal Way Link Extension noise wall not included.

FIGURE 5. Noise Wall #1

FIGURE 6. Noise Wall #2

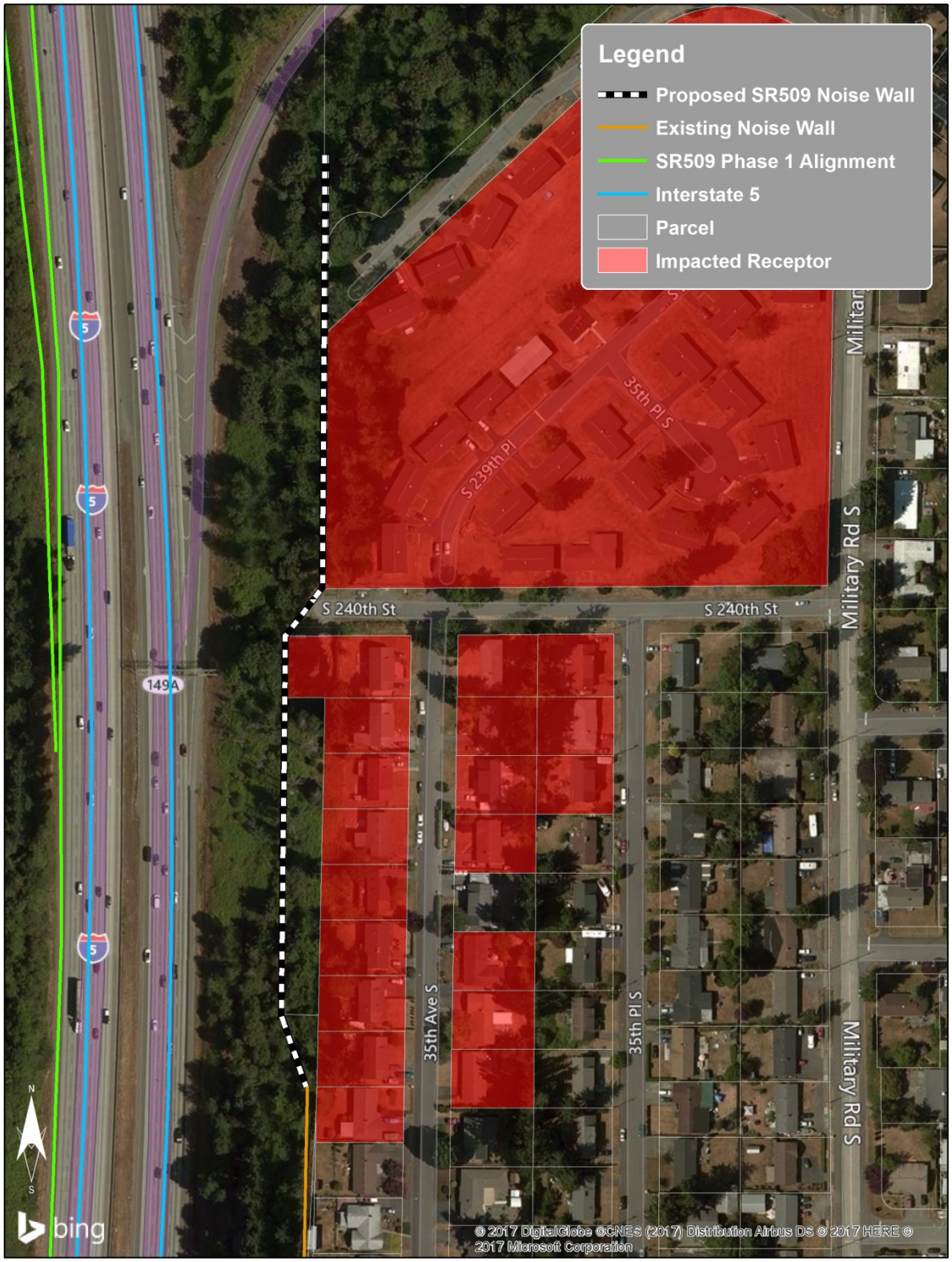
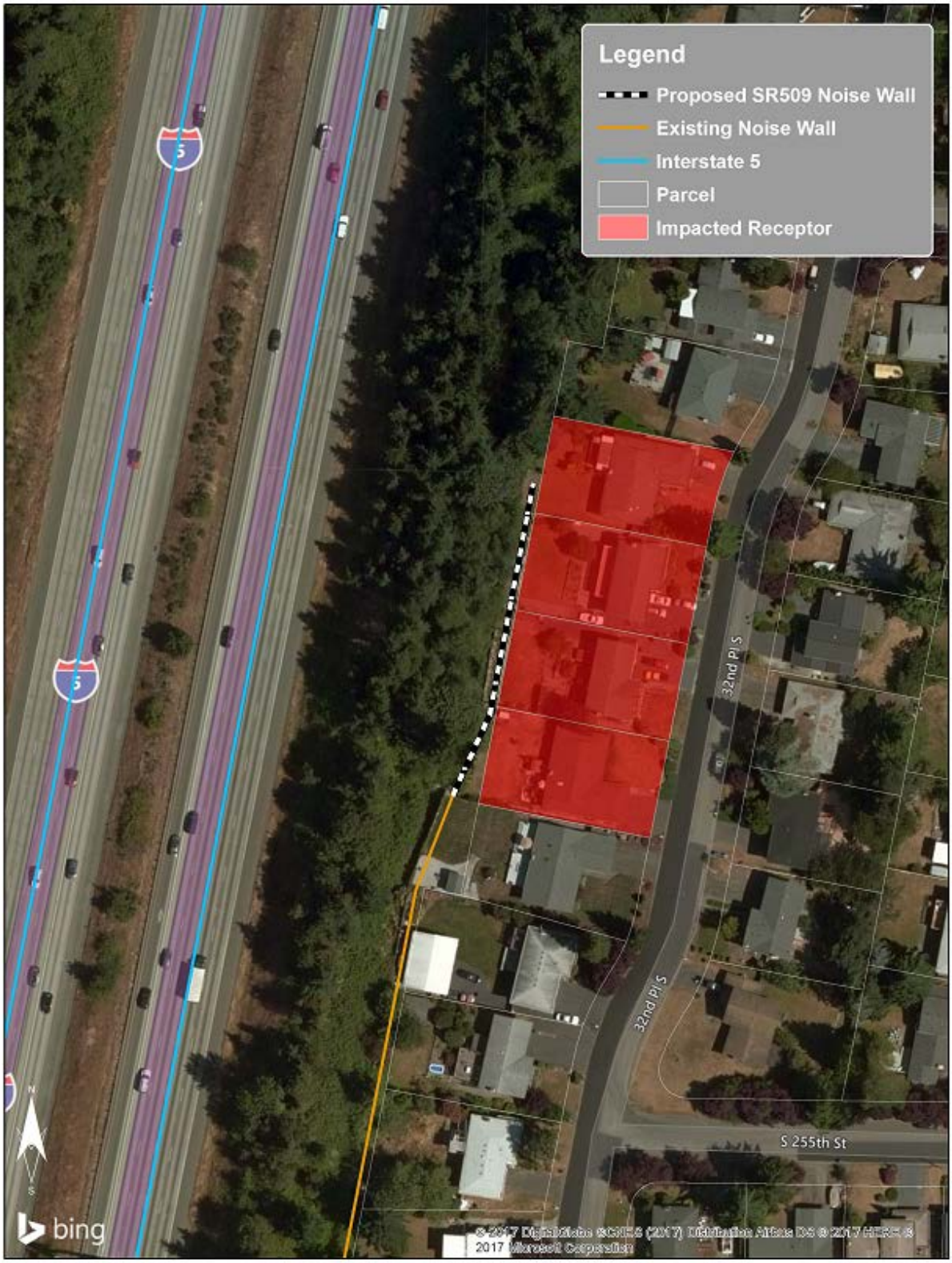


FIGURE 7. Noise Wall #3



6. How would temporary construction effects compare to the 2003 FEIS Alternative C2?

Construction activity impacts would be similar to those described in the 2003 FEIS. Construction activities would include clearing and grubbing, excavation, wall construction, pile driving, demolition or resurfacing of existing roadways, bridge construction, paving, and striping. Sound levels predicted in the 2003 FEIS ranged from 69 to 106 dBA at 50 feet and 57 to 94 dBA at 200 feet. Mitigation measures included in the 2003 FEIS included placing stationary noise sources away from noise-sensitive receivers, using portable noise barriers, placing limits on idling equipment, minimizing backing of vehicles, avoiding noisy activities to the extent feasible, installing engine exhaust mufflers, using ambient sensitive backup alarms, and limiting night work. Another construction noise control measure that may be considered for Phase 1 Improvements are ambient-sensing broadband backup alarms, which do not have the tonal component of typical backup alarms.

The number of nights work would occur is as of yet undetermined, but would likely be similar to those planned for Alternative C2, as described in 2003 FEIS. Any work done within the following hours would be subject to permitting by the local jurisdiction, either with a nighttime work permit or noise variance.

- King County – all receptor types
  - Weekdays (typical activities) – 7 p.m. to 7 a.m.
  - Weekdays (impact activities) – 5 p.m. to 8 a.m.
  - Weekends (typical activities) – 7 p.m. to 9 a.m.
  - Weekends (impact activities) – 5 p.m. to 9 a.m.
- City of Burien – residential receptors only
  - Weekdays – 10 p.m. to 7 a.m.
  - Weekends – 10 p.m. to 9 a.m.
- City of Federal Way – all receptor types
  - Weekdays – 8 p.m. to 7 a.m.
  - Weekends – 8 p.m. to 9 a.m.
- Cities of SeaTac and Kent – residential receptors only
  - 10 p.m. to 7 a.m. near residential receptors

7. How would measures to minimize harm compare to the 2003 FEIS Alternative C2?

Thirteen noise barriers were proposed for future consideration in the 2003 FEIS. Fewer barrier areas (three) are proposed for future consideration in this updated analysis for the Phase 1 Improvements because there would be fewer noise impacts.

8. Conclusion

No new significant impacts to noise would occur as a result of the Phase 1 Improvements that were not previously identified in the 2003 FEIS. The updated analysis identifies significantly fewer noise impacts than were originally estimated in the 2003 FEIS. Based on the information above, WSDOT does not anticipate any new significant impacts that were not evaluated in the 2003 FEIS.

References

Port of Seattle, 2013. *Sea-Tac International Airport Noise Contours*

Sound Transit. 2016. Federal Way Link Extension FEIS, *Appendix G3 – Noise and Vibration Technical Report.*

United States Department of Transportation. 2011. *23 CFR 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise*

Washington State Department of Transportation. 2011. *Traffic Noise Policy and Procedures*

City of Burien. *Burien Municipal Code Chapter 9.105.400 - Noise*

City of SeaTac. *SeaTac Municipal Code Chapter 15.460.020 - Noise*

City of Kent. *Kent City Code Chapter 8.05 - Noise Control*

City of Federal Way. *Federal Way Revised Code Chapter 7.10 – Noise*

King County. *King County Code Chapter 12.86 - Noise*

Washington State Department of Ecology. *Washington Administrative Code Chapter 173-60 Maximum Environmental Noise Levels*

Attachments

Federal Way Link Extension Noise Analysis Utilization Procedure

Noise levels in the SR 509 project area will be affected by non-SR 509 noise sources, such as the Federal Way Link Extension (FWLE). The day-night noise levels (Ldn) from the light rail operations of the FWLE have been estimated for the FWLE Final Environmental Impact Statement (FEIS). The noise analysis for the SR 509 project will be based on the maximum hourly equivalent noise level (Leq), not the Ldn. The purpose of this document is to determine the approach to be used to derive the maximum hourly Leq FWLE noise level from the available data on light rail operations and estimated Ldn levels in the FWLE FEIS. Based on the evaluation method described below, **the resulting adjustment factor was found to be {-3 dB}**.

The FWLE estimated Ldn noise levels in the FEIS were calculated using methods and data found in TRAFFIC NOISE AND VIBRATION IMPACT ASSESSMENT, Office of Planning and Environment, Federal Transit Administration, FTA-VA-90-1003-06, May 2006. Additional data were obtained through measurements on equipment in other areas of the existing transit system. The Ldn levels were estimated by calculating the energy average of the hourly Leq for each hour of the day and night, with a 10 dBA penalty added to the nighttime levels. The equations for estimating the hourly Leq for each component of the rail system are generally in the following format, or similar:

$$L_{eqC}(h) = SEL_{ref} + 10\log(N_{cars}) + 20\log\left(\frac{S}{50}\right) + 10\log(V) - 35.6$$

Where:

SEL is the sound exposure level, dBA

N is the number of identical components

S is the speed, miles per hour

V is the volume, trains per hour

35.6 is to convert the SEL to an hourly Leq basis

The estimation of maximum hourly Leq is based on the assumption that the only difference between hourly levels is the number of average trains per hour. It is assumed that the speed, number of cars, SEL, and any other noise sources (for example, horns) for all trains are identical.

Train volume information was obtained from headway data found in Section 5.1.1.5 (Operational Plan) in the FWLE FEIS. The operating plan used in the analysis assumes four-car trains operating between 5:00 a.m. and 1:00 a.m. daily with the following headways:

1. Peak (6:00 a.m. to 8:30 a.m. and 3:00 p.m. to 6:30 p.m.): 8-minute headways
2. Midday and early evening (8:30 a.m. to 3:00 p.m. and 6:30 p.m. to 10:00 p.m.): 10-minute headways
3. Early morning and late evening (5:00 a.m. to 6:00 a.m. and 10:00 p.m. to 1:00 a.m.): 15-minute headways

Vehicle, track, and systems maintenance occurs between approximately 1:00 a.m. and 5:00 a.m. daily, outside of normal hours of light rail service. Based on preliminary operating plans, about two trains may be deployed between approximately 4:30 and 5:00 a.m. to stage trains for the beginning of morning service at FWLE stations. Similarly, about two trains may operate between approximately 1:00 and 1:30 a.m. along the FWLE as they return to the OMFs at the close of service each day.

Based on this information, determine the average hourly train volumes over a 24 hour period and the adjustment to be made in the Leq calculation.

Table A1 FWLE Noise Calculations

Day or Night?	Time Period	Headway, min	Trains per hour, avg	Volume Adjustment, 10*log(trains/hr)
Day	7:00 am - 8:30 am	8	7.5	8.75
	8:30 am - 3:00 pm	10	6.0	7.78
	3:00 pm - 6:30 pm	8	7.5	8.75
	6:30 pm - 10:00 pm	10	6.0	7.78
Night	10:00 pm - 1:00 am	15	4.0	6.02
	1:00 am - 2:00 am	30	2.0	3.01
	2:00 am - 4:00 am	N/A	0	N/A
	4:00 am - 5:00 am	30	2	3.01
	5:00 am - 6:00 am	15	4.0	6.02
	6:00 am - 7:00 am	8	7.5	8.75

Assume an arbitrary actual Leq from the passby of a single light rail train (Lpb) of 60 dBA. Calculate the resulting Ldn based on the actual volume of trains per hour and the inclusion of the 10 dBA nighttime penalty in the Ldn calculation:

$$L_{pb} := 60$$

$$L_{day} := 10 \cdot \log10\left(\frac{\left(\left(10^{\frac{L_{pb}+8.75}{10}}\right)\cdot 5 + \left(10^{\left(\frac{L_{pb}+7.78}{10}\right)}\cdot 10\right)\right)}{15}\right)$$

$$L_{day} = 68.1$$

$$L_{night} := 10 \cdot \log10\left(\frac{\left(\left(10^{\frac{L_{pb}+10+8.75}{10}}\right)\cdot 1 + \left(10^{\left(\frac{L_{pb}+10+6.02}{10}\right)}\cdot 4 + \left(10^{\frac{L_{pb}+10+3.01}{10}}\cdot 2\right)\right)\right)}{9}\right)$$

$$L_{night} = 74.9$$

$$L_{dn} := 10 \cdot \log10\left(\frac{10^{\frac{L_{day}}{10}} \cdot 15 + 10^{\frac{L_{night}}{10}} \cdot 9}{24}\right)$$

$L_{dn} = 71.9$

Calculate the maximum hourly Leq. It will be the hour with the highest train volume.

$L_{max\_hr} := L_{pb} + 10 \cdot \log10(7.5)$

$L_{max\_hr} = 68.8$

Calculate the difference between the Ldn and the maximum hourly Leq:

$L_{dn} - L_{max\_hr} = 3.2$ Round off to a difference of 3 dBA.

Sea-Tac Airport Part 150 Noise Contours Utilization Procedure

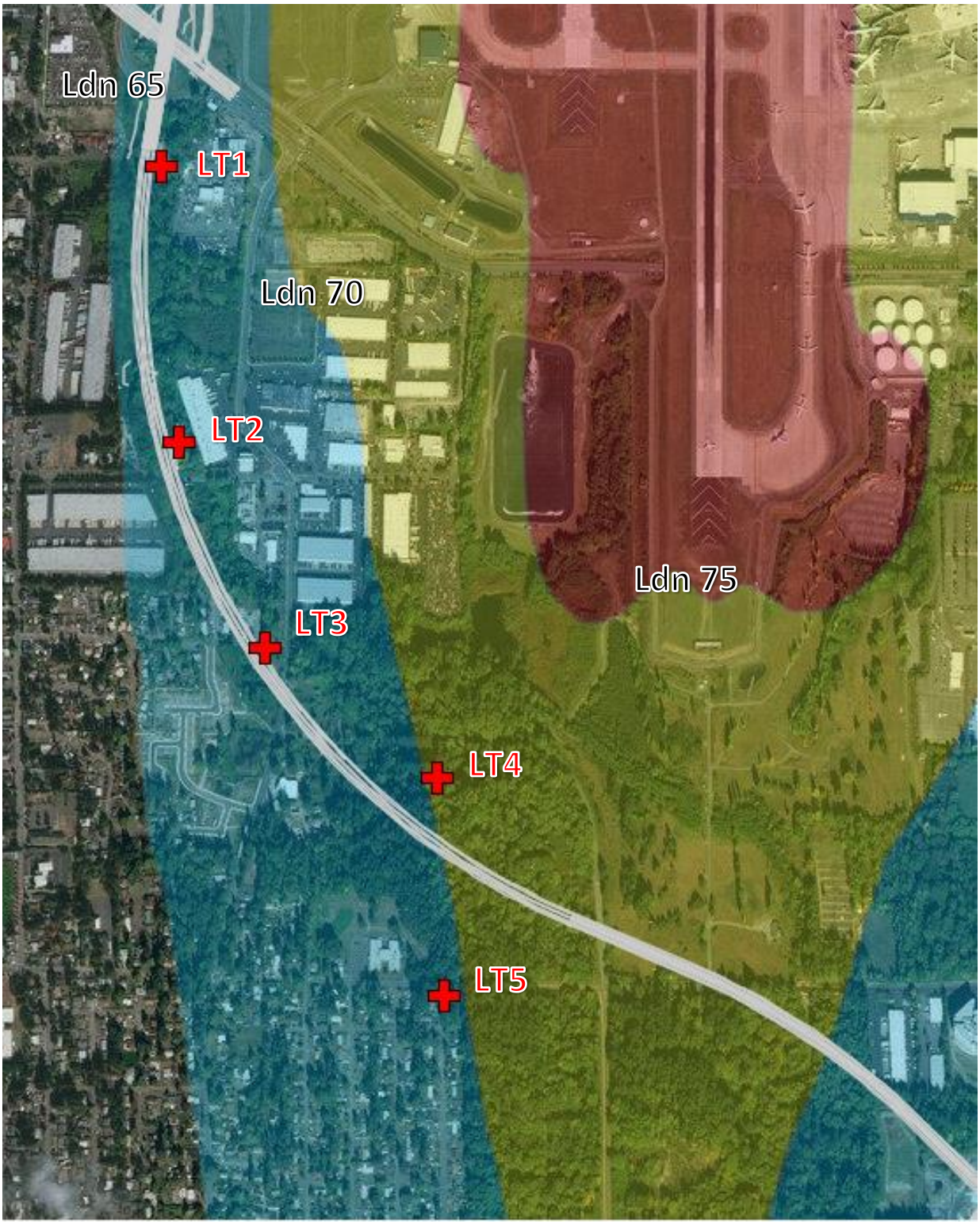
Noise levels in the SR 509 project area will be affected by non-SR 509 noise sources, such as aircraft operations at Seattle-Tacoma International Airport (Sea-Tac). The day-night noise levels (Ldn) from flight operations at Sea-Tac have been estimated in noise contours published by the Port of Seattle in the Part 150 study for Sea-Tac. The noise analysis for the SR 509 project will be based on the maximum hourly equivalent noise level (Leq), not the Ldn. The purpose of this document is to determine the approach to be used to derive the maximum hourly Leq Sea-Tac noise level from the available data on Ldn levels, based on a median "delta" value between the two metrics.

Measurements of existing sound levels south of Sea-Tac were conducted at five locations between March 15 and May 31, 2016. These data were then used to conduct a statistical analysis of typical differences between 24-hour Ldn values and peak-hour Leq. A summary of the measurement results are shown below. Since peak hours have been defined as between 7:30 and 8:30 a.m. and between 4:30 and 5:30 p.m., four hourly Leq values were used for each 24 hour period (7:00 to 8:00 a.m., 8:00 to 9:00 a.m., 4:00 to 5:00 p.m., and 5:00 to 6:00 p.m.) to provide a larger statistical dataset totaling of 17 Ldn and 68 peak hour Leq values. **The resulting adjustment factor was found to be {-4 dB}**. Therefore, the peak hour Leq for a particular site within the Sea-Tac noise contours can be estimated by applying this adjustment factor to the Sea-Tac Ldn value shown in the Sea-Tac noise contours.

Measurement results are summarized in the table below. Measurement locations are shown in Figure A1, along with 2018 Sea-Tac Ldn sound level contours. Measurement data was only used to determine the adjustment factor from Ldn to Leq.

Table A2 Measured Sea-Tac Sound Levels					
Location	**Start Date and Time**	**Duration**	**Ldn**	**Range of Peak hour Leq**	**Range of Delta**
LT-1	May 19, 2 p.m.	24 hours	66	57 – 64	2 – 9
	May 20, 2 p.m.		66	56 – 62	4 – 10
	May 21, 2 p.m.		67	59 – 63	4 – 8
LT-2	May 22, 5 p.m.		72	63 – 70	2 – 9
	May 23, 5 p.m.		69	63 – 68	1 – 6
	May 24, 5 p.m.		71	64 – 68	3 – 7
LT-3	May 31, 1 p.m.		71	66 – 69	2 – 5
	June 1, 1 p.m.		71	67 – 69	2 – 4
	June 2, 1 p.m.		71	66 – 69	2 – 5
LT-4	May 15, 3 p.m.		69	63 – 69	0 – 6
	May 16, 3 p.m.		69	64 – 69	0 – 5
	May 17, 3 p.m.		69	64 – 69	0 –5
	May 18, 3 p.m.		67	62 – 70	-3 – 5
	May 19, 3 p.m.		66	60 – 65	1 – 6
LT-5	May 15, 4 p.m.		69	63 – 67	2 – 6
	May 16, 4 p.m.		68	63 – 68	0 – 5
	May 17, 4 p.m.		69	64 – 70	-1 – 5

Figure A1



Traffic Noise Model Validation Measurement Location Data Sheets

Table A3 Short-Term Traffic Noise Model Validation Measurements – Site 1 (February 17, 2017)

Location:	**ST1-1**		**ST1-2**			
Nearest Parcel #:	0134000120		0134000050			
Nearest Street Address:	17751 10TH AVE S		830 S 177TH PL			
Measurement Start	11:25 p.m.		11:25 p.m.			
Duration (filtered)	17 minutes		17 minutes			
Sound Level Meter	Rion NL-52		B&K 2270			
Leq (aircraft filtered)	59.0		54.1			
Leq (TNM validation model)	60.8		52.1			
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
SR 509 southbound	59 mph	793	31	63	3	0
SR 509 northbound	60 mph	765	24	59	0	0

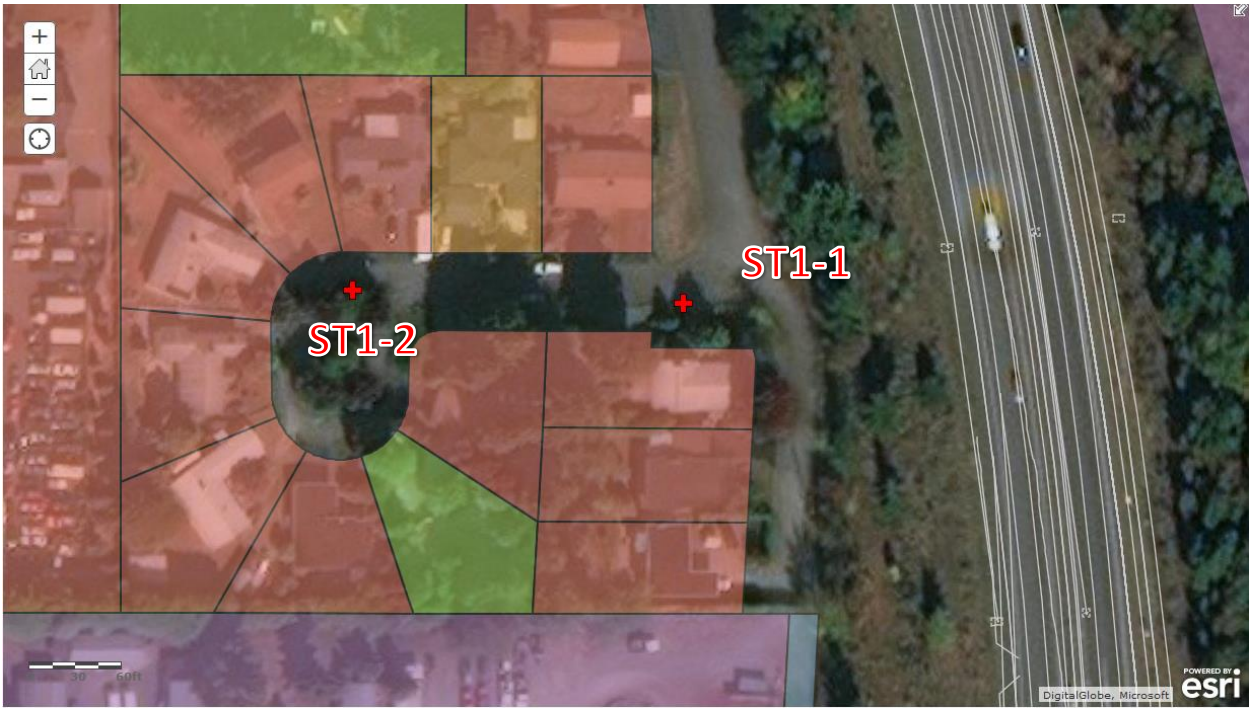


Table A4 Short-Term Traffic Noise Model Validation Measurements – Site 2 (February 17, 2017)

Location:	**ST2-1**		**ST2-2**	**ST2-3**	**ST2-4**	
Nearest Parcel #:	3673400067		3673400056	3673400060	3673400061	
Nearest Street Address:	3304 S 211TH ST		3312 S 211TH ST	3320 S 211TH ST	21021 MILITARY RD S	
Measurement start	2:15 p.m.		2:35 p.m.	2:15 p.m.	2:35 p.m.	
Duration (filtered)	14 minutes		14 minutes	15 minutes	N/A	
Sound Level Meter	Rion NL-52		Rion NL-52	B&K 2270	B&K 2270	
Leq (aircraft filtered)	72.9		69.4	67.3	N/A	
Leq (TNM validation model)	71.8		68.4	67.7	N/A	
Notes				S 211th prominent	S 211th dominant	
Hourly counts (filtered))	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	60 mph	8396	110	344	14	28
I-5 northbound	68 mph	5986	114	344	46	8

Table A5 Short-Term Traffic Noise Model Validation Measurements – Site 3 (March 31, 2017)

Location:	**ST3-1**		**ST3-2**			
Nearest Parcel #:	5083000075		5083100060			
Nearest Street Address:	21203 32ND AVE S		21150 31ST AVE S			
Measurement start	1:58 p.m.		2:32 p.m.			
Duration (filtered)	15 minutes		16 minutes			
Sound Level Meter	SV-971		SV-971			
Leq (aircraft filtered)	62.1		54.4			
Leq (TNM validation model)	62.8		55.6			
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	64-65 mph	8197	205	215	23	33
I-5 northbound	61-65 mph	5994	122	310	41	19

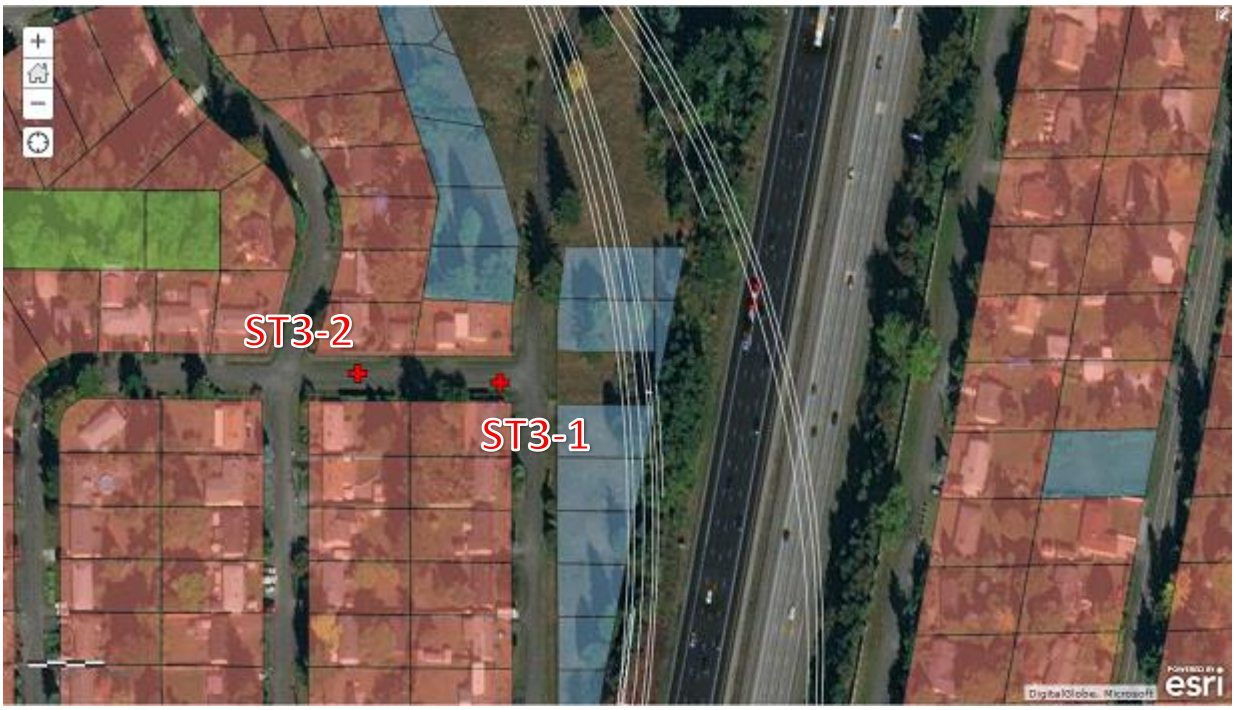


Table A6 Short-Term Traffic Noise Model Validation Measurements – Site 4 (April 14, 2017)

Location:	ST4-1		ST4-2	ST4-3	ST4-4	
Nearest Parcel #:	7259200020		7259200023	7259200015	7259200015	
Nearest Street Address:	3209 S 221ST ST		3217 S 221ST ST	3222 S 221ST ST	3222 S 221ST ST	
Measurement start	10:18 a.m.		10:18 a.m.	10:50 a.m.	10:50 a.m.	
Duration (filtered)	15 minutes		15 minutes	15 minutes	N/A	
Sound Level Meter	B&K 2250		B&K 2270	B&K 2250	B&K 2270	
Leq (aircraft filtered)	71.7		70.9	67.8	N/A	
Leq (TNM validation model)	72.3		70.1	67.4	N/A	
Notes					Military RD dominant	
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	67	5184	184	434	18	6
I-5 northbound	65	5482	148	398	24	8

Table A7 Short-Term Traffic Noise Model Validation Measurements – Site 5 (March 31, 2017)

Location:	**ST5-1**		**ST5-2**			
Nearest Parcel #:	5514600097		5514600090			
Nearest Street Address:	3040 S 224TH ST		3028 S 224TH ST			
Measurement start	11:29 a.m.		11:59 a.m.			
Duration (filtered)	15 minutes		16 minutes			
Sound Level Meter	SV-971		SV-971			
Leq (aircraft filtered)	63.6		60.2			
Leq (TNM validation model)	63.4		60.8			
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	61-64	6308	167	375	18	17
I-5 northbound	65	5855	190	360	27	19

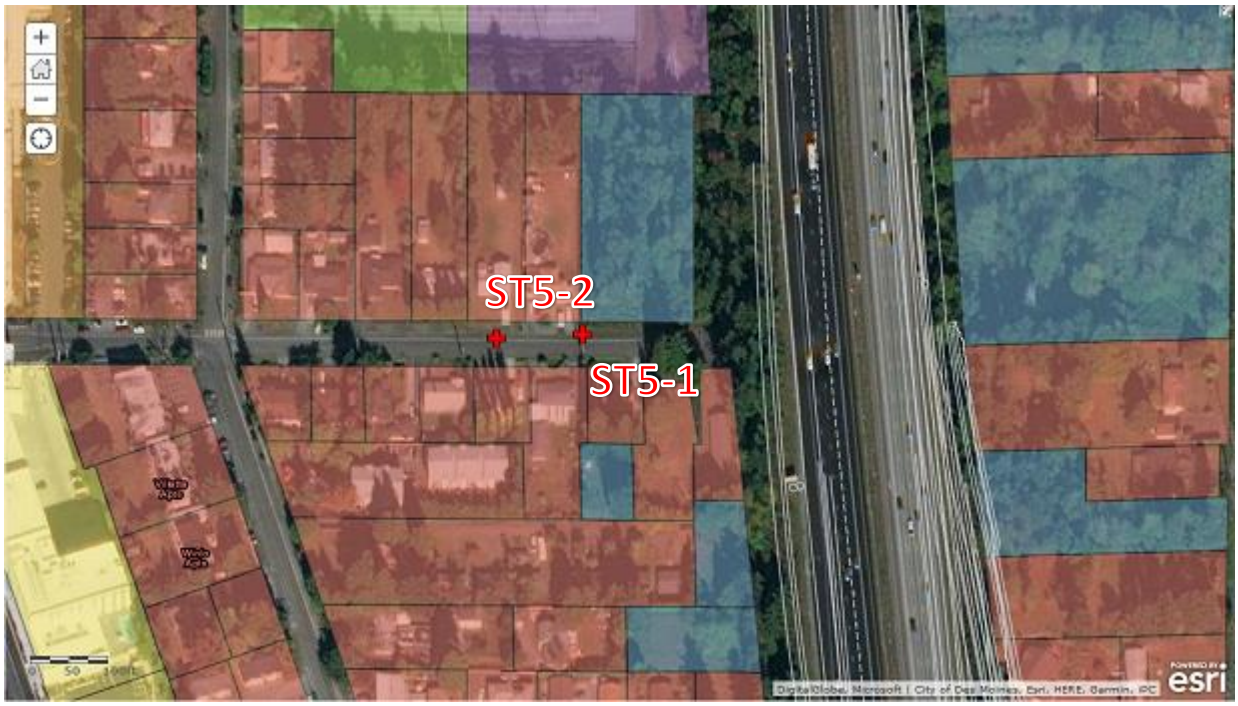


Table A8 Short-Term Traffic Noise Model Validation Measurements – Site 6 (May 4, 2017)

Location:	**ST6-1**					
Nearest Parcel #:	8857600480					
Nearest Street Address:	24403 35TH PL S					
Measurement start	12:32 p.m.					
Duration (filtered)	19 minutes					
Sound Level Meter	NL-52					
Leq (aircraft filtered)	58.9					
Leq (TNM validation model)	56.9					
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	60	5212	188	416	9	19
I-5 northbound	65	4918	191	413	34	25

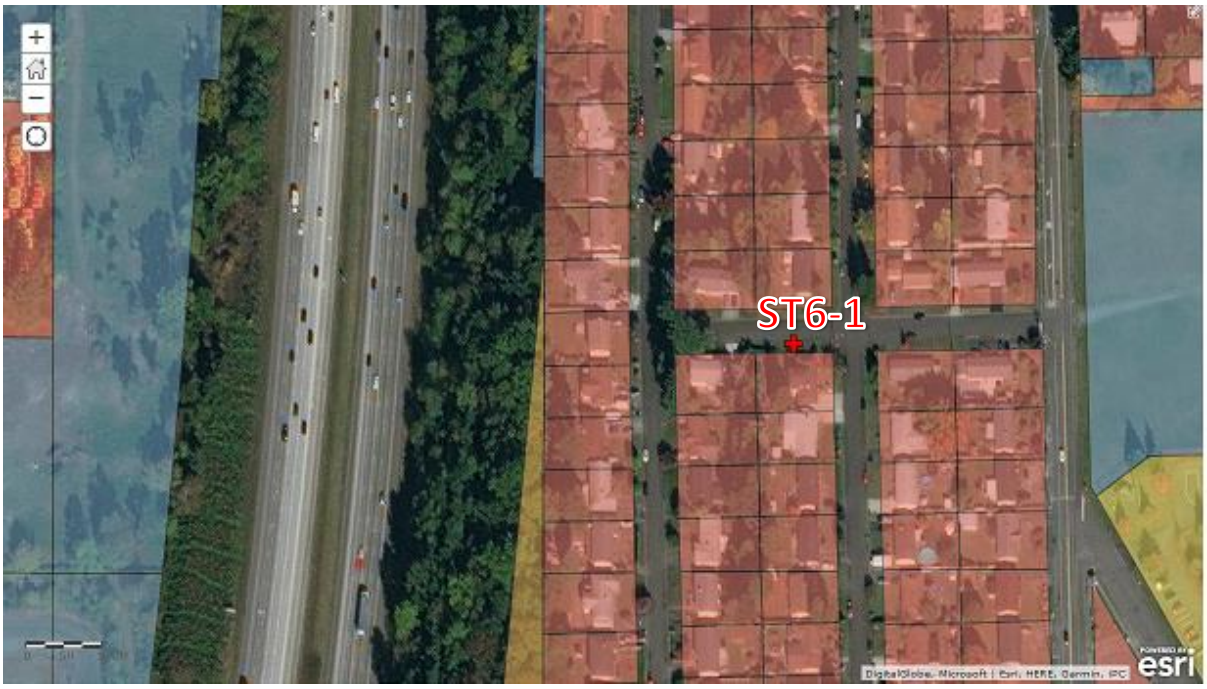


Table A9 Short-Term Traffic Noise Model Validation Measurements – Site 7 (May 4, 2017)

Location:	**ST7-1**					
Nearest Parcel #:	1950900125					
Nearest Street Address:	3025 S 252ND ST					
Measurement start	12:32 p.m.					
Duration (filtered)	21 minutes					
Sound Level Meter	Rion NL-21					
Leq (aircraft filtered)	61.3					
Leq (TNM validation model)	63.2					
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	60	5212	188	416	9	19
I-5 northbound	65	4918	191	413	34	25

Table A10 Short-Term Traffic Noise Model Validation Measurements – Site 8 (May 4, 2017)

Location:	**ST8-1**		**ST8-2**			
Nearest Parcel #:	7633500010		9835800700			
Nearest Street Address:	25601 32ND PL S		25524 32ND PL S			
Measurement start	12:32 p.m.		12:32 p.m.			
Duration (filtered)	20 minutes		20 minutes			
Sound Level Meter	Rion NL-21		Rion NL-21			
Leq (aircraft filtered)	57.6		58.8			
Leq (TNM validation model)	59.2		58.8			
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	60	5212	188	416	9	19
I-5 northbound	65	4918	191	413	34	25

Table A11 Short-Term Traffic Noise Model Validation Measurements – Site 9 (May 4, 2017)						
Location:	**ST9-1**		**ST9-2**	**ST9-3**		
Nearest Parcel #:	2936600095		2936600081	2822049105		
Nearest Street Address:	3005 S 265TH ST		3024 S 265TH ST	26505 MILITARY RD S		
Measurement start	12:32 p.m.		12:32 p.m.	12:32 p.m.		
Duration (filtered)	18 minutes		18 minutes	18 minutes		
Sound Level Meter	Rion NL-52		Rion NL-52	Rion NL-52		
Leq (aircraft filtered)	65.8		62.1	59.4		
Leq (TNM validation model)	65.6		61.6	61.2		
Notes						
Hourly counts (filtered)	**Speed**	**Car**	**Medium Truck**	**Heavy Truck**	**Bus**	**Cycle**
I-5 southbound	60	5212	188	416	9	19
I-5 northbound	65	4918	191	413	34	25

Excluded Parcels

Figure A2 Excluded Parcels #1 (property acquisition by SR 509 or FWLE)

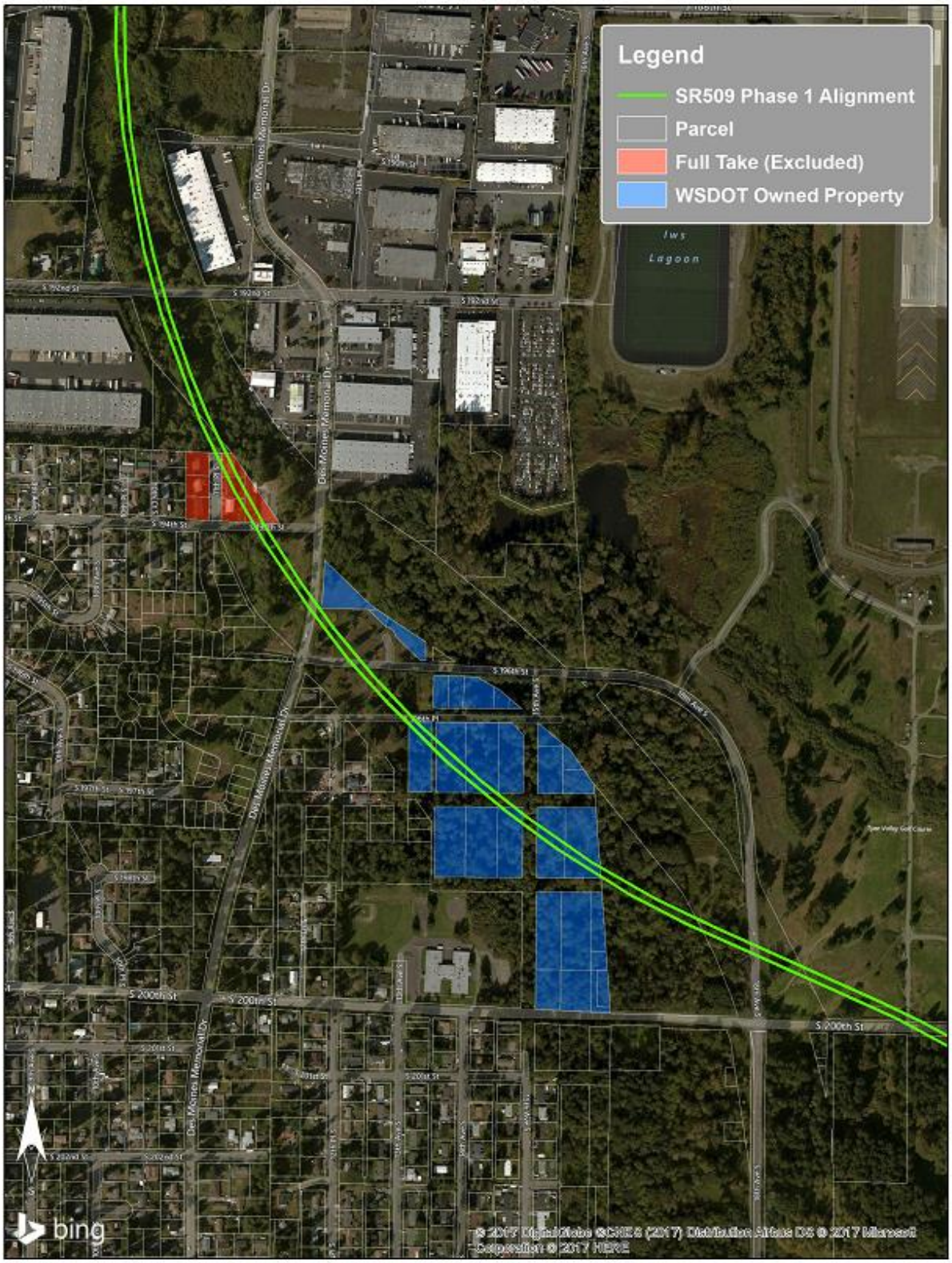


Figure A3 Excluded Parcels #2 (property acquisition by SR 509 or FWLE)

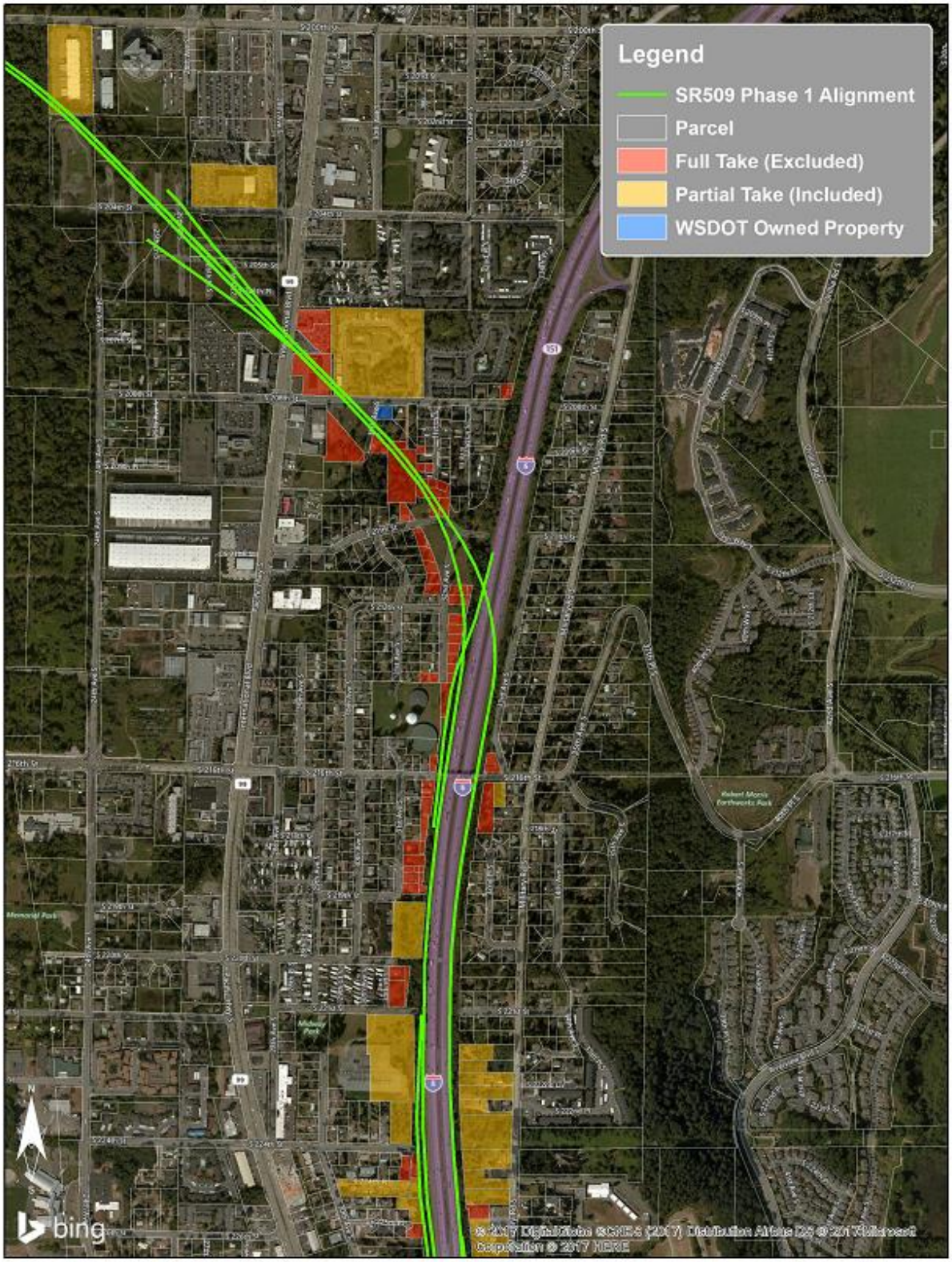
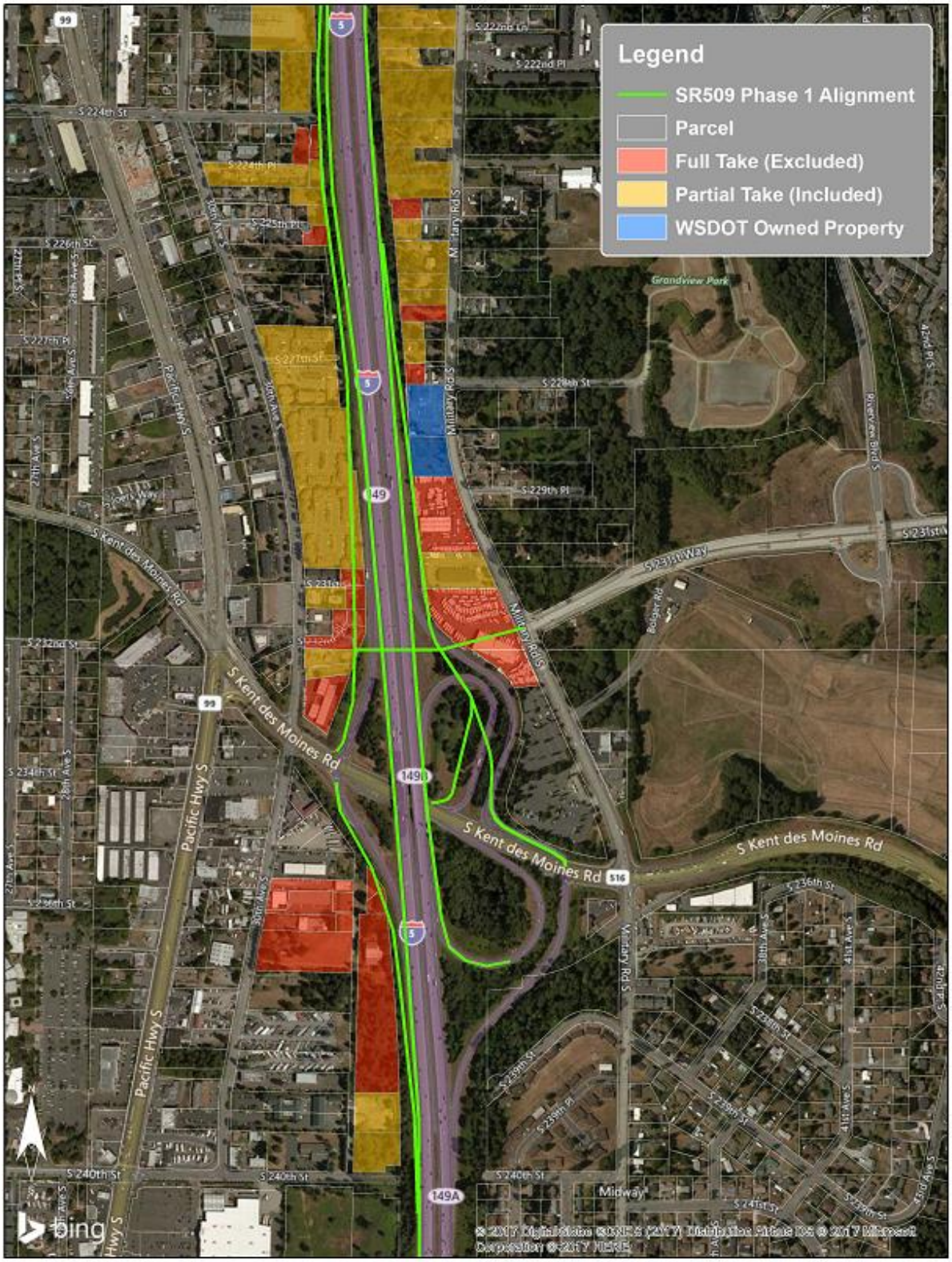


Figure A4 Excluded Parcels #3 (property acquisition by SR 509 or FWLE)



Phase 1 Improvements Noise Analysis Approach

INTRODUCTION

The intent of this memorandum is to present a summary of the methodologies that will be used to evaluate potential noise impacts from the SR509 Corridor Completion Project ("Project"). Noise analysis results will be presented in a Noise Discipline Report (Noise DR) that will accompany other EIS Re-Evaluation documents prepared under Washington State Department of Transportation (WSDOT) and Federal Highway Administration (FHWA) policies.

PROXIMITY TO NON-TRAFFIC NOISE SOURCES

The Project is located within the noise footprint of Sea-Tac Airport (Sea-Tac) and the planned Federal Way Link Extension (FWLE) of the Sound Transit Link light rail system. Based on available information, King County International Airport is not expected to influence a noise impact assessment for the Project.

The presence of these non-traffic noise sources (Sea-Tac and FWLE) complicates implementation of the WSDOT Noise Policy. This memorandum proposes modified approaches to traffic noise impact analysis to account for contributions from these non-traffic noise sources. Modifications to the criteria used to assess traffic noise impacts are not proposed, only the analysis steps taken to determine the sound levels by which to assess potential impacts.

PROPOSED APPROACH

Traffic noise impacts at nearby receptors will be identified in accordance with WSDOT Traffic Noise Policy, with the following exceptions:

Existing/No-Build/Build

WSDOT Noise Policy requires analysis of the following conditions to determine potential noise impacts:

- Existing – sound levels in the Project vicinity, based on traffic conditions prior to construction of the Project, may reflect a different year than the year the analysis is conducted.
- No-Build – sound levels in the vicinity if the Project were not built, based purely on traffic growth projections given the existing roadway configuration.
- Build – sound levels generated by the Project.

Sea-Tac is an existing non-traffic noise source in the Project vicinity with sound level projections available for the year 2018 (assumed to be similar to 2025 and 2045 sound levels), which will be included in the Existing, No-Build, and Build conditions.

The FWLE Final Environmental Impact Statement (FEIS) was published on November 18, 2016 with a Records of Decision (RODs) issued on March 6, 2017 (FTA) and March 9, 2017 (FHWA). FWLE revenue operations are anticipated to commence in 2024. Construction of the SR509 Corridor Completion Project is anticipated to occur between 2022 and 2030, after FWLE is operational. Therefore, sound emissions from FWLE will be included in the Existing, No-Build, and Build condition.

In summary:

- Existing
    - 2025 traffic conditions
    - Sea-Tac 2018 noise contours and FWLE noise predictions
- No-Build
    - 2045 traffic conditions without SR509 extension
    - Sea-Tac 2018 noise contours and FWLE noise predictions
- Build

- 2045 traffic conditions with SR509 extension
- Sea-Tac 2018 noise contours and FWLE noise predictions

Noise Model Validation

WSDOT Noise Policy requires the use of field measurement data (sound levels and traffic counts) to validate the accuracy of the noise model when analyzing modifications to an existing roadway. This condition applies at the existing southern extent of SR509 north of 188th Street and the areas of I-5 to be widened as a part of the Project. The following modified approach is proposed to account for influences on these measurements from non-traffic noise sources:

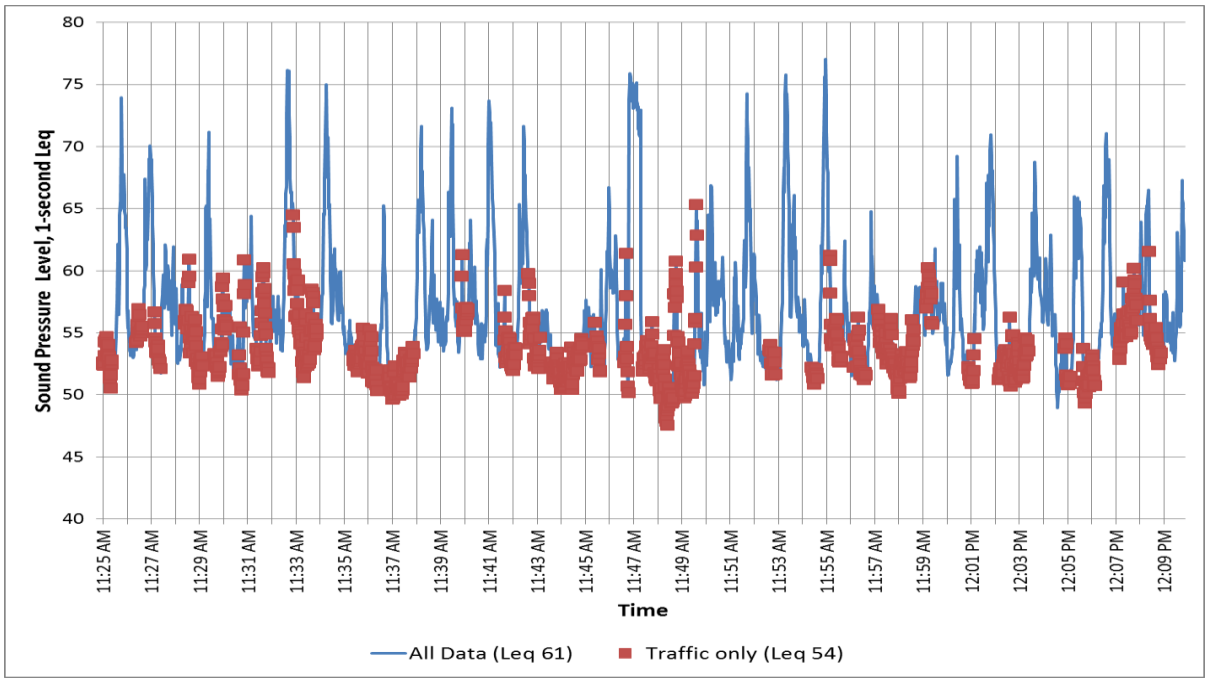
- WSDOT Noise Policy
  - 15 minute measurements to represent hourly Leq, with stable Leq after 10 minutes.
  - Traffic counts for use in TNM validation model input.
  - Measurements conducted during free flow conditions.
- Proposed SR509 approach
  - A dedicated observer will monitor interfering non-traffic noise sources (i.e. aircraft) and note times of sound level interference. These periods that include interference will be excluded from an overall Leq calculation based on 1-second Leq data collected at each monitoring location. Measurements will be conducted until at least 15 minutes of traffic-only measurement data is obtained.
  - Traffic counts will be conducted with video recordings that include a time-stamp, synchronized to each sound level meter prior to the start of measurements. Traffic counts will only be used during clean measurement periods (traffic-only).
  - If the proposed approach does not result in model validation within 2 dB, as required by WSDOT Noise Policy, additional field measurements will be conducted during hours when the interfering non-traffic noise sources are inactive.
    - Example: Sea-Tac Airport is typically inactive between 1 a.m. and 5 a.m. To account for lower traffic flows during this time, minimum measurement duration would be increased to at least 30 minutes to represent an hourly Leq, but may be up to one hour to ensure adequate vehicle counts for the validation model. Vehicle mix during free-flow conditions will also be checked to verify vehicle mix during the validation measurement period is within 10% of free-flow conditions.

An example of this process was conducted on February 17, 2017, at the location shown in Figure 6, approximately 1,050 feet west of Sea-Tac runway 34L and 450 feet west of the SR509 centerline. The cumulative Leq was 61 dBA, the traffic Leq was 54 dBA.

Photo A1. Video Camera Location

Photo A2. Video Camera Feed

Figure A5. Validation Measurement Example (far monitoring location)



Substantial Increase

WSDOT Noise Policy also requires comparison between noise model predictions for Existing and Build conditions to identify noise impacts based on the 10 dB substantial increase threshold. The following modified approach is proposed to account for contributions to existing and future ambient conditions from local non-traffic noise sources:

- WSDOT Noise Policy
  - Existing roadway (southern extent of SR509 and I-5)
    - Comparison between modeled worst hourly traffic noise for Existing and Build conditions based on the noise model validated by short-term measurements of existing conditions, as required by WSDOT Noise Policy.
  - New roadway (SR509 extension to I-5)
    - Measurement of existing noise conditions, as allowed by WSDOT Noise Policy.
- Proposed SR509 approach
  - Existing roadway (southern extent of SR509 and I-5)
    - Comparison between total sound level for Existing and Build conditions. Sound levels for Existing condition determined by modeled worst hour traffic noise levels combined with published noise predictions for Sea-Tac and FWLE. Sound levels for Build condition determined by modeled worst hour traffic noise levels combined with published noise predictions for Sea-Tac and FWLE.
    - Sea-Tac contours are presented in a day-night level (Ldn) metric, which cannot be combined with the modeled worst hour noise levels (Leq). An adjustment factor for these Ldn values will be determined based on 72-hour noise measurements within the Sea-Tac noise footprint, providing several data points to compare hourly Leq trends with airport Ldn values. If monitoring data is obtained from the Port of Seattle, that information will be used in addition to collected field data. The calculation used to determine Sea-Tac peak hour Leq will be included in an

Appendix to the Noise DR and will be based on the median delta between Ldn and peak hour Leq.

- FWLE sound level predictions are presented in the FEIS using Ldn and Leq metrics, depending on the receptor category and noise sources (light rail or traffic). Hourly Leq values will be determined from Ldn using day/night light rail vehicle operations defined in the FIES for the preferred alternative. The calculation used to determine FWLE peak hour Leq will be included in an Appendix to the Noise DR and will be based on FTA methodologies.

- New roadway (SR509 extension to I-5)
  - Comparison between total sound level for Existing and Build conditions.
  - Sound levels for the Existing condition determined by combining published noise predictions from Sea-Tac, field measurements, and FWLE.
  - Sound levels for the Build condition determined by modeled worst hour traffic noise levels combined with published noise predictions for Sea-Tac and FWLE.

Noise Abatement

Pursuant to WSDOT Noise Policy, if traffic noise impacts are identified, abatement measures will be reviewed. The following modified approach is proposed to account for noise reductions afforded by planned FWLE sound walls described in the FEIS:

- WSDOT Noise Policy
  - Identify potential noise impacts with existing abatement included, based on the Build condition. Where impacts are identified, review abatement methods (noise walls, earthen berms, etc.) for feasibility and reasonableness.
- Proposed SR509 approach
  - Identify potential noise impacts based on the Build condition with existing and planned at-grade FWLE sound walls included in the "without SR509" FWLE analysis condition detailed in the FWLE FEIS.
  - Review effects of increased noise wall height or length on any remaining noise impacts. Assessment for increased height or length of existing or at-grade noise walls planned for FWLE will be based on additional wall area only.

Analysis Tools

All traffic noise modeling will be conducted in TNM 2.5. Traffic noise model output, field measurements, noise wall footprints, receptor inventories, and noise data for Sea-Tac and FWLE will be maintained in an ArcGIS database. Examples of the current ArcGIS database are shown below, information will evolve as the analysis progresses, including receptor activity categories, monitoring locations, etc.

Figure A6. Project Alignment and Non-Traffic Noise Sources

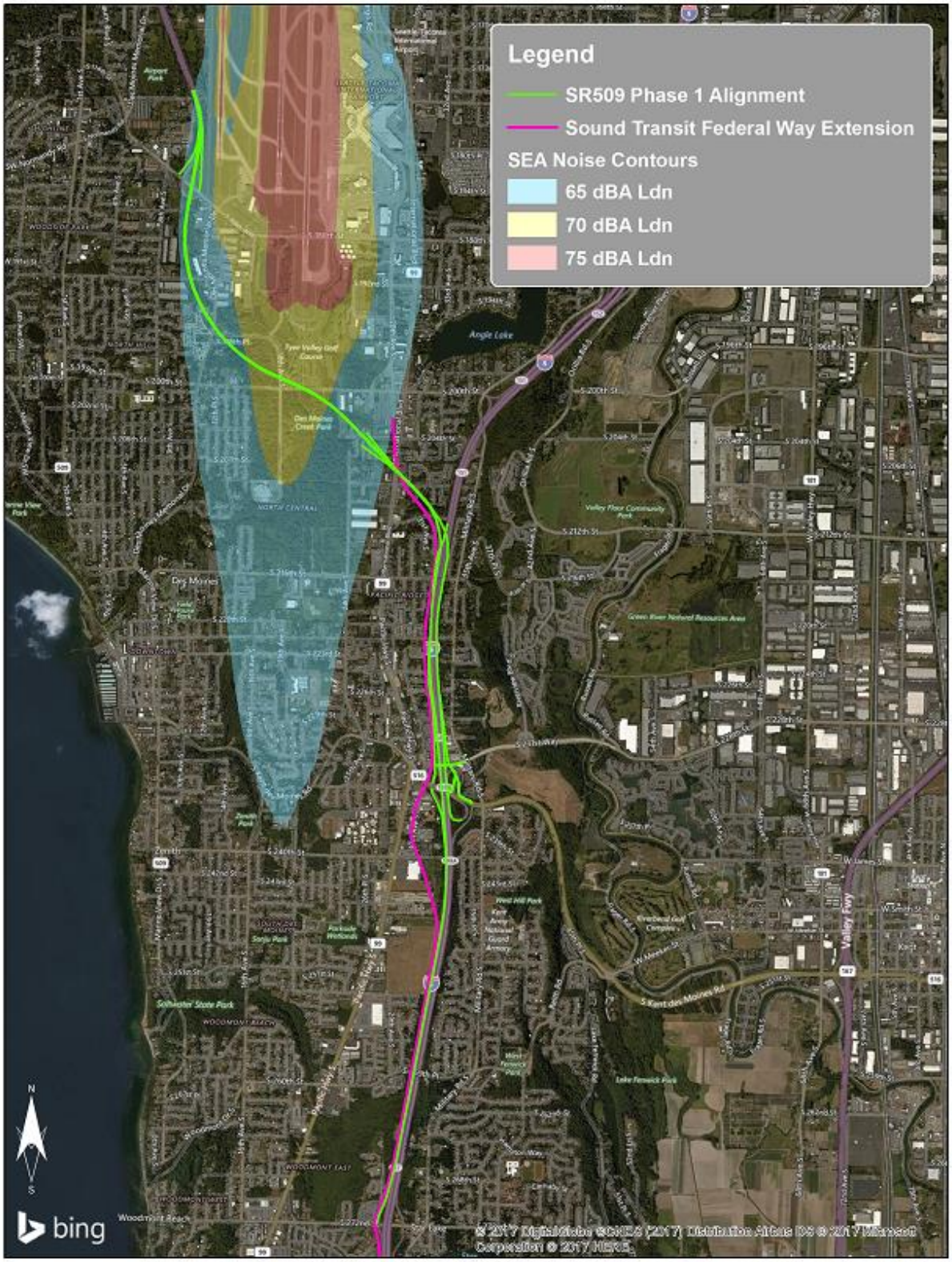


Figure A7. Project Alignment Detail #1

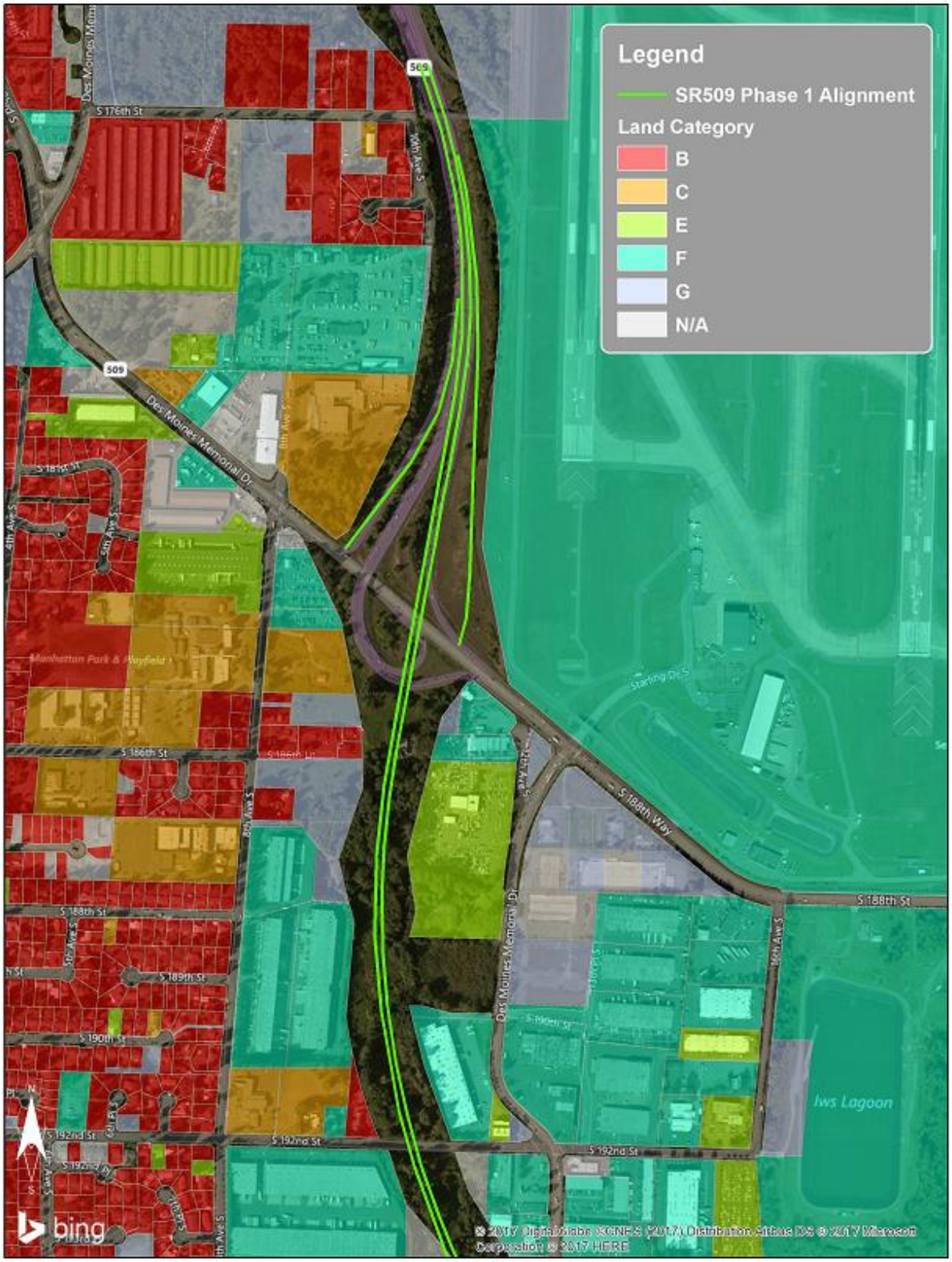


Figure A8. Project Alignment Detail #2

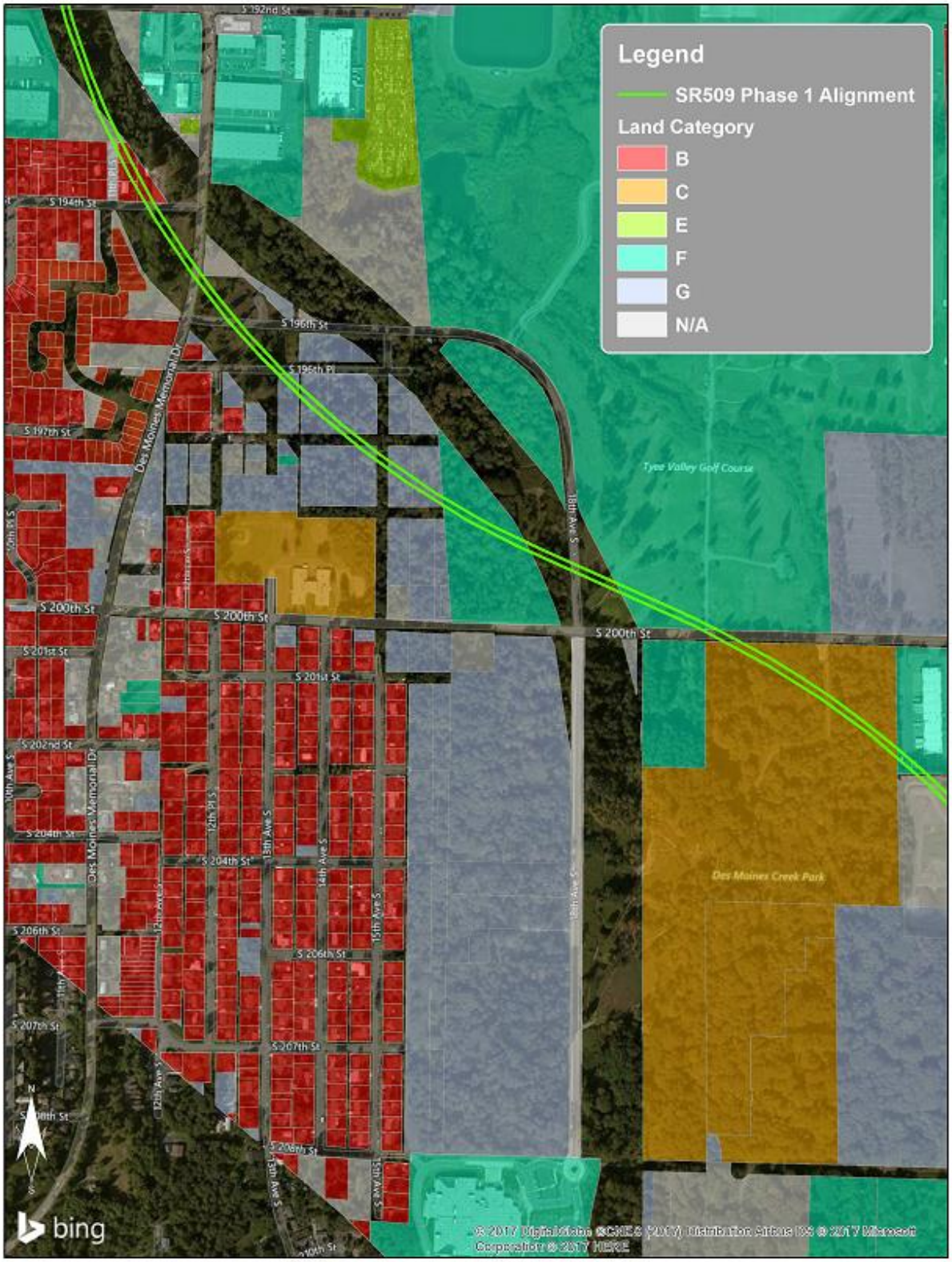


Figure A9. Project Alignment Detail #3

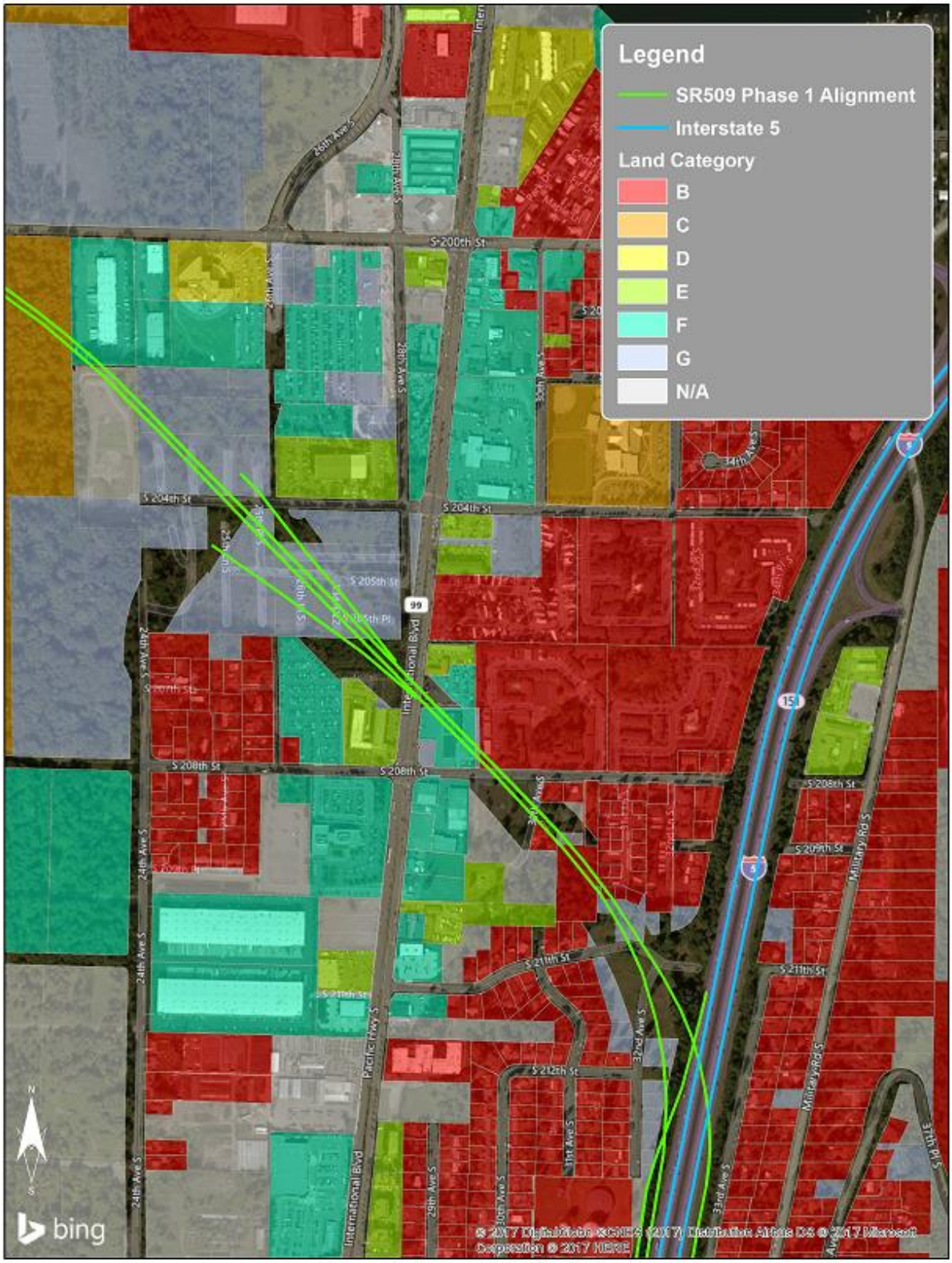


Figure A10. Project Alignment Detail #4

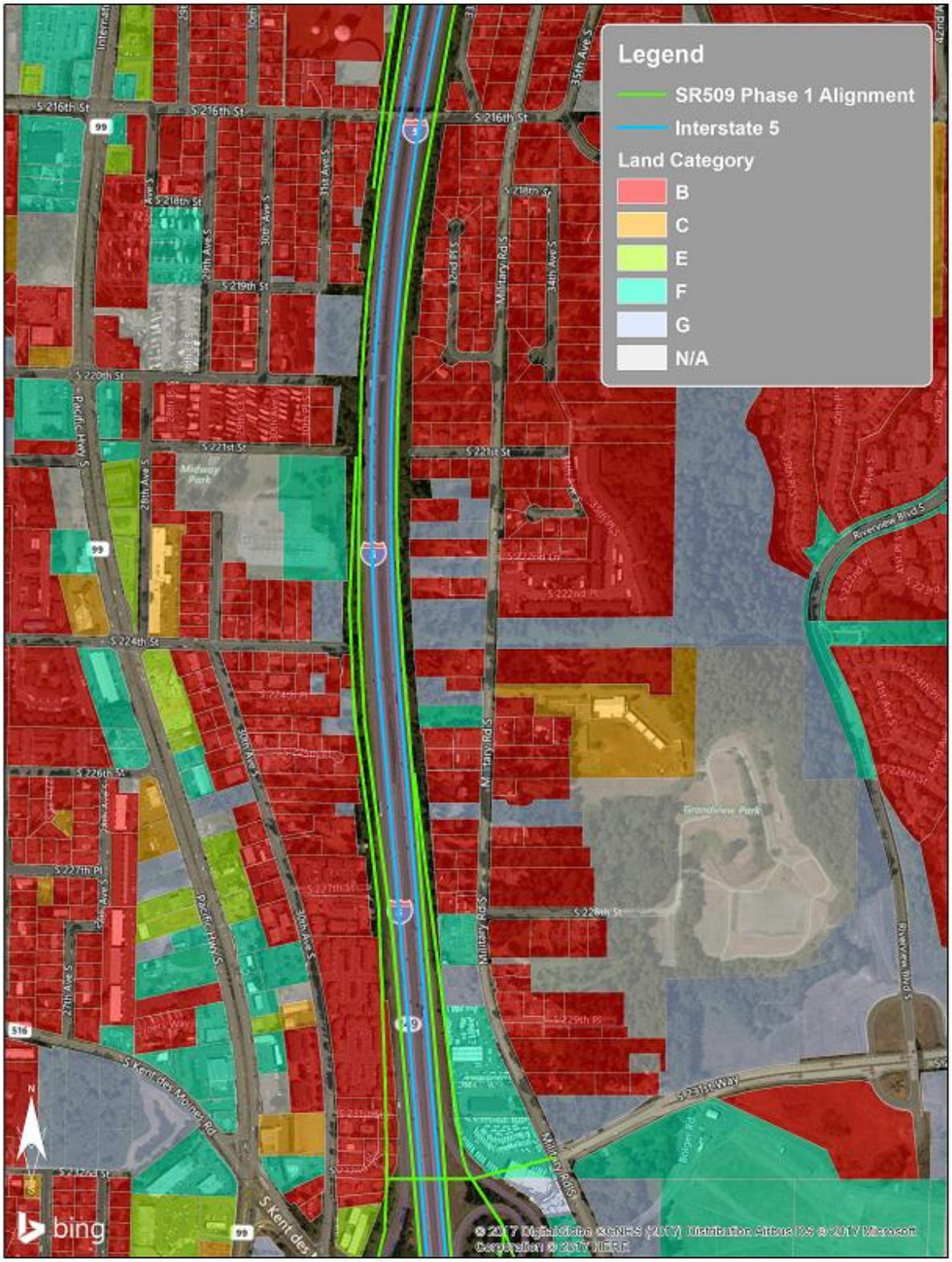


Figure A11. Project Alignment Detail #5

Figure A12. Project Alignment Detail #6

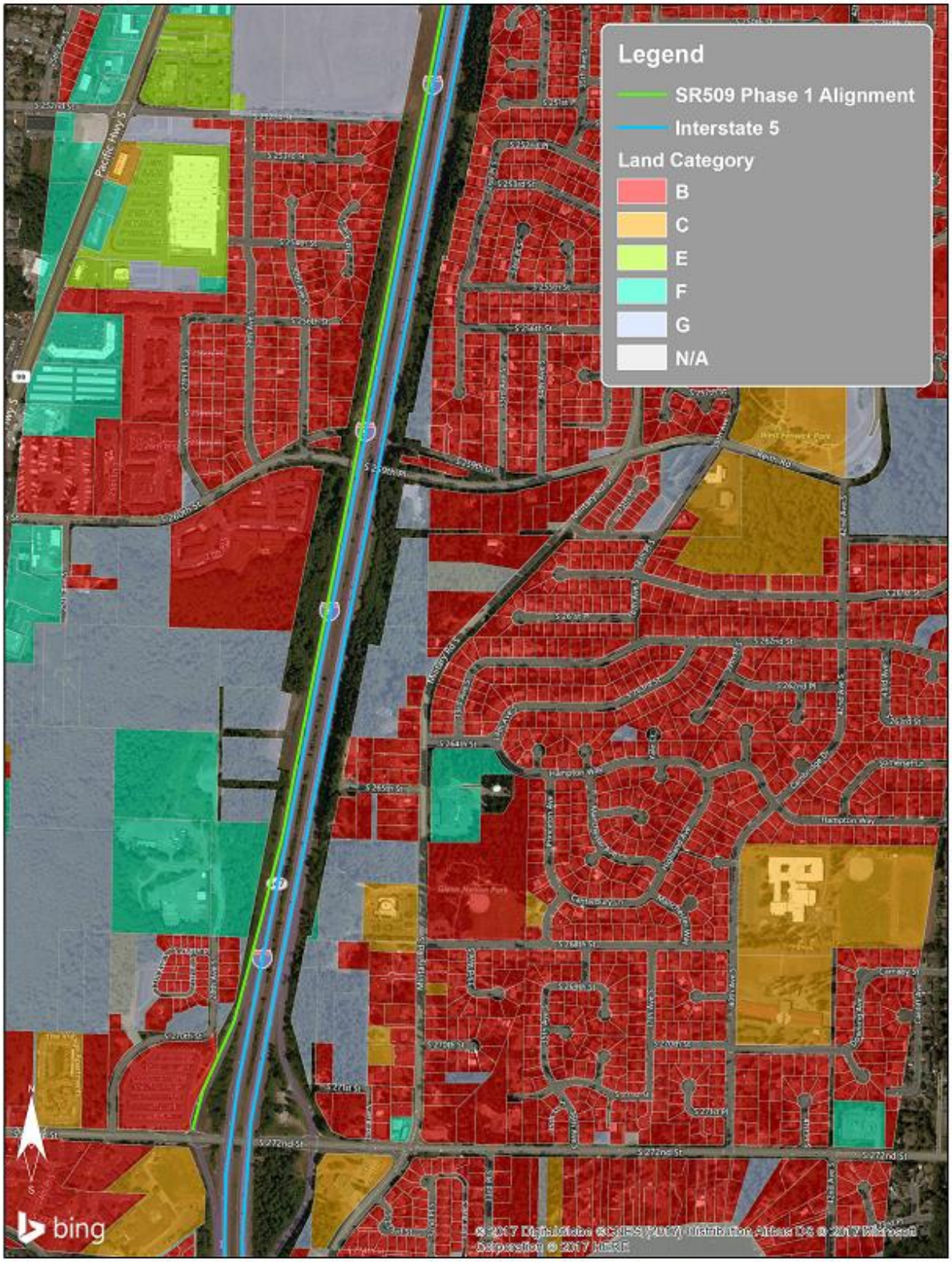


Figure A13. Locations of Evaluated Noise Walls

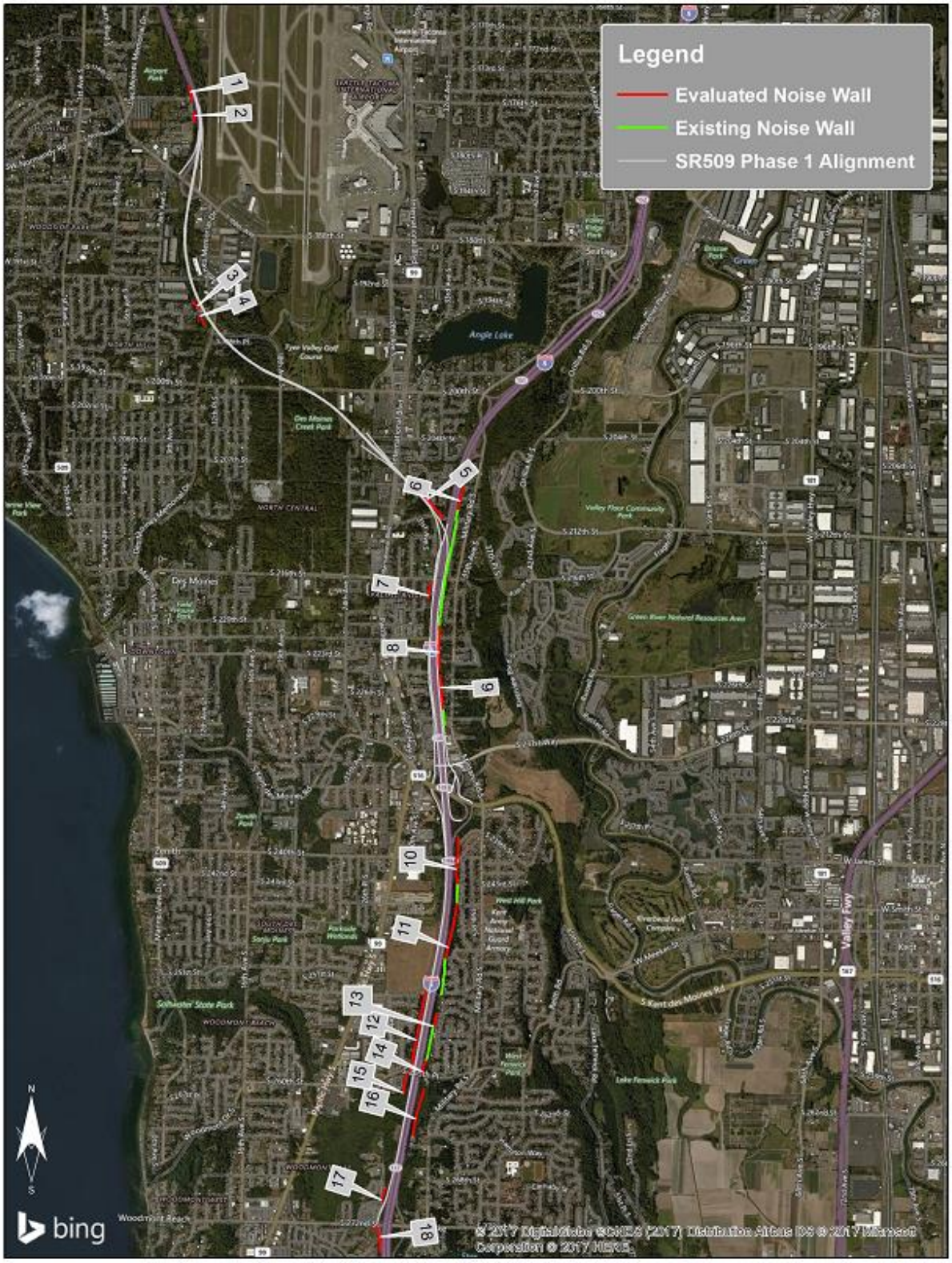


Figure A14. Locations of Proposed Noise Walls