WSDOT

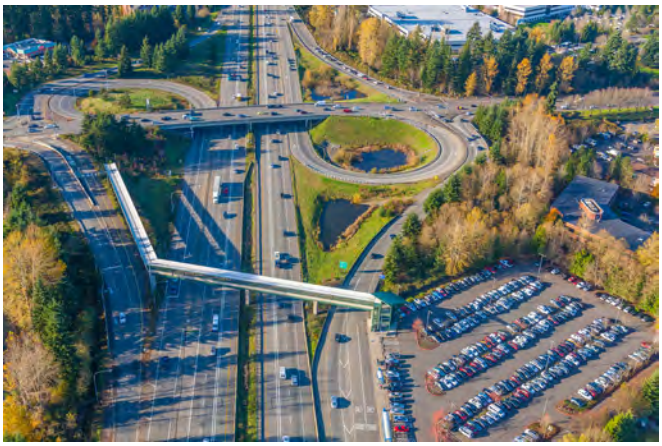
U. S. Department of Transportation
Federal Highway Administration

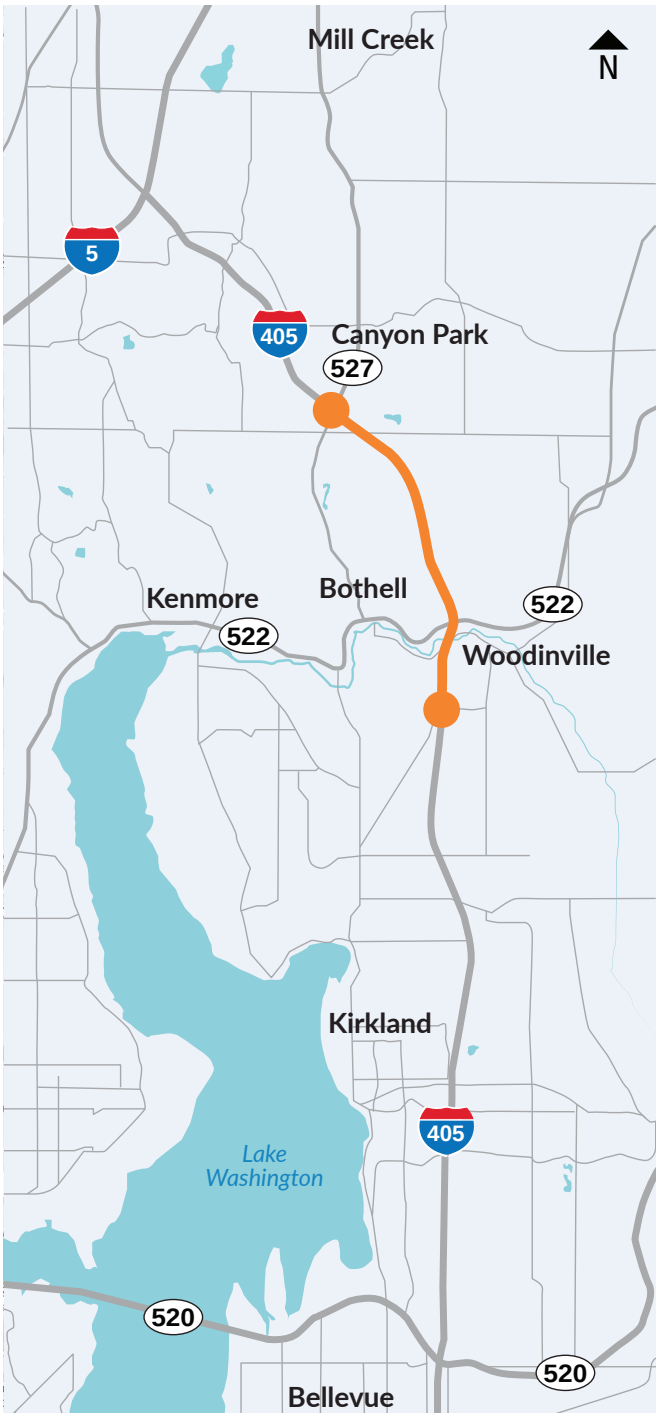
MAY 2020

ENVIRONMENTAL ASSESSMENT

Appendix B: Noise Discipline Report

I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project (MP 21.79 to 27.06)





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SECTION 1 SUMMARY

The *Noise Discipline Report* was prepared in support of the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project (Project) Environmental Assessment (EA). This report evaluates the environmental effects of proposed improvements on Interstate 405 (I-405) from milepost (MP) 21.79 to MP 27.06 in support of the EA.

1.1 Purpose of the Report

The Washington State Department of Transportation (WSDOT) requires a noise analysis on all Type I projects per its *Traffic Noise Policy and Procedures Manual* (WSDOT 2011). Type I projects involve 1) the construction of a new highway on a new alignment, 2) significant horizontal or vertical changes to the current highway alignment, or 3) increases to the number of through-traffic lanes on an existing highway. This Project qualifies as a Type 1 project for highway noise analysis because of the addition of through-traffic lanes, restriping of existing pavement for the purpose of adding through-traffic lanes, and the addition and relocation of interchange lanes and ramps. This report describes existing noise levels, identifies and assesses potential effects of the Project to noise levels, and identifies measures to reduce noise.

1.2 Study Approach

The noise study area covers approximately 500 feet from the pavement edge throughout the Project limits. The Project study area primarily consists of single-family and multifamily residential land use, along with places of worship; schools; parks and trails; and retail, industrial, and commercial properties.

The I-405 roadway in the study area is primarily at grade or elevated on bridge structures above local streets and waterways, depending on the location. This portion of I-405 currently varies from three to five travel lanes in each direction. The posted speed limit on I-405 is 60 mph; however, existing travel speeds can dip below 45 mph during times of congestion.

The study area also includes part of SR 522 and SR 527 near their interchanges with I-405.

- The SR 522 roadway in the study area is at grade below I-405 with two travel lanes in each direction traveling east through the interchange and three travel lanes in each direction beyond the I-405 ramps at the far east side of the interchange. The posted speed limit on SR 522 is 60 mph east of the North Creek Trail bridge and 35 mph west of the North Creek Trail bridge.
- The SR 527 roadway in the study area is at grade at a similar level to I-405 except for where the roadway crosses over I-405 at the interchange. This portion of SR 527 varies from two to five lanes in each direction on either side of I-405 and is two lanes in each direction on the I-405 overcrossing. The posted speed limit for this area of SR 527 is 45 mph.

WSDOT used the Federal Highway Administration (FHWA) Traffic Noise Model Version 2.5 to validate and predict future (2045) traffic noise levels. The model included 989 receivers, representing 1,648 dwelling units. WSDOT compared the predicted loudest-hourly noise levels

to the FHWA Noise Abatement Criteria (NAC) to determine if there would be noise impacts with the Project. The FHWA NAC define the noise level values for traffic noise impact by land use activity categories. A traffic noise impact occurs when the traffic noise level is predicted to approach (within 1 decibel) or exceed the NAC in the design year Build Alternative or a substantial increase is predicted between existing conditions and Build Alternative. WSDOT defines a substantial increase in noise level between existing conditions and Build Alternative to be 10 A-weighted decibels (dBA) or more.

Construction noise impacts are based on the maximum noise levels of construction equipment published by the U.S. Environmental Protection Agency and shown in Section 5.4, Construction Noise, Exhibit 5-35.

1.3 Operational Noise Effects

Exhibit 1-1 summarizes the results of the noise analysis conducted for 989 receivers representing 1,648 dwelling units in the study area.

Exhibit 1-1. Summary of Noise Modeling Results

	Existing (2018)	No Build Alternative (2045)	Build Alternative (2045) Without Mitigation
Range of traffic noise levels	37 to 75 dBA	38 to 75 dBA	37 to 75 dBA
Receivers approaching or exceeding the NAC	190 receivers, representing 256 dwelling units	227 receivers representing 307 dwelling units	221 receivers representing 293 dwelling units

dBA = A-weighted decibels; NAC = noise abatement criteria

- **Existing conditions (2018)** - The 190 receivers listed in Exhibit 1-1 include 152 residential receivers (representing 214 residences), 29 trail receivers, 2 daycare receivers (representing 4 residential equivalency [RE] units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school outdoor garden, 1 neighborhood pool, 1 tennis court, and 1 hotel courtyard.
- **No Build Alternative (2045)** - The 227 receivers include 185 residential receivers (representing 259 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units), 1 tennis court, and 1 hotel courtyard.
- **Build Alternative (2045)** - The 221 receivers include 180 residential receivers (representing 246 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units), 1 tennis court, and 1 hotel courtyard.

1.3.1 Proposed Noise Walls

WSDOT evaluated 17 noise walls along WSDOT right of way to protect potentially affected homes and other sensitive receivers, such as parks and trails, in the study area. The noise walls were evaluated for both feasibility (a combination of acoustic and engineering considerations that evaluates if abatement can be constructed that achieves a meaningful reduction in noise levels) and reasonableness (assesses the practicality of the abatement measure based on a number of factors after abatement is found to be feasible).

WSDOT found three noise walls to be feasible and reasonable and recommends these walls for construction based on preliminary design data. Four would not be feasible, and 10 would be feasible but not reasonable. These 14 walls were not recommended for construction. With the proposed three noise walls summarized in Exhibit 1-2, 34 receivers representing 43 residences would drop below the NAC. This means that with the Project, 187 receivers (representing 250 dwelling units) would be affected, which is less than the No Build.

Exhibit 1-2. Noise Effects and Noise Abatement Considered

Proposed Wall Name	Description	Benefits of the Proposed Noise Wall in 2045
Wall East 2	- Location: Along the northbound I-405 off-ramp to NE 160th Street (see Exhibit 5-1, Sheet 2 of 12). - Dimensions: Area of about 9,507 square feet (528 feet long and 18 feet high).	- Would reduce noise below the NAC for 7 receivers representing 13 residences. - Would reduce noise levels by up to 9 dBA as compared to the No Build in 2045. - Some upper floor receivers with balconies would continue to experience noise levels that would be above the NAC. Ground floor use areas are the primary area of concern when providing noise abatement, and noise walls are not typically designed to reduce noise levels at upper floors. This noise wall has been designed to reduce noise levels at second-floor balconies because the second floor qualifies as the first row of receivers in this area where I-405 is in a cut section, and line-of-sight considerations indicate more noise exposure for the second-floor balconies.
Wall East 6	- Location: Along northbound I-405 on either side of 228th Street SE (see Exhibit 5-1, Sheets 10 and 11 of 12). Would extend an existing noise wall (Wall NW1). The existing noise wall would remain or be replaced as needed. - Dimensions: Area of about 31,776 square feet (1,793 feet long and 15 to 18 feet high).	- Would reduce noise levels to below the NAC for 16 receivers representing 17 residences. - Would reduce noise levels by up to 9 dBA as compared to the No Build in 2045.
Wall West 7	- Location: Along the west side of southbound I-405, north of SR 527 near 9th Avenue SE (see Exhibit 5-1, Sheet 12 of 12). - Dimensions: Area of about 14,396 square feet (1,200 feet long and 12 feet high).	- Would reduce noise levels to below the NAC for 11 receivers representing 13 residences. - Would reduce noise levels by 5 to 10 dBA as compared to the No Build in 2045.

dB = A-weighted decibels; NAC = Noise Abatement Criteria

1.3.2 Existing Noise Walls

There are nine existing noise walls in the noise study area. In addition to the new walls proposed for construction, WSDOT may need to remove and replace one existing noise wall (NW1) to accommodate the Project design. Wall NW1 may be replaced along the existing alignment and on retaining wall along northbound I-405 north of the 228th Street SE bridge, then connect to the 17th Avenue SE northbound retaining wall as part of proposed Wall East 6 (discussed in Section 5.3.1, Proposed Noise Walls and shown on Exhibit 5-1, Sheets 10 and 11).

Of the eight remaining existing noise walls, four walls would not maintain the noise level below the NAC of 66 dBA at receivers behind the wall. These four noise walls would remain in place with the Project, are currently benefiting receivers behind the wall, and are meeting feasibility and reasonableness criteria. Because impacts are identified behind these four existing noise walls with the Project, an analysis was conducted for each wall to determine if additional abatement is feasible and reasonable. The results indicate upgrades to these existing walls would not be feasible or reasonable, so these walls will remain unchanged with the Project. The results are further discussed in Section 5.3.2, Existing Noise Walls.

1.4 Construction Effects Overview

Construction creates temporary noise that varies depending on the type of construction activity, the location of the activity, and the type of equipment used. The most constant noise source at construction sites is usually engine noise. Mobile equipment generally operates intermittently or in cycles of operation, while stationary equipment, such as generators and compressors, generally operates at fairly constant sound levels. Trucks are present during most phases of construction and are not confined to one area, so noise from trucks may affect more receivers than other construction noise. Other common noise sources typically include impact equipment, which could be pneumatic, hydraulic, or electric-powered.

The maximum noise levels of construction equipment typically range from 69 to 106 dBA at 50 feet. As a point source, construction noise decreases by 6 dBA per doubling of distance from the source moving away from the equipment. The various pieces of equipment are almost never operating simultaneously at full power, and some would be powered off, idling, or operating at less than full power at any time. Construction noise is exempt from state and local property line regulations during daytime hours. If nighttime construction is required for the Project, WSDOT will apply for variances or exemptions from local noise ordinances for the night work. Such noise variances or exemptions require construction noise abatement measures that vary by jurisdiction.

SECTION 2 PROJECT DESCRIPTION

2.1 Proposed Project Elements

The Project begins on I-405 south of the I-405/SR 522 interchange at milepost (MP) 21.79 and continues to just north of the I-405/SR 527 interchange to MP 27.06. Exhibit 2-1 lists improvements proposed with the Project. Exhibit 2-2, Sheets 1 through 5, show the locations of the proposed improvements.

Exhibit 2-1. Improvements Proposed with the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Project Element	Proposed Improvements
I-405 lanes and shoulders from SR 522 to SR 527	– Create a dual ETL system from MP 21.79 (south of the I-405/SR 522 interchange) to MP 27.06 (just north of the I-405/SR 527 interchange). • From MP 21.79 to MP 22.30: Restripe existing lanes to create a dual ETL system. • From MP 22.30 to MP 26.30: Resurface and widen I-405 to add one ETL in each direction. • From MP 26.30 to MP 27.06: Widen I-405 to construct direct access ramps and connect to the existing single ETL starting near MP 26.30.
I-405 tolling from SR 522 to SR 527	– Construct new tolling gantries to collect tolls for the ETLs and direct access ramps.
I-405/SR 522 interchange area	– Construct new direct access ramps and two inline transit stations (one in each direction) in the I-405 median. Transit stations would include station platforms, signage, artwork, lighting, fare machines, and site furnishing such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles. – Construct a bus station and turnaround loop, pick-up and drop-off facilities, and new nonmotorized connection to the North Creek Trail near the SR 522 interchange. Funding and construction timeline to be coordinated with local transit agencies. – Construct new northbound bridge through the SR 522 interchange. • Reconfigure the northbound I-405 to eastbound SR 522 ramp from one lane to two lanes. – Reconfigure I-405 on- and off-ramps. • Realign the southbound I-405 to westbound SR 522 ramp. • Realign the eastbound and westbound SR 522 ramps to northbound I-405.
SR 522 roadway	– Add three signalized intersections, which would change where the freeway portion of SR 522 begins and ends. Signals would be added at the following locations: • The northbound I-405 to westbound SR 522 off-ramp and the eastbound SR 522 to northbound I-405 on-ramp. • The southbound I-405 to eastbound SR 522 ramp. • Between the above two locations where the new I-405 ETL direct access ramps connect with SR 522.
228th Street SE	– Widen the northbound I-405 bridge over 228th Street SE.

Exhibit 2-1. Improvements Proposed with the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Project Element	Proposed Improvements
SR 527 interchange area	– Construct new direct access ramps to the north, south and east just south of SR 527 at 17th Avenue SE. – Construct two inline transit stations (one in each direction) in the I-405 median. Transit stations would include station platforms, signage, artwork, lighting, fare machines, and site furnishing such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles. – Reconstruct the pedestrian bridge over I-405.
17th Avenue SE, 220th Street SE, SR 527	– Reconfigure 17th Avenue SE and portions of 220th Street SE and SR 527 to include a roundabout at the Canyon Park Park and Ride, bicycle and pedestrian improvements, and improvements at the SR 527 and 17th Avenue SE intersections with 220th Street SE.
Fish barrier corrections	– Replace five fish barriers with restored stream connections at the following streams: • Par Creek (WDFW ID 993083) • Stream 25.0L (WDFW ID 993104) • North Fork of Perry Creek (WDFW ID 08.0070 A0.25) • Two fish barriers at Queensborough Creek (WDFW ID 993084 and 993109)
Sammamish River bridges	– Remove the existing northbound I-405 to eastbound SR 522 bridge over the Sammamish River, including two bridge piers within the OHWM. – Remove the existing northbound I-405 to westbound SR 522 bridge over the Sammamish River, including two bridge piers within the OHWM. – Build a new bridge for northbound I-405 traffic over the Sammamish River. – Build a new bridge over the Sammamish River for the new direct access ramp at SR 522. – Build a new bridge over the Sammamish River for the northbound I-405 to SR 522 ramp.
Noise and retaining walls	– Construct 3 new noise walls near NE 160th Street and SR 527. See Exhibit 2-2, Sheets 1, 4 and 5. – Construct several new retaining walls. See Exhibit 2-2, Sheets 1 through 5.
Stormwater management	– Provide enhanced treatment for an area equivalent to 100 percent of new PGIS (approximately 24 acres). – Retrofit about 23 acres of existing untreated PGIS and continue to treat stormwater from the approximately 44 acres of PGIS that currently receives treatment. – Construct three new stormwater outfalls, one on the Sammamish River and two on the North Fork of Perry Creek.
Construction duration	– Construction is expected to last 3 to 4 years, beginning in 2021.

ETL = express toll lane; ID = identification number; MP = milepost; OHWM = ordinary high water mark; PGIS = pollution-generating impervious surface; WDFW = Washington Department of Fish and Wildlife

Exhibit 2-2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project, Sheet 1 of 5

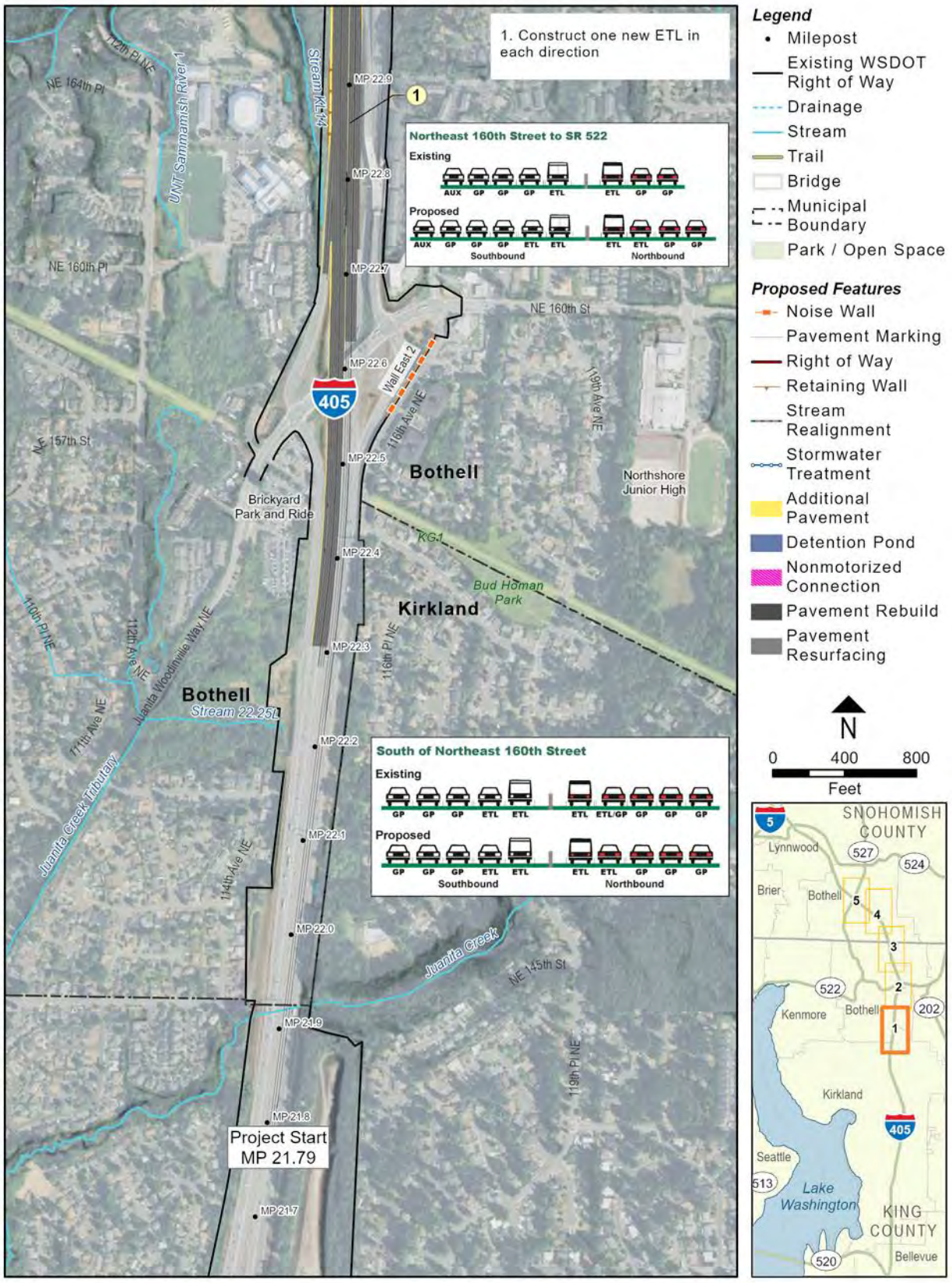


Exhibit 2-2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project, Sheet 2 of 5

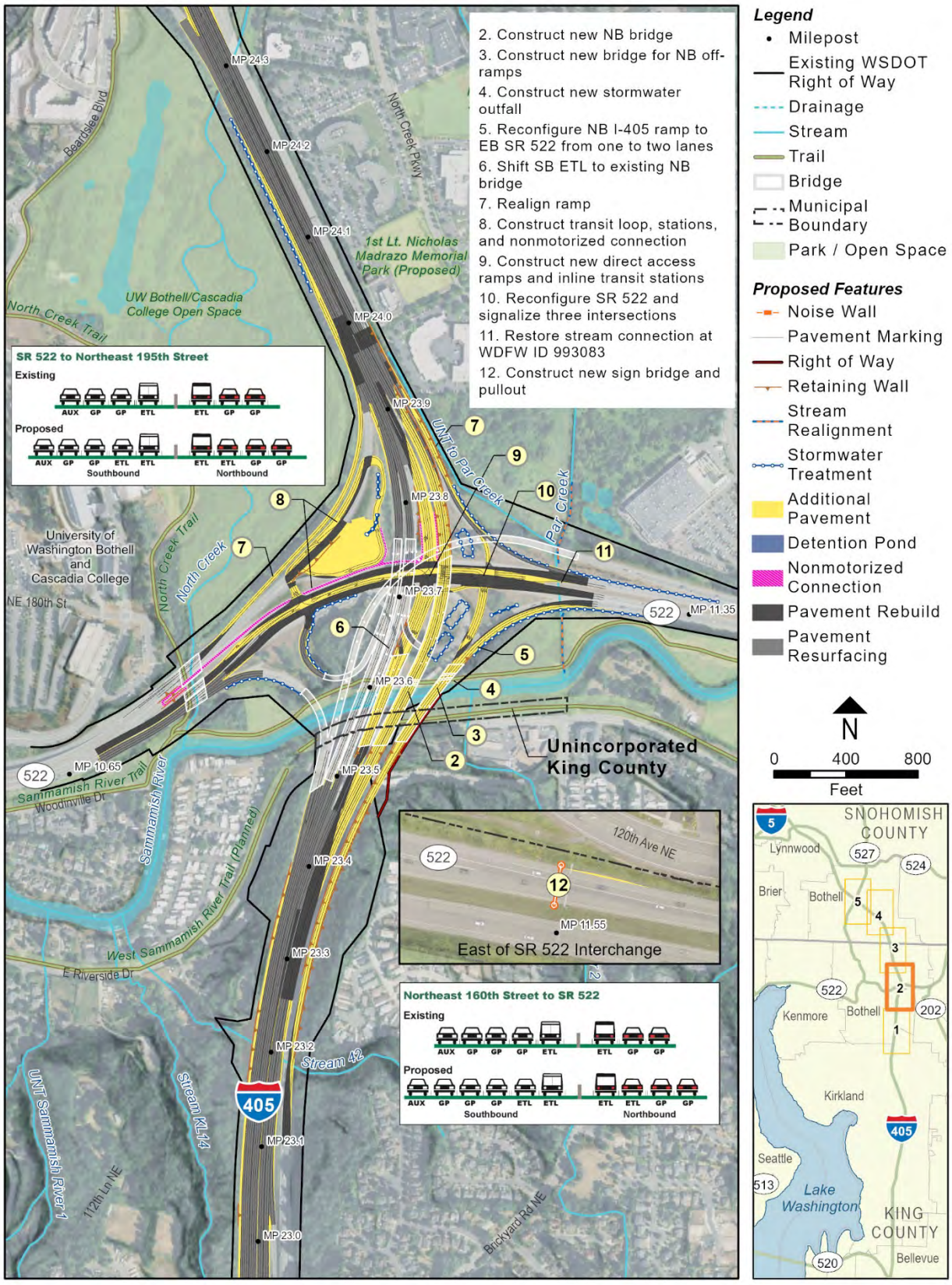


Exhibit 2-2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project, Sheet 3 of 5

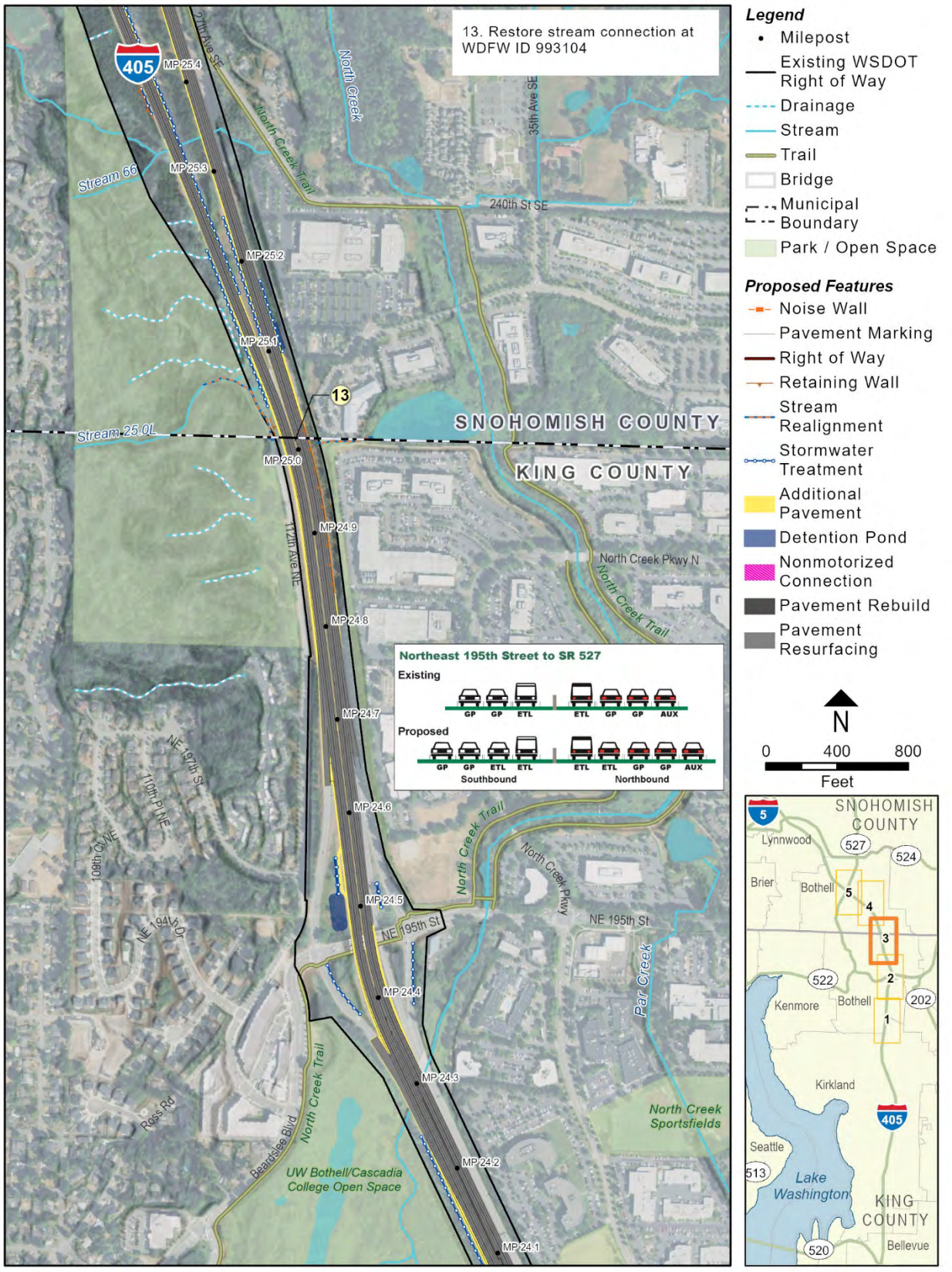


Exhibit 2-2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project, Sheet 4 of 5

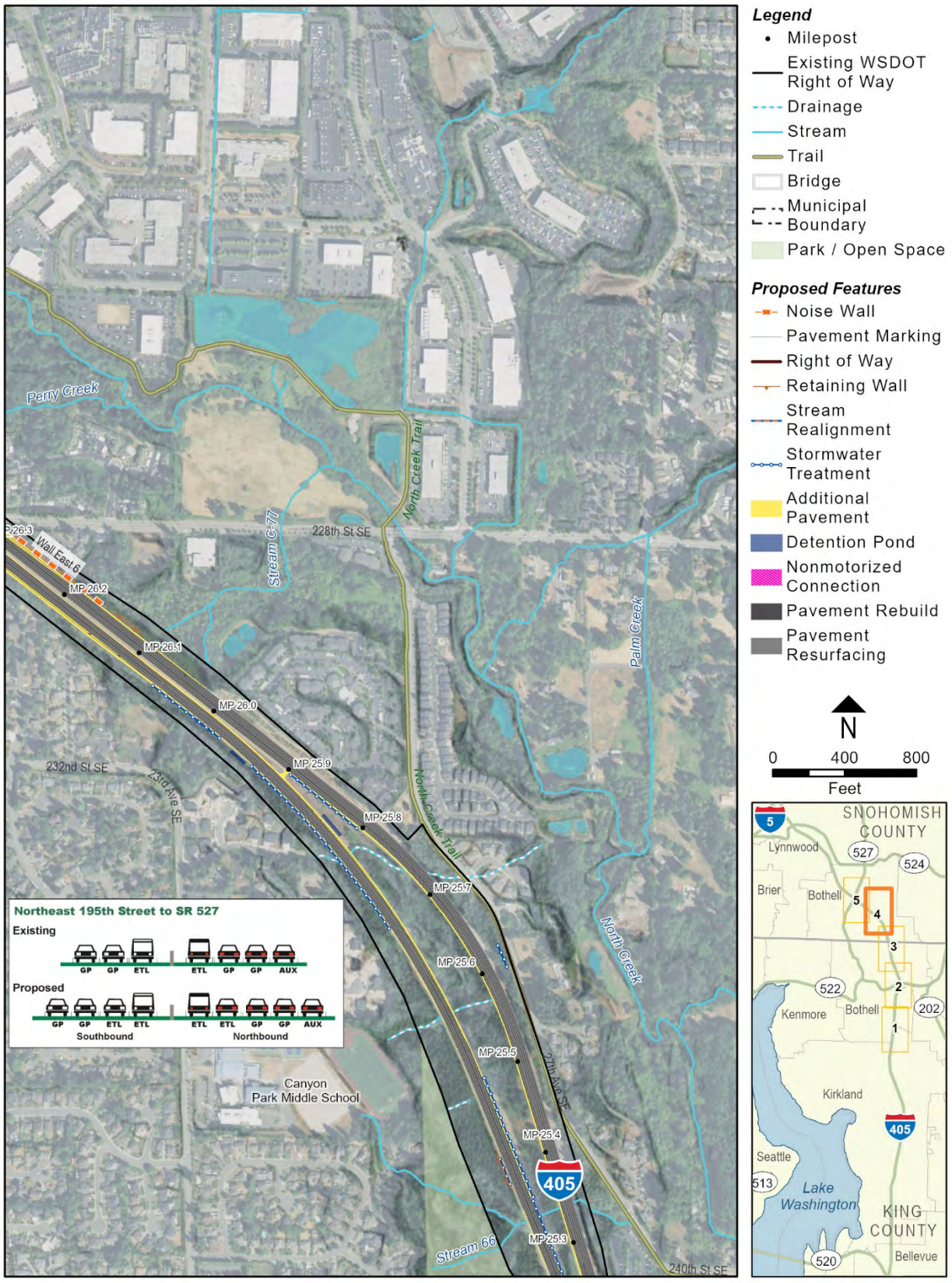
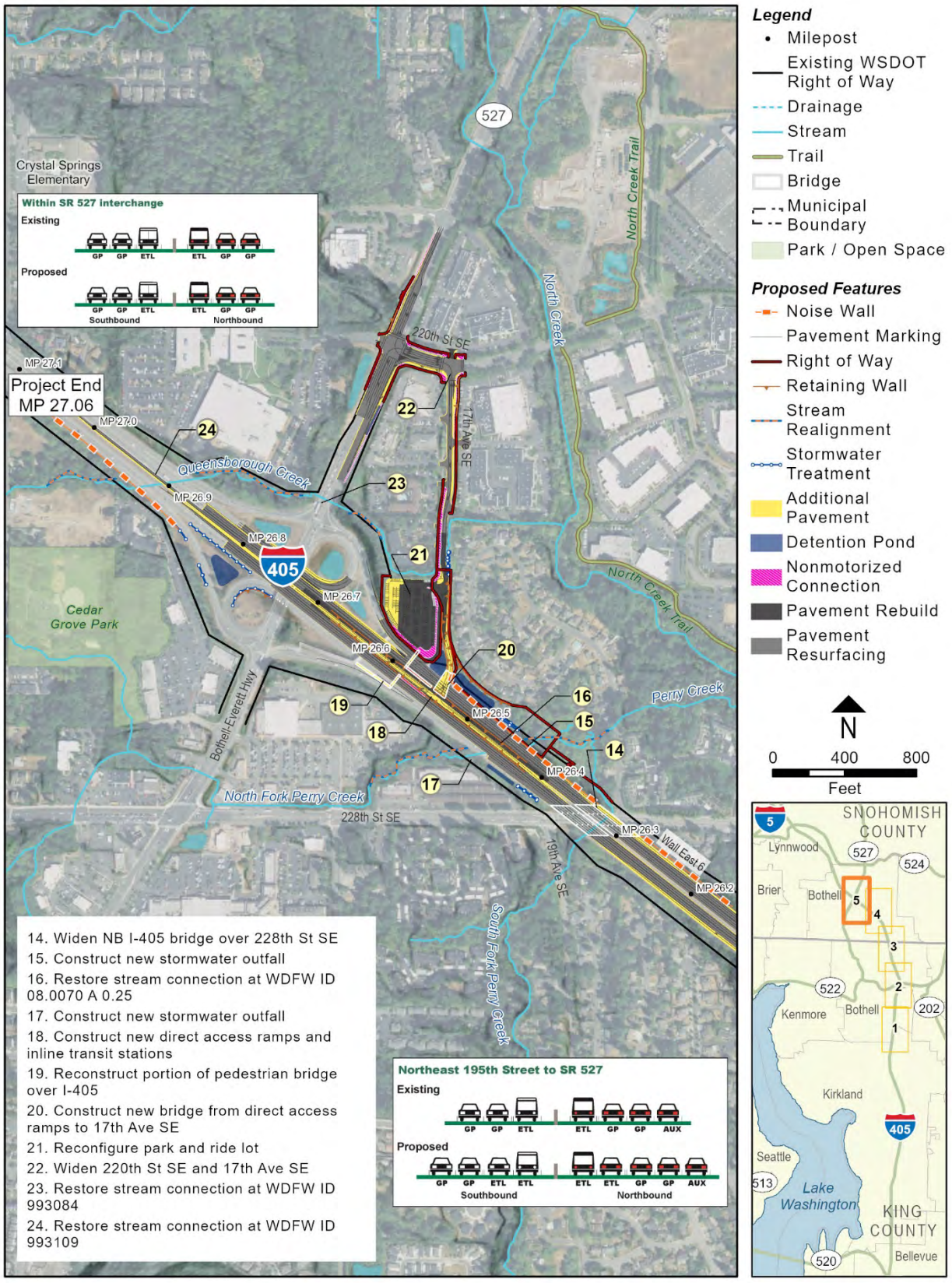


Exhibit 2-2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project, Sheet 5 of 5



2.2 Express Toll Lanes Overview

How do I get more information about ETLs on I-405?

https://wsdot.wa.gov/Tolling/405/

Currently, there is one ETL in each direction of I 405 between SR 522 and SR 527. WSDOT expects that the new ETL in this section would operate in the same way as the existing ETL, from 5 a.m. to 7 p.m. on weekdays. At all other times and on major holidays, the ETLs would be free and open to all without a *Good To Go!* pass. During operating hours:

- **Single-occupancy vehicles** would pay a toll to use the ETLs with or without a *Good To Go!* pass.
- **Transit, High-Occupancy Vehicles (HOV) 3+, and motorcycles** would travel for free with a *Good To Go!* flex or motorcycle pass.
- **HOV 2+** would travel for free from 9 a.m. to 3 p.m. with a *Good To Go!* flex pass. From 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m. HOV 2+ would pay a toll to use the ETLs with or without a *Good To Go!* flex pass.
- **Large vehicles** over 10,000 pounds gross vehicle weight would not be able to use the ETLs at any time.

2.3 Project Construction Overview

WSDOT expects to construct the Project using a design-build delivery method, in which WSDOT executes a single contract with one entity for design and construction services. With design-build projects, contractors have the flexibility to offer innovative and cost-effective alternatives to deliver the project, improve project performance, and reduce project effects. If the contractor proposes design modifications not covered by this Environmental Assessment, additional environmental review would be conducted as needed.

Construction would generally occur between 2021 and 2025, but construction activities in some areas would be complete prior to 2025. Once a contractor is selected for the Project, they could use multiple work crews in multiple locations to reduce the overall construction period. Work would include removing existing asphalt and concrete surfaces, clearing and grading adjacent areas, laying the aggregate roadway foundation, placing new asphalt and concrete surfaces, replacing culverts, and building and demolishing bridges. Removing bridge piers from the Sammamish River could require the construction of temporary work bridges and would require in-water work, which may include temporary use of cofferdams and a work barge, depending on the contractors' chosen means and methods. Realigning the I-405 mainline would require approximately 170,000 cubic yards of excavation and 166,000 cubic yards of fill.

Construction equipment would include backhoes, excavators, front-end loaders, pavement grinders, jack hammers, trucks, vactor trucks, cranes, drilling rigs and augers, concrete pumping equipment, and slurry processing equipment. Specific haul routes and the number of construction vehicles would not be known until a construction contract is signed. When possible, the work sites would be accessed from I-405 and SR 522. Construction staging areas for employee parking, large equipment storage, and material stockpiles would be located within WSDOT and Bothell right of way to the extent possible. The contractor may also find other locations for construction staging.

SECTION 3 STUDY APPROACH

3.1 Noise Background Information

3.1.1 Type 1 Trigger for Noise Analysis

A traffic noise analysis is required by law (23 Code of Federal Regulations [CFR] 772) for federally funded projects and required by WSDOT policy (WSDOT 2011) for other funded projects that meet the following criteria:

- Construct a new highway.
- Significantly realign an existing highway, or change the horizontal or vertical alignment.
- Increase the number of through-traffic lanes on an existing highway.
- Alter terrain to create new line-of-sight to traffic for noise-sensitive receivers.

The Project proposes to increase the number of through-traffic lanes on an existing highway to improve mobility. Implementation of the Project to add through-traffic lanes and relocate interchange lanes and ramps is a Type 1 trigger for a traffic noise analysis.

3.1.2 Definition of Sound

Sound is created when objects vibrate, resulting in a minute variation in surrounding atmospheric pressure, called sound pressure. The human response to sound depends on the magnitude of a sound as a function of its frequency and time pattern (EPA 1974). Magnitude is a measure of the physical sound energy in the air. The range of magnitude the ear can hear, from the faintest to the loudest sound, is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). Loudness refers to how people subjectively judge a sound and how it varies between people.

Sound is measured using the logarithmic decibel scale, so that doubling the number of noise sources, such as the number of cars on a roadway, increases the sound level by three A-weighted decibels (dBA). Therefore, when you combine two sources emitting 60 dBA, the combined sound level is 63 dBA, not 120 dBA. The human ear can barely perceive a 3-dBA increase, while a 5-dBA increase is about 1.5 times as loud and readily noticed. A 10-dBA increase appears to be a doubling in noise level to most listeners. A tenfold increase in the number of noise sources adds 10 dBA.

In addition to magnitude, humans also respond to a sound's frequency or pitch. The human ear is very effective at perceiving frequencies between 1,000 and 5,000 Hertz, with less efficiency outside this range. Environmental noise is composed of many frequencies. The dBA of sound levels is a filter applied electronically by a sound-level meter that combines the many frequencies into one sound level that simulates how an average person hears sounds. WSDOT evaluates traffic noise impacts by modeling the loudest-hourly traffic noise levels using the equivalent sound pressure level (L_{eq}) noise descriptor. L_{eq} is defined as the continuous steady sound level that would have the same total A-weighted sound energy as the real fluctuating sound measured over a given period of time.

3.1.3 Definition of Noise

Noise is unwanted or unpleasant sound. Noise is a subjective term because, as described above, sound levels are perceived differently by different people. Exhibit 3-1 presents the magnitudes of typical noise levels.

Exhibit 3-1. Typical Noise Levels

Transportation Noise Sources	Noise Level (dBA)	Other Sources	Description
-	130	50-horsepower siren (100 feet)	Painfully loud
Jet takeoff (200 feet)	120	Thunder	
Car horn (3 feet)	110	Rock band	
Jet takeoff (2,000 feet)	100	Shout (0.5 foot)	Very annoying
Heavy truck (50 feet)	90	Jack hammer (50 feet)	Hearing loss with prolonged exposure
Train on structure (50 feet)	85	Backhoe (50 feet)	
City bus passing (50 feet)	80	Bulldozer (50 feet)	Annoying
Train (50 feet)	75	Blender (3 feet)	
City bus at stop (50 feet)	70	Vacuum cleaner (3 feet)	
Freeway traffic (50 feet)		Lawn mower (50 feet)	
Train in station (50 feet)	65	Washing machine (3 feet)	Intrusive
Light traffic (50 feet)	60	TV (10 feet)	
-		Talking (3 feet)	
Light traffic (100 feet)	50	Flowing stream	Quiet

dBA = A-weighted decibels
Source: FTA 1995

3.1.4 Traffic Noise Sources

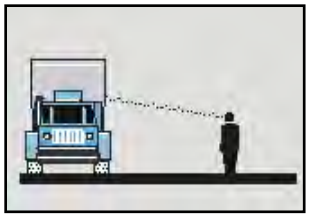
An increase in traffic volumes, vehicle speeds, or the amount of heavy trucks increases traffic noise levels. Traffic noise is a combination of noises from the engine, exhaust, and tires. Defective mufflers and truck compression braking on steep grades can increase traffic noise levels. The terrain and vegetation near the roadway, shielding by barriers and buildings, and the distance from the road can contribute to minimizing the traffic noise heard from roadway traffic.

3.1.5 Sound Propagation

Sound propagation, or how far the sound travels, is affected by the terrain and the elevation of the receiver relative to the noise source. Breaking the line of sight between the receiver and the noise source can reduce noise levels. Listed below are examples of sound propagation pathways.

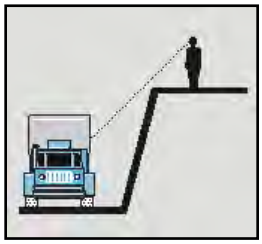
- Level ground – Noise travels in a straight path between the source and receiver.

  Level Ground



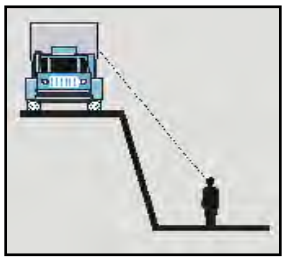
- Depressed source/elevated receiver – Terrain may act as a partial noise barrier and reduce noise levels if it crests between the source and receiver.

  Depressed Source/Elevated Receiver



- Elevated source/depressed receiver – The edge of the roadway may act as a partial noise barrier. Even a short barrier, such as a concrete safety barrier, can reduce the noise level.

  Elevated Source/Depressed Receiver



Line and Point Sources

Noise levels decrease with distance from the source. For a line source, like a highway, noise levels decrease 3 dBA for every doubling of distance, between the source and the receiver over hard ground (concrete, pavement), e.g., from 66 dB at 50 feet to 63 dB at 100 feet. Noise levels decrease 4.5 dBA for every doubling of distance over soft ground (grass). For point sources, such as most construction noise, the levels decrease between 6 and 7.5 dBA for every doubling of distance, depending on ground hardness.

3.1.6 Effects of Noise

The FHWA NAC are based on speech interference, which is a well-documented impact that is relatively reproducible in human response studies. Environmental noise indirectly affects human welfare by interfering with sleep, thought, and conversation. Prolonged exposure to very high levels of environmental noise can cause hearing loss, and EPA has established a protective level of 70 dBA $L_{eq(24)}$ for hearing loss (EPA 1974).

3.1.7 Noise Level Descriptors

The L_{eq} is a measure of the average noise level during a specified period of time. A 1-hour period, or hourly L_{eq} [$L_{eq(h)}$], is used to measure highway noise. L_{eq} is a measure of total noise during a time period that places more emphasis on occasional high noise levels that accompany general background noise levels. For example, if you have two different sounds, and one contains twice as much energy but lasts only half as long as the other, the two would have the same L_{eq} noise levels.

Either the total noise energy or the highest instantaneous noise level can describe short-term noise levels, such as those from a single truck passing by. The sound exposure level is a measure of total sound energy from an event and is useful in determining what the L_{eq} would be over a period in time when several noise events occur. L_{max} is the maximum sound level that occurs during a single event and is related to impacts on speech interference and sleep disruption. L_{min} is the minimum sound level during a period of time.

The variation of sound levels recorded during a measurement period is represented by L_n, where "n" is the percent of time that a sound level is exceeded. For example, the L_{10} level is the noise level that is exceeded 10 percent of the time. Sound varies in the environment and people will generally find a higher, but constant, sound level more tolerable than a quiet background level interrupted by higher sound level events. For example, steady traffic noise from a highway is normally less bothersome than occasional aircraft flyovers in an otherwise quiet area.

3.1.8 Noise Regulations and Impact Criteria

Traffic noise impacts occur when predicted $L_{eq(h)}$ noise levels approach or exceed the FHWA NAC, or substantially exceed existing noise levels per 23 CFR 772. WSDOT considers a noise impact to occur if predicted $L_{eq(h)}$ noise levels approach within 1 dBA of the NAC. Exhibit 3-2 describes the $L_{eq(h)}$ NAC noise levels for various land activity categories specified by the NAC. WSDOT also considers an increase of 10 dBA or more to be a substantial increase and constitute a traffic noise impact. See Attachment B, Traffic Noise Analysis and Abatement Process, for a detailed description of the noise analysis and abatement process.

Exhibit 3-2. FHWA Noise Abatement Criteria by Land Use

Activity Category	$L_{eq(h)}$[a] 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. For example, Arlington National Cemetery.
B	67 (exterior)	Residential (single-family and multifamily 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, 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.
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.

[a] $L_{eq(h)}$ are A-weighted (dBA) hourly equivalent steady state sound levels used for impact determination and are not design standards for abatement.

3.1.9 Construction Noise Levels Limits

Traffic and construction noise are exempt from the Washington Administrative Code (WAC) property line noise limits during daytime hours, but noise limits still apply to construction noise at night. Noise levels shown in Exhibit 3-3 apply only to construction noise at residential properties between 10 p.m. and 7 a.m. At night, construction noise must meet Washington State Department of Ecology property line regulations (WAC 173-60-040) that set limits based on the Environmental Designation for Noise Abatement (EDNA) of the land use: residential (Class A), commercial (Class B), and industrial (Class C).

Allowable nighttime (10 p.m. to 7 a.m.) noise levels at Class A receiving properties (residential) are reduced by 10 dBA (WAC 173-60).

Exhibit 3-3. Maximum Permissible Environmental Noise Levels

Environmental Designation for Noise Abatement of Noise Source	EDNA of Receiving Property (dBA)		
	Class A	Class B	Class C
Residential (Class A)	55	57	60
Commercial (Class B)	57	60	65
Industrial (Class C)	60	65	70

dbA = A-weighted decibels

Short-term exceedance of the sound levels in Exhibit 3-3 is allowed. During any 1-hour period, the maximum level may be exceeded by the following:

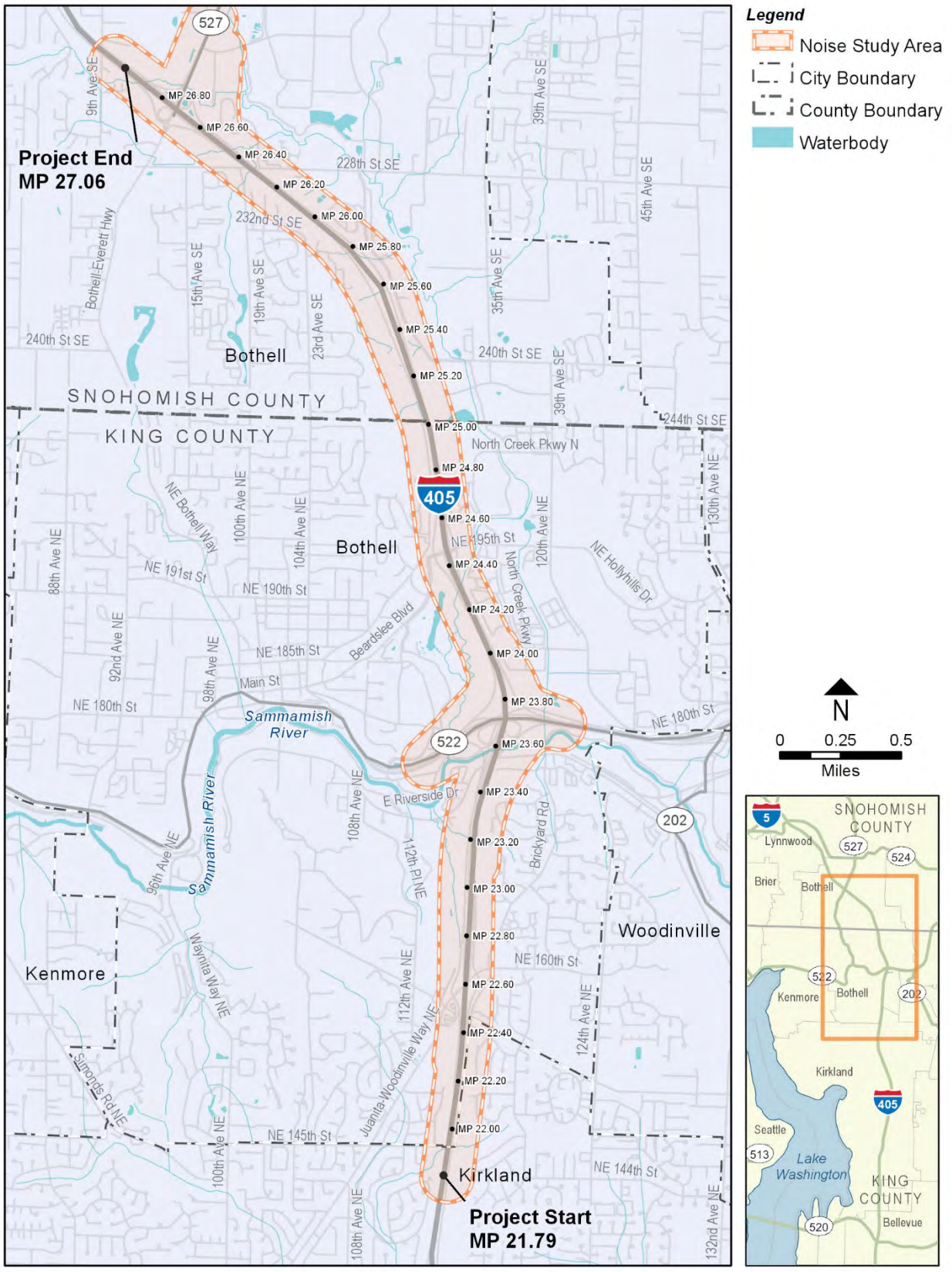
- 5 dBA for a total of 15 minutes
- 10 dBA for a total of 5 minutes
- 15 dBA for a total of 1.5 minutes (WAC 173-60-040)

The allowed exceptions are defined by the percentage of time a given level is exceeded. For example, L_{25} is the noise level exceeded 15 minutes during an hour. Therefore, the permissible L_{25} would be 5 dBA greater than the values in Exhibit 3-3, provided that the noise level is below the permissible level for the rest of the hour and never exceeds the permissible level by more than 5 dBA.

3.2 Study Area

The noise study analyzed traffic noise effects up to 500 feet from the edge of the pavement on both sides of I-405 from MP 21.79 to MP 27.06. The study area extends to the limits of noise impacts, where there would be a future noise level of 66 dBA or less in 2045. Exhibit 3-4 shows the noise study area. Attachment B, Traffic Noise Analysis and Abatement Process, describes the noise analysis and abatement process.

Exhibit 3-4. Project Vicinity Map – Noise Study Area



SECTION 4 EXISTING CONDITIONS

FHWA requirements and WSDOT policy dictate that noise studies assess properties adjacent to highway projects that could be affected by traffic noise. Primary consideration must be given to areas of frequent outdoor human use, such as residences with yards, decks, or patios. Parks and schools with outdoor play areas also warrant primary consideration of potential noise impacts. Land use in the study area consists of single-family and multifamily residential land use, along with places of worship, schools, parks and trails, retail, industrial and commercial properties. This section presents results of noise modeling for current and future traffic noise levels in the study area.

4.1 Traffic Noise Measurement

WSDOT measured ambient sound levels to determine the existing noise environment, identify major noise sources in the study area, and validate the noise model. The team did not use traffic noise measurements to describe existing conditions, which were modeled after the noise model has been validated. WSDOT conducted the measurements between August 27 and September 13, 2018, with a calibrated Larson Davis model LxT noise meter, which complies with American National Standards Institute S1.4 for a Type 1 accuracy instrument. WSDOT noise meters are calibrated via laboratory testing annually and calibrated in the field during the noise measurement process. The team considered the methodologies contained in the FHWA publication *Measurement of Highway Related Noise* (FHWA 1996).

For noise model validation, WSDOT recorded traffic counts in the field during the same time period as the noise measurements. WSDOT collected 15-minute L_{eq} measurements at locations representative of sound-level environments in the study area during free-flowing traffic conditions. FHWA allows 15-minute L_{eq} measurements to represent the hourly $L_{eq(h)}$. WSDOT collected noise measurements at 41 locations. Measured noise levels ranged from 51.1 dBA L_{eq} to 74.2 dBA L_{eq} depending on proximity of the measurement site to I-405. Short-term noise events from aircrafts and traffic on side streets contribute to the noise environment in the study area; however, the primary noise source throughout the study area is from vehicles traveling on I-405.

WSDOT used the FHWA Traffic Noise Model (TNM) Version 2.5 to validate and predict future $L_{eq(h)}$ traffic noise levels. The model estimates the sound levels from a series of straight-line roadway segments. TNM also considers the effects of existing barriers, topography, vegetation, and atmospheric absorption. TNM does not include noise from sources other than traffic, so when nontraffic noise such as aircraft, is present, TNM will under-predict the actual total noise level. To ensure the model did not under-predict roadway traffic noise, WSDOT paused noise measurements or excluded nontraffic noise sources from the data to avoid interference of other noise sources in validation of the model.

4.2 Traffic Noise Model Validation

WSDOT used available project engineering plans, topographic contours, and aerial imagery to create a three-dimensional model in TNM of the geometry of the existing and future design

roadway configurations and the surrounding terrain and buildings. Inputs to the model included three-dimensional physical characteristics of road alignments (i.e., curves, hills, depressed, elevated); hourly traffic volumes in defined vehicle classes (i.e., cars, medium trucks and heavy trucks); vehicle speeds; receptor location and height; and data on the characteristics and locations of specific ground types, topographical features, and other features likely to influence the propagation of traffic noise between the roadway and receptors. The model also included existing noise walls in the study area.

To ensure that the noise model used to predict traffic noise impacts accurately reflects the sound levels in the noise study area, WSDOT constructed a model using the same traffic volumes, speed, and vehicle types that were present during the ambient sound level measurements. Modeled values must be within ±2.0 dBA of the measured levels to validate the model.

Exhibit 4-1 lists the validation locations and the comparison of measured to modeled values for the Project. Modeled noise levels at the 41 measurement sites were within ±2.0 dBA of the measured values, which indicates that the model accurately represented site conditions.

Exhibits 4-2 and 4-3 show the measurement site locations. In these exhibits, measured receivers are denoted by the letter V followed by a number.

Exhibit 4-1. Noise Model Validation

Site #[a]	Measured Receiver Location	Date	Start Time	Measured L_{eq} (dBA)	Modeled L_{eq} (dBA)	Difference (dBA)
V1	14805 116th Place NE	8/27/2018	10:25 a.m.	61.6	59.6	-2.0
V2	11607 116th Place NE	8/27/2018	10:24 a.m.	60.5	58.7	-1.8
V4	15200 116th Place NE	8/27/2018	11:03 a.m.	60.9	59.1	-1.8
V5	16125 Juanita Woodinville Way NE	8/27/2018	1:02 p.m.	57.6	57.0	-0.6
V6	16125 Juanita Woodinville Way NE	8/27/2018	12:57 p.m.	51.1	49.4	-1.7
V7	15515 Juanita Woodinville Way NE	8/27/2018	1:38 p.m.	67.7	66.6	-1.1
V8	15515 Juanita Woodinville Way NE	8/27/2018	1:35 p.m.	59.6	59.0	-0.6
V9	14754 114th Avenue NE	8/27/2018	2:29 p.m.	57.7	59.5	1.8
V10	14754 114th Avenue NE	8/27/2018	2:26 p.m.	59.9	61.5	1.6
V11	14526 114th Ave NE	8/28/2018	11:25 a.m.	61.9	60.8	-1.1
V12	17138 117th Court NE	8/28/2018	12:11 p.m.	57.7	56.2	-1.5
V13	17139 117th Court NE	8/28/2018	12:12 p.m.	65.6	67.2	1.6
V14	11510 E Riverside Drive	8/28/2018	1:50 p.m.	58.8	60.8	2.0
V15	11510 E Riverside Drive Lot 29	8/28/2018	1:53 p.m.	59.8	61.3	1.5
V16	North Creek Trail	8/29/2018	12:25 p.m.	58.1	59.3	1.2
V17	19333 N Creek Parkway NE	8/29/2018	1:15 p.m.	59.7	61.3	1.6
V18	19128 112th Avenue NE, The Village at Beardslee Crossing	8/29/2018	1:55 p.m.	65.5	64.4	-1.1
V19	19701 112th Avenue NE	8/29/2018	2:43 p.m.	64.2	62.3	-1.9
V20	19701 112th Avenue NE	8/29/2018	3:05 p.m.	61.2	60.2	-1.0
V21	20001 N Creek Parkway	9/4/2018	10:00 a.m.	67.2	65.7	-1.5
V22	3300 Monte Villa Parkway	9/4/2018	10:18 a.m.	65.3	65.7	0.4
V23	North Creek Trail	9/4/2018	10:57 a.m.	64.9	65.7	0.8

Exhibit 4-1. Noise Model Validation

Site #[a]	Measured Receiver Location	Date	Start Time	Measured L_{eq} (dBA)	Modeled L_{eq} (dBA)	Difference (dBA)
V24	2711 223rd Place SE	9/4/2018	10:59 a.m.	59.9	61.9	2.0
V25	23112 27th Avenue SE, Stonemeadow Farms Apartments	9/4/2018	12:15 p.m.	57.0	57.8	0.8
V26	23122 27th Avenue NE	9/4/2018	12:07 p.m.	53.2	54.9	1.7
V27	23232 27th Avenue SE	9/4/2018	12:58 p.m.	62.2	62.6	0.4
V28	North Creek Trail	9/4/2018	1:01 p.m.	64.9	63.1	-1.8
V29	22929 21st Avenue SE	9/5/2018	10:03 a.m.	70.0	71.8	1.8
V30	23012 21st Avenue SE	9/5/2018	10:28 a.m.	59.7	61.1	1.4
V31	2012 228th Street SE	9/5/2018	11:05 a.m.	67.9	69.5	1.6
V32	2110 228th Street SE	9/5/2018	11:30 a.m.	65.0	64.7	-0.3
V33	22432 225th Street SE	9/5/2018	12:36 p.m.	58.8	59.9	1.1
V34	1711 225th Street SE	9/5/2018	13:03 p.m.	56.1	57.9	1.8
V35	Sammamish River Trail	9/6/2018	10:56 a.m.	63.6	63.4	-0.2
V36	North Creek Trail	9/6/2018	12:28 p.m.	58.4	59.9	1.5
V37	22600 Bothell Everett Highway, Hilton Garden Inn	9/6/2018	1:08 p.m.	69.8	71.6	1.8
V38	920 221st Place SE	9/6/2018	1:48 p.m.	68.5	69.2	0.7
V39	920 221st Place SE	9/6/2018	2:08 p.m.	62.3	63.6	1.3
V44	Sammamish River Trail	9/10/2018	12:34 p.m.	74.2	73.1	-1.1
V49	23723 23rd Avenue SE	9/13/2018	11:34 a.m.	59.5	58.8	-0.7
V54	14529 114th Avenue NE	8/28/2018	11:25 a.m.	58.4	59.8	1.4

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

[a] Site V3 was not included in the Project due to other noise sources present during the measurement that could not be removed from the measured traffic noise level. Sites V40-V43, V45-V48, and V50-V53 do not fall within the currently defined project limits.

Exhibit 4-2. Traffic Noise Measurement Locations, Sheet 1 of 2

Exhibit 4-2. Traffic Noise Measurement Locations, Sheet 2 of 2

SECTION 5 PROJECT EFFECTS

5.1 Operational Traffic Noise

Existing (2018), No Build Alternative (2045), and Build Alternative (2045) noise levels were modeled at 989 receivers. Those receivers include: 384 receivers representing 536 single-family residences; 508 receivers representing 1,005 multifamily residences; 4 active sport areas; 4 places of worship (2 with Category D interior use); 49 trail receivers; 3 receivers representing 2 day care centers; 3 hotels; 1 fire department; 2 playgrounds; 2 swimming pools; 3 receivers representing Cedar Park Christian School (2 Category C outdoor uses and 1 Category D interior use); 1 picnic area; 11 offices (2 with outdoor use); 7 commercial properties (1 with outdoor use); 5 industrial; and 2 retail properties. Exhibit 3-2 describes the categories of noise abatement criteria by type of land use.

Of the 989 receivers evaluated, the following were determined to be at or above the Noise Abatement Criteria (NAC):

- **Existing conditions (2018) traffic noise impacts.** 190 receivers (representing 256 dwelling units), including 152 residential receivers (representing 214 residences), 29 trail receivers, 2 daycare receivers (representing 4 residential equivalent [RE] units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school outdoor garden, 1 neighborhood pool, 1 tennis court, and 1 hotel courtyard.
- **No Build Alternative (2045) traffic noise impacts.** 227 receivers (representing 307 dwelling units), including 185 residential receivers (representing 259 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units), 1 tennis court, and 1 hotel courtyard.
- **Build Alternative (2045) traffic noise impacts.** 221 receivers (representing 293 dwelling units), including 180 residential receivers (representing 246 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units) 1 tennis court, and 1 hotel courtyard.

Exhibit 5-1, Sheets 1 through 12 identify the modeled receiver locations in the study area; each location is labeled with a number preceded by the letter R. Measured receivers are also shown to provide more detail on location and denoted by the letter V followed by a number. The noise model predicted loudest-hourly noise levels using the loudest afternoon hour traffic volumes for all conditions.

Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 1 of 12

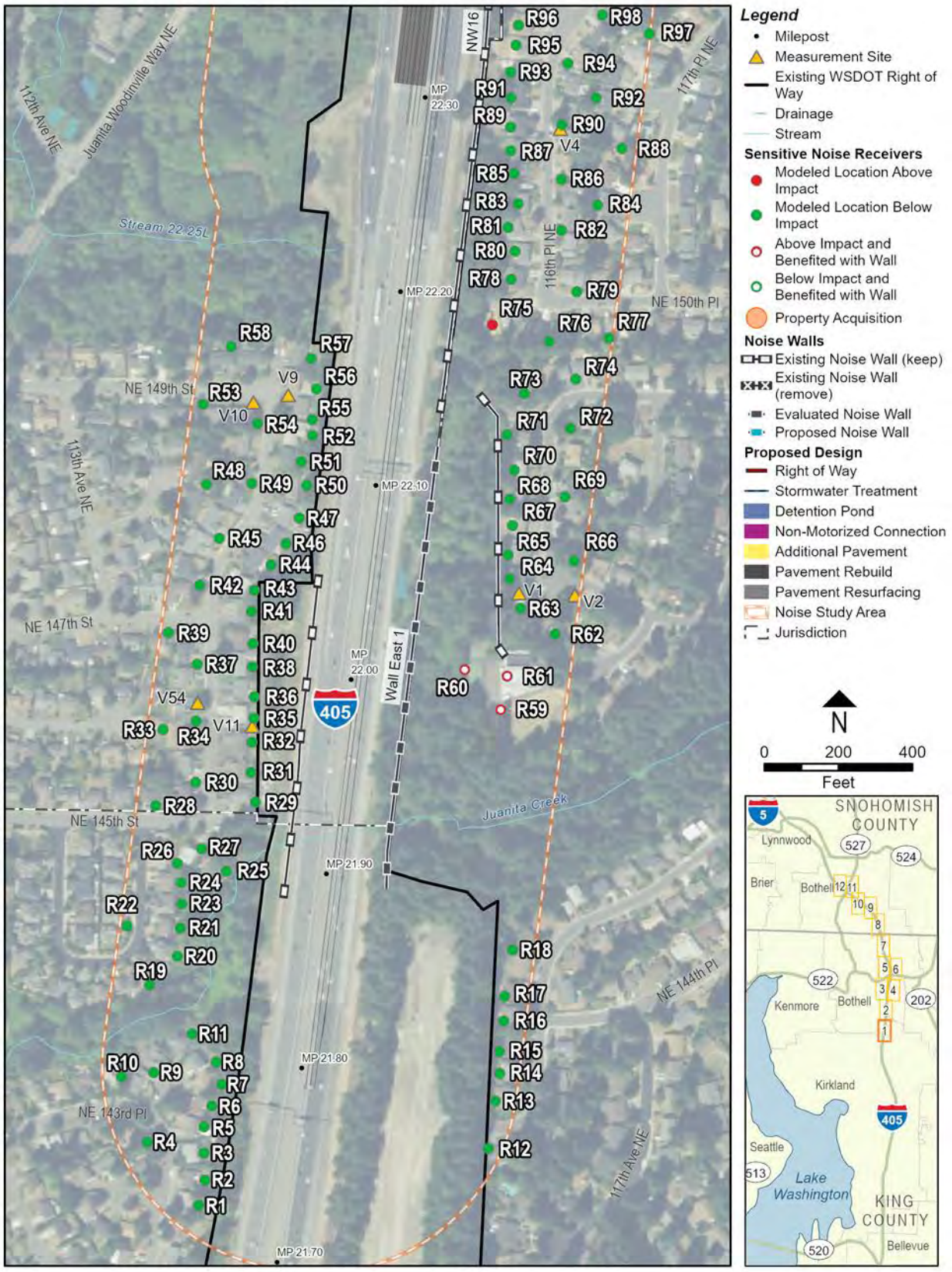


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 2 of 12

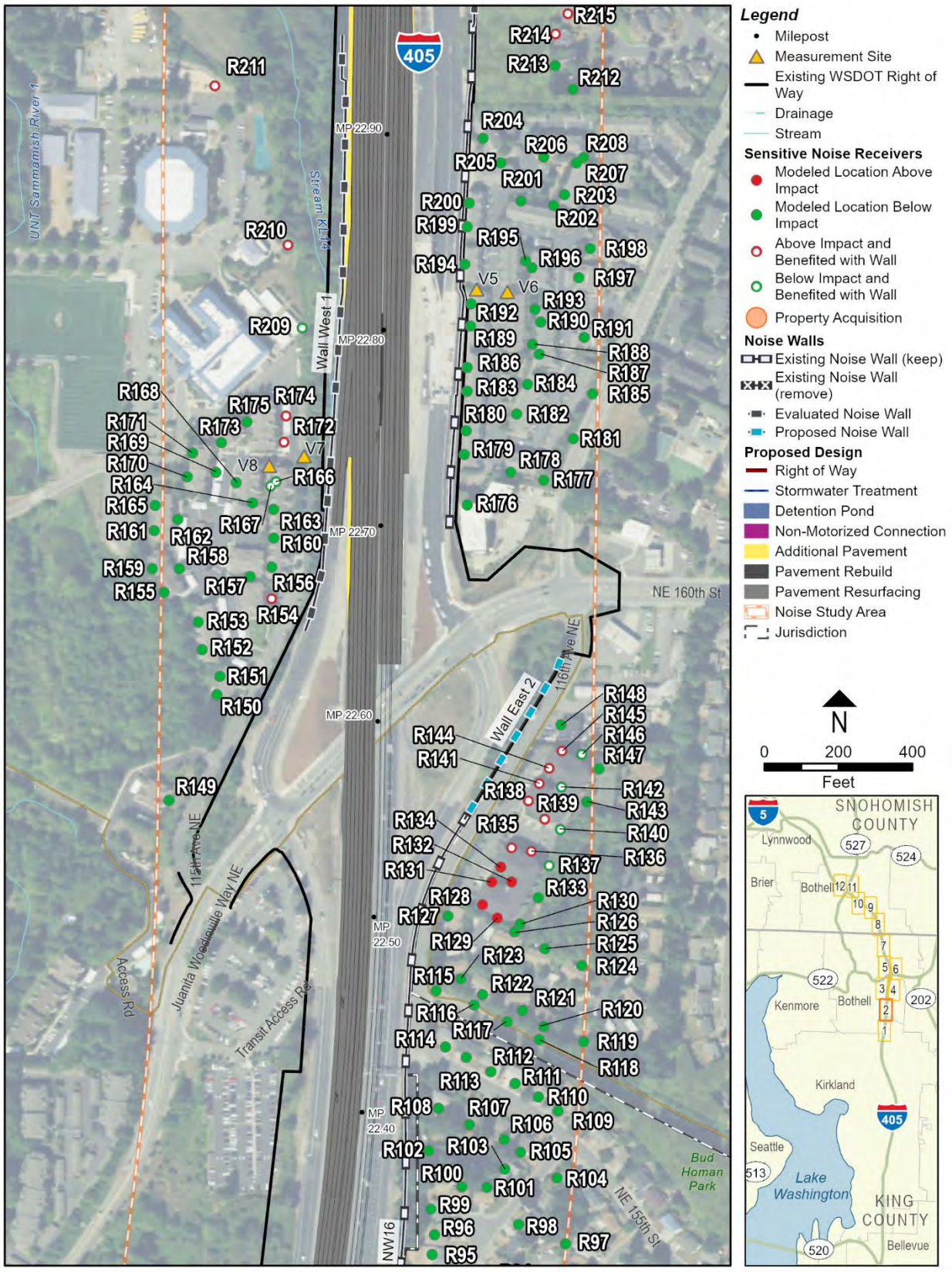


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 3 of 12

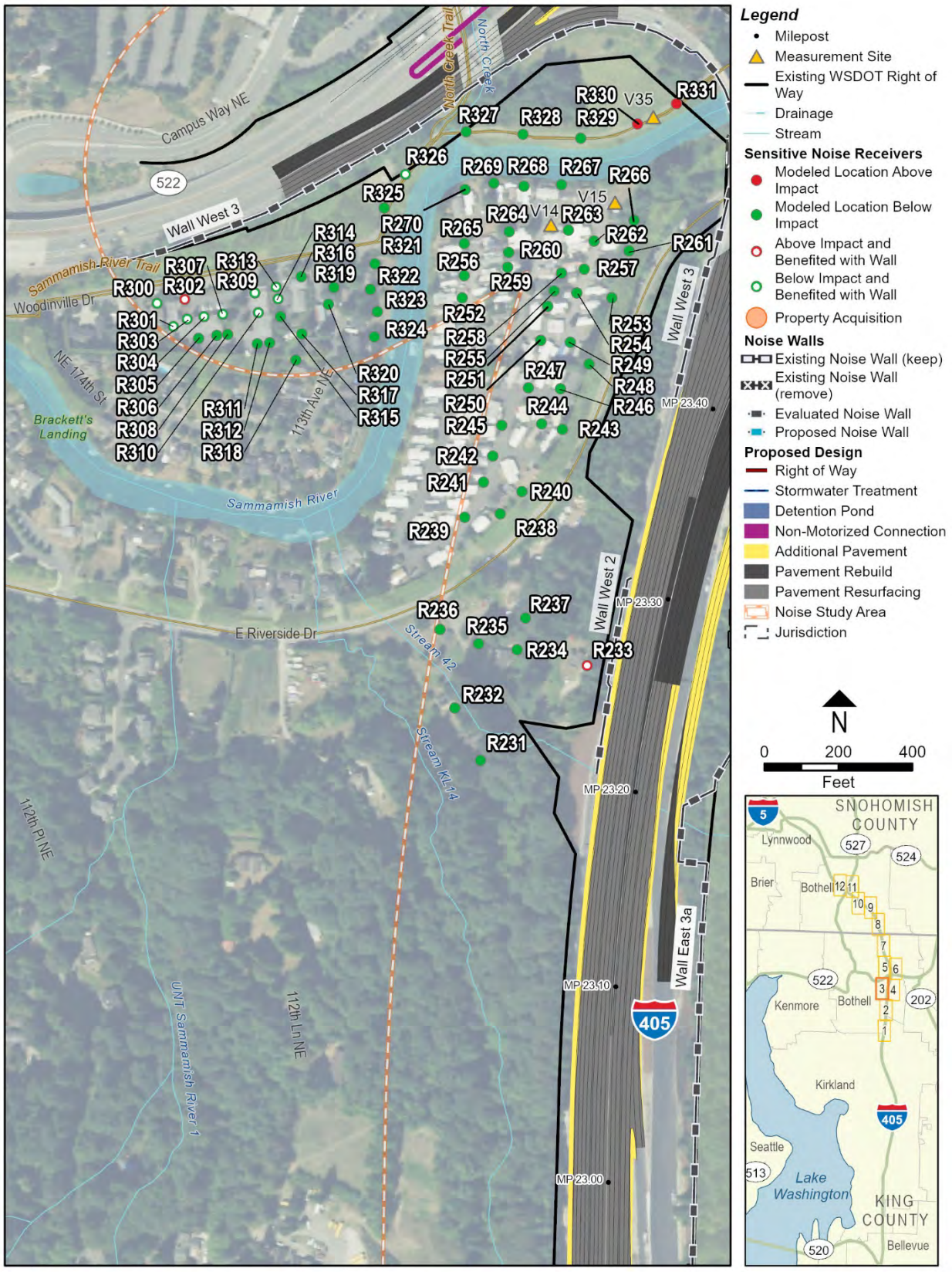


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 4 of 12

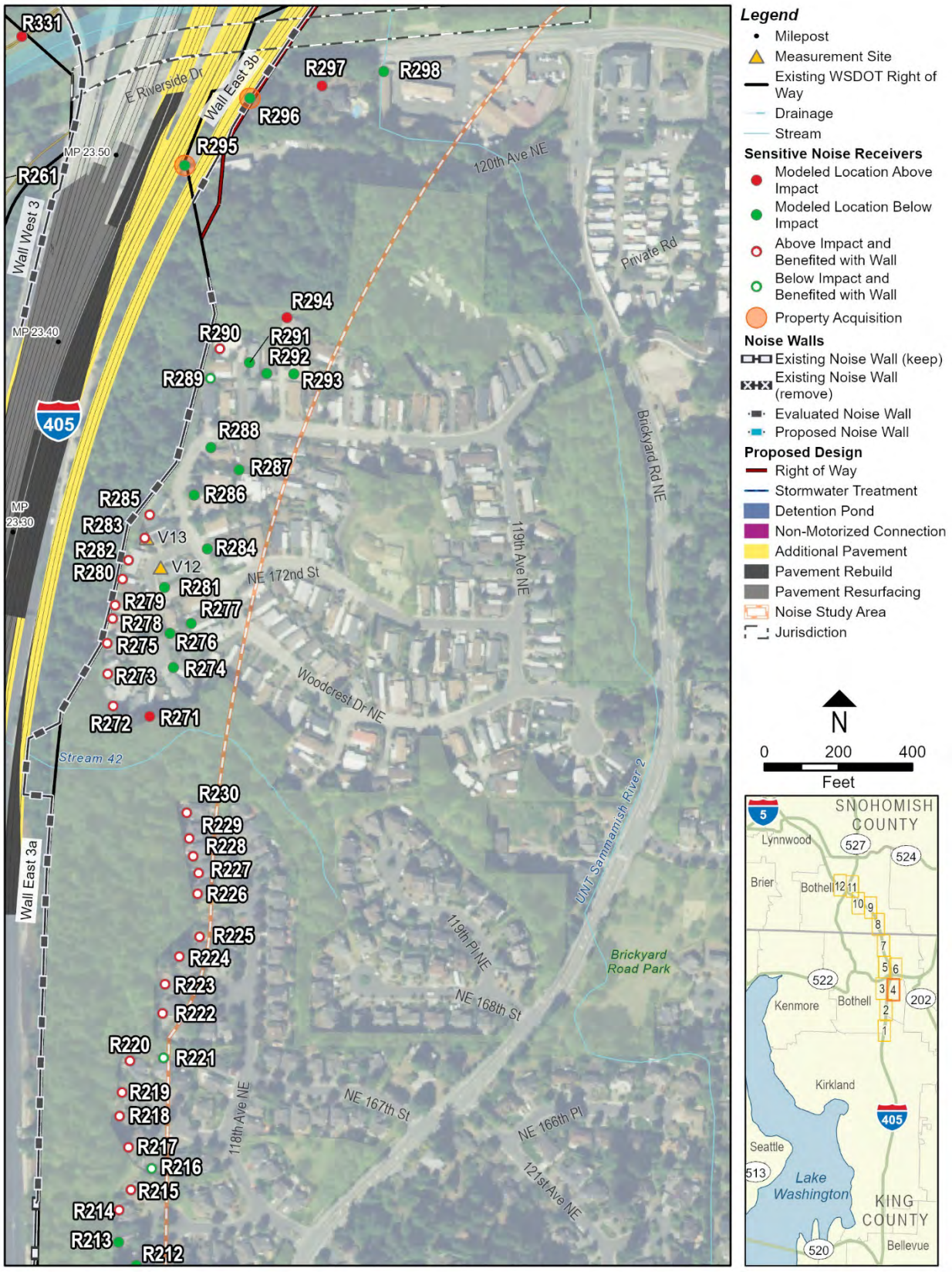


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 5 of 12

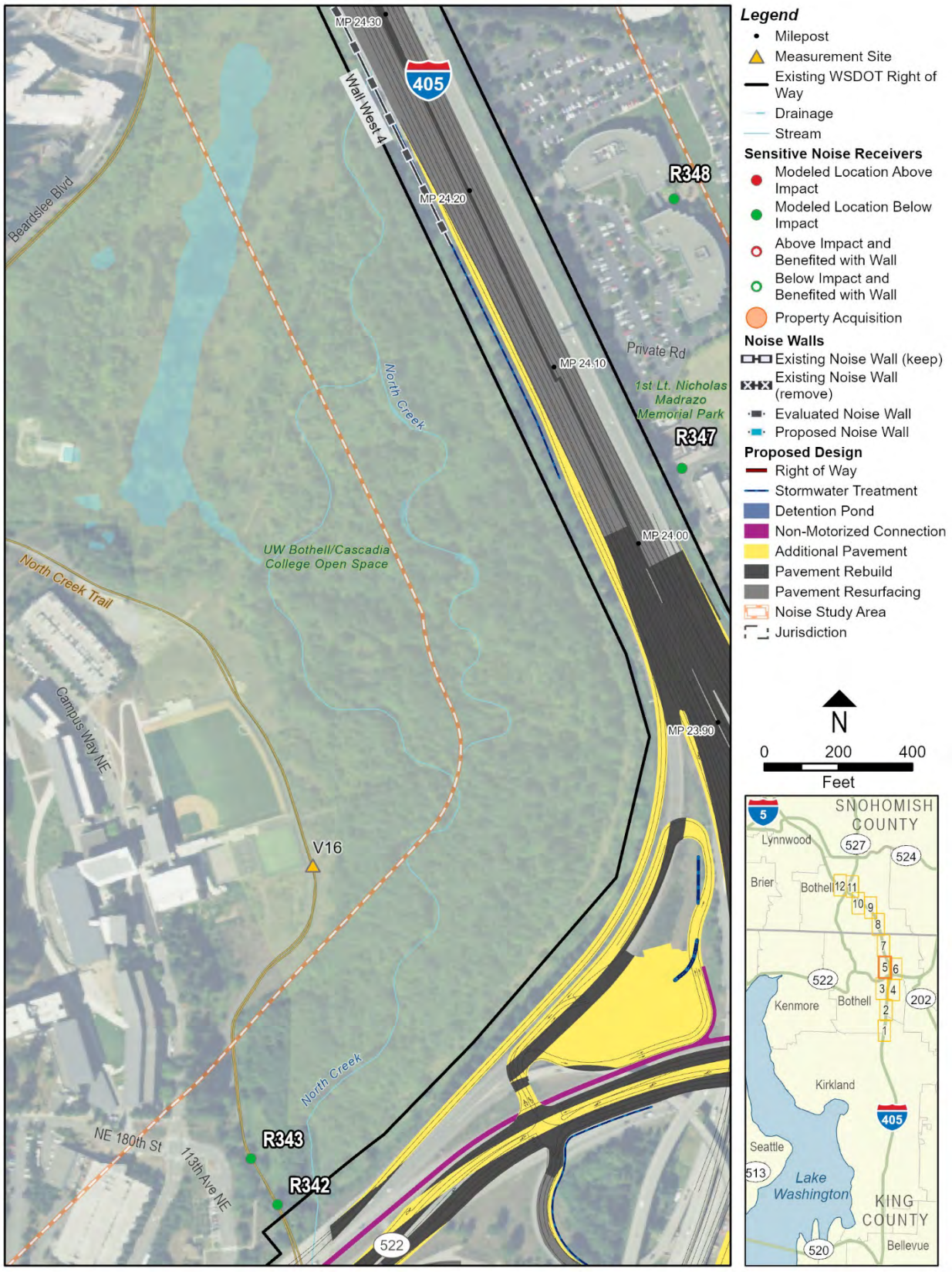


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 6 of 12

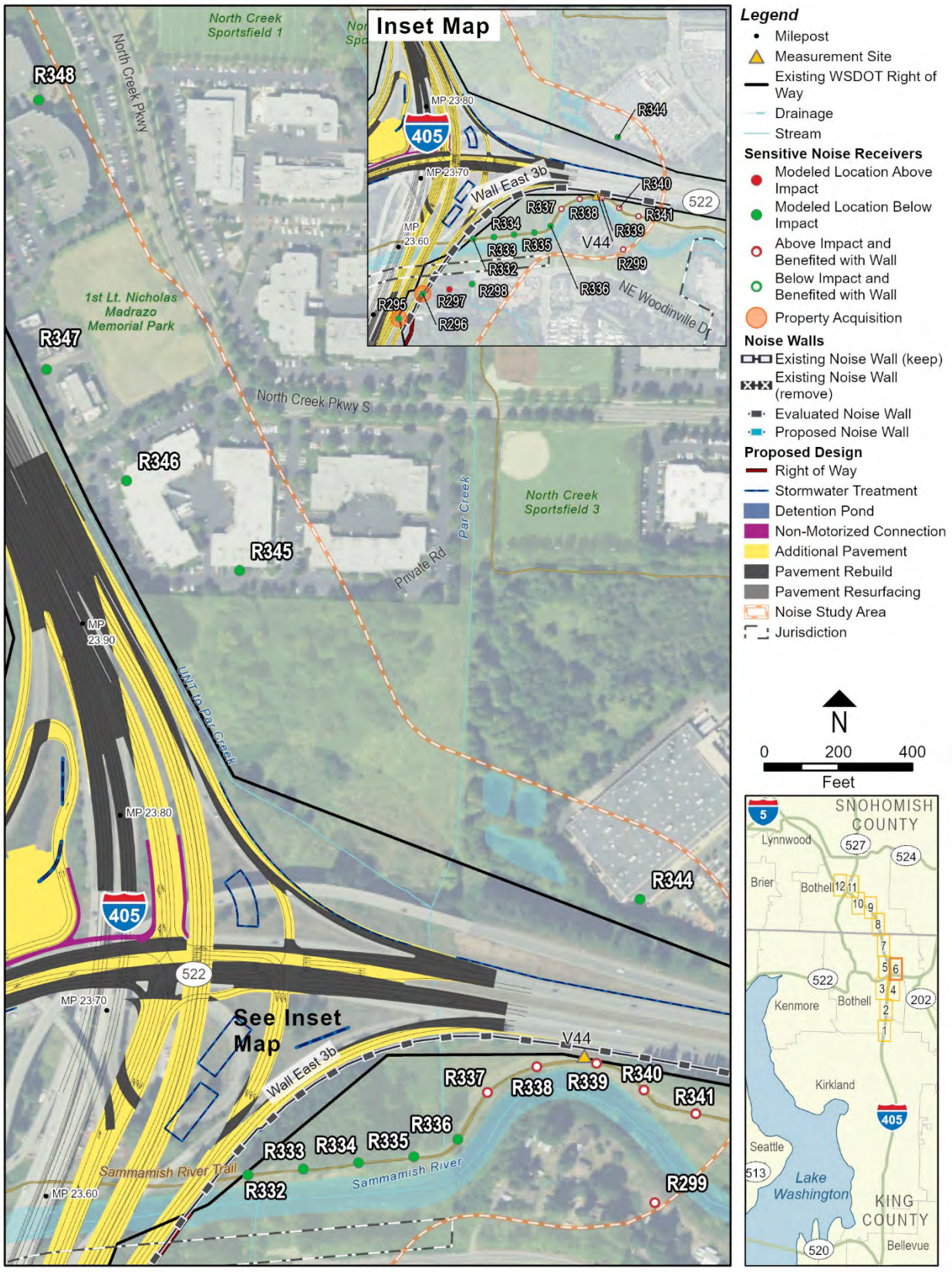


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 7 of 12

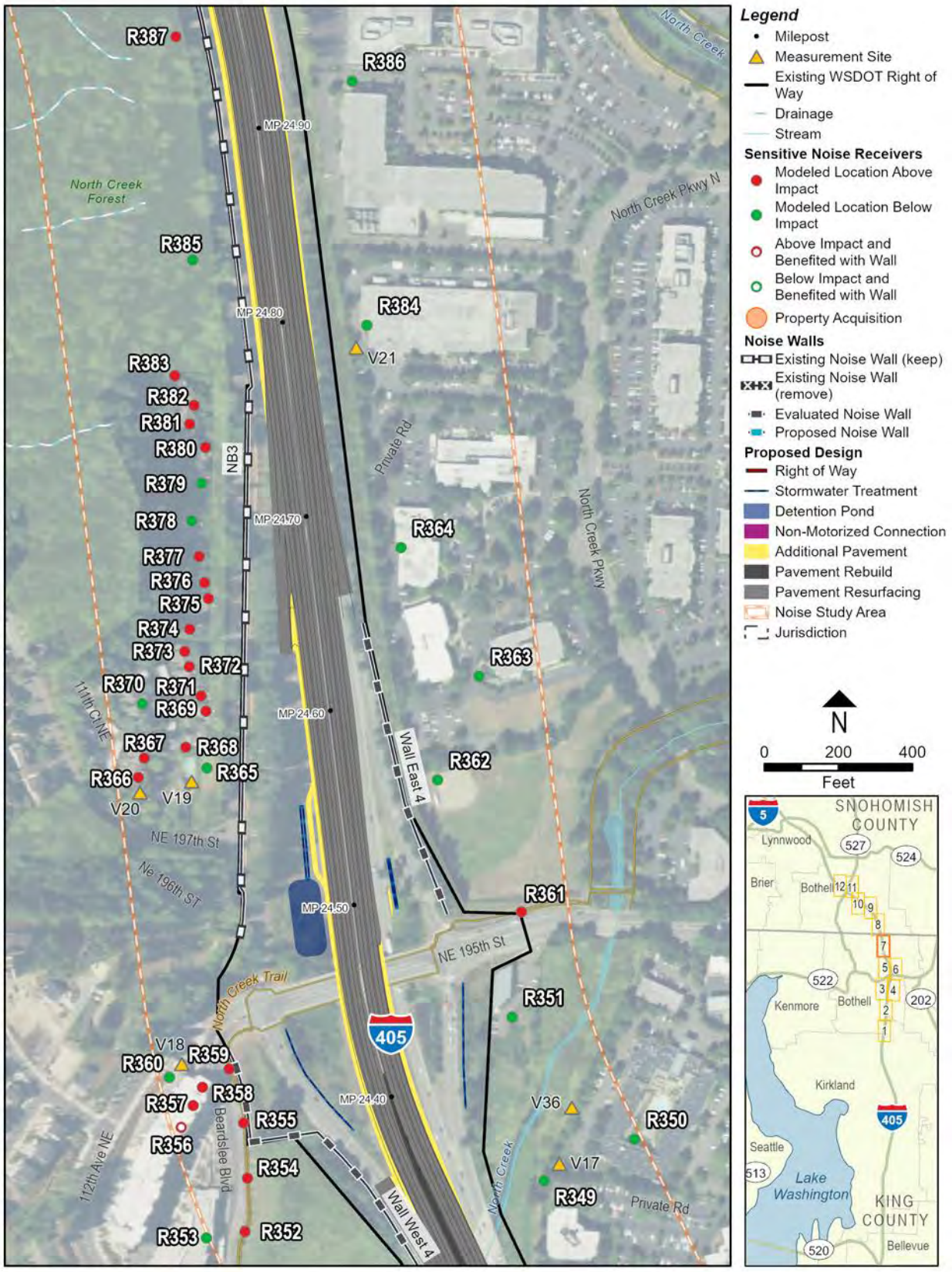


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 8 of 12

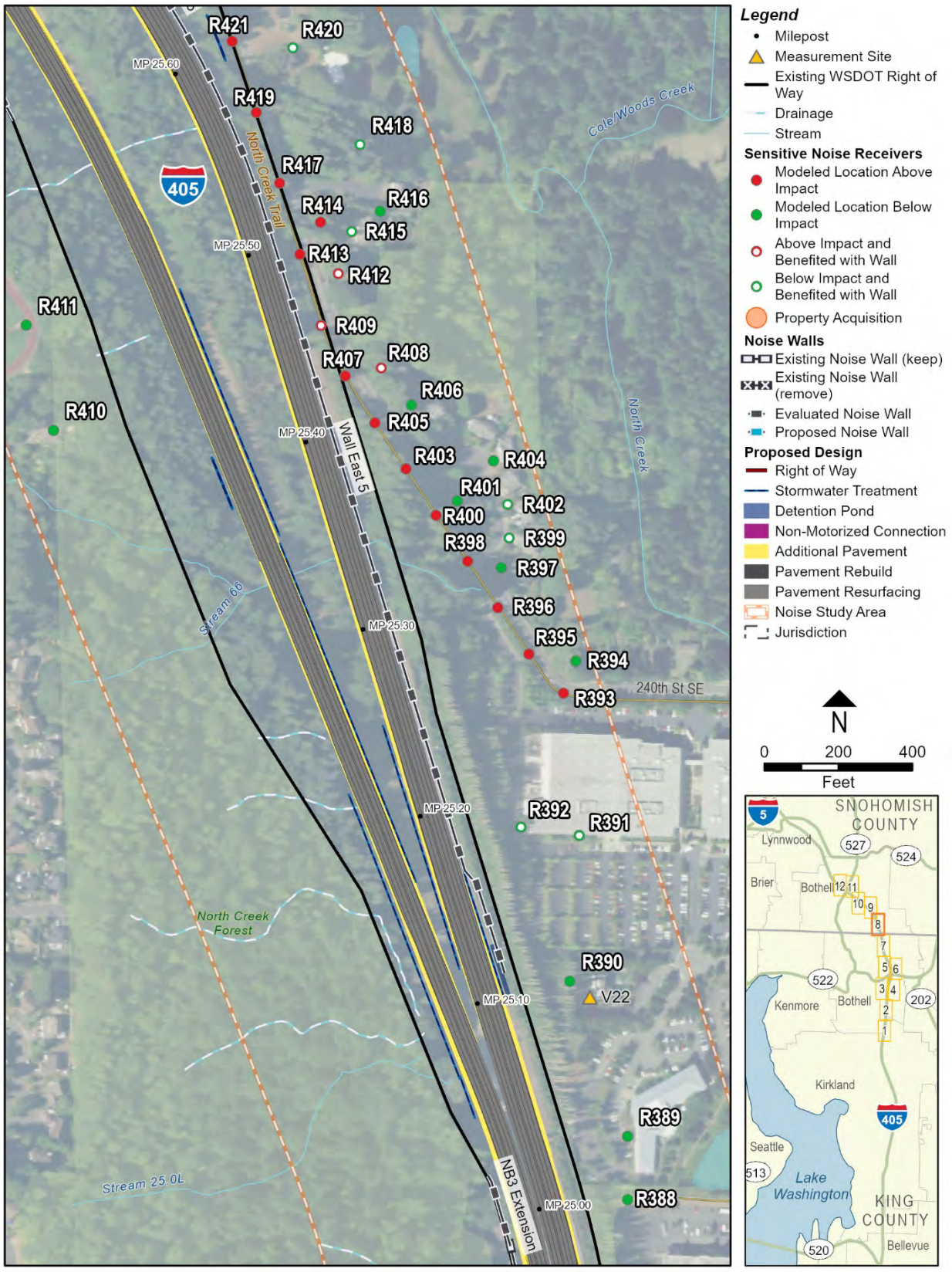


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 9 of 12

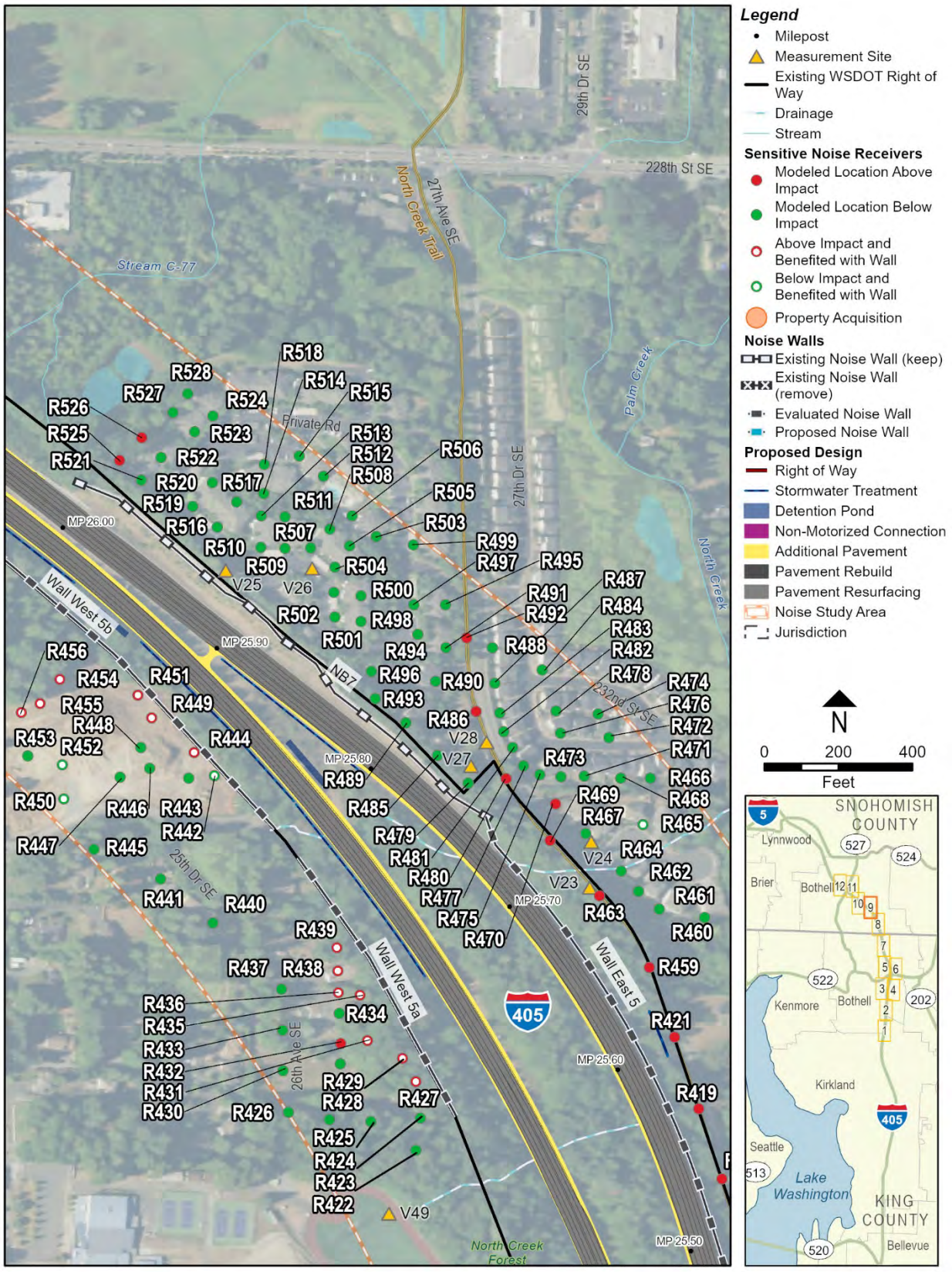


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 10 of 12

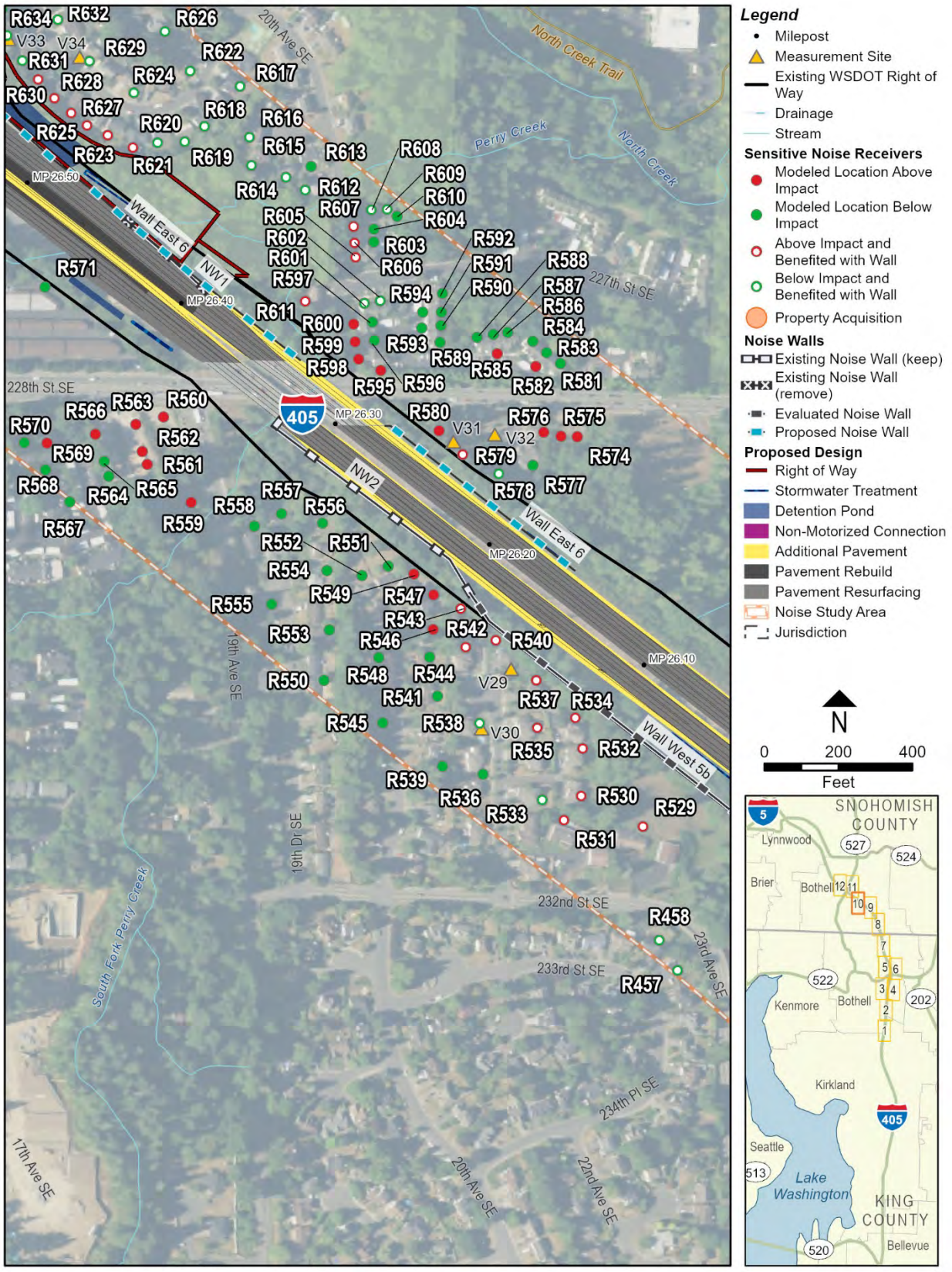


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 11 of 12

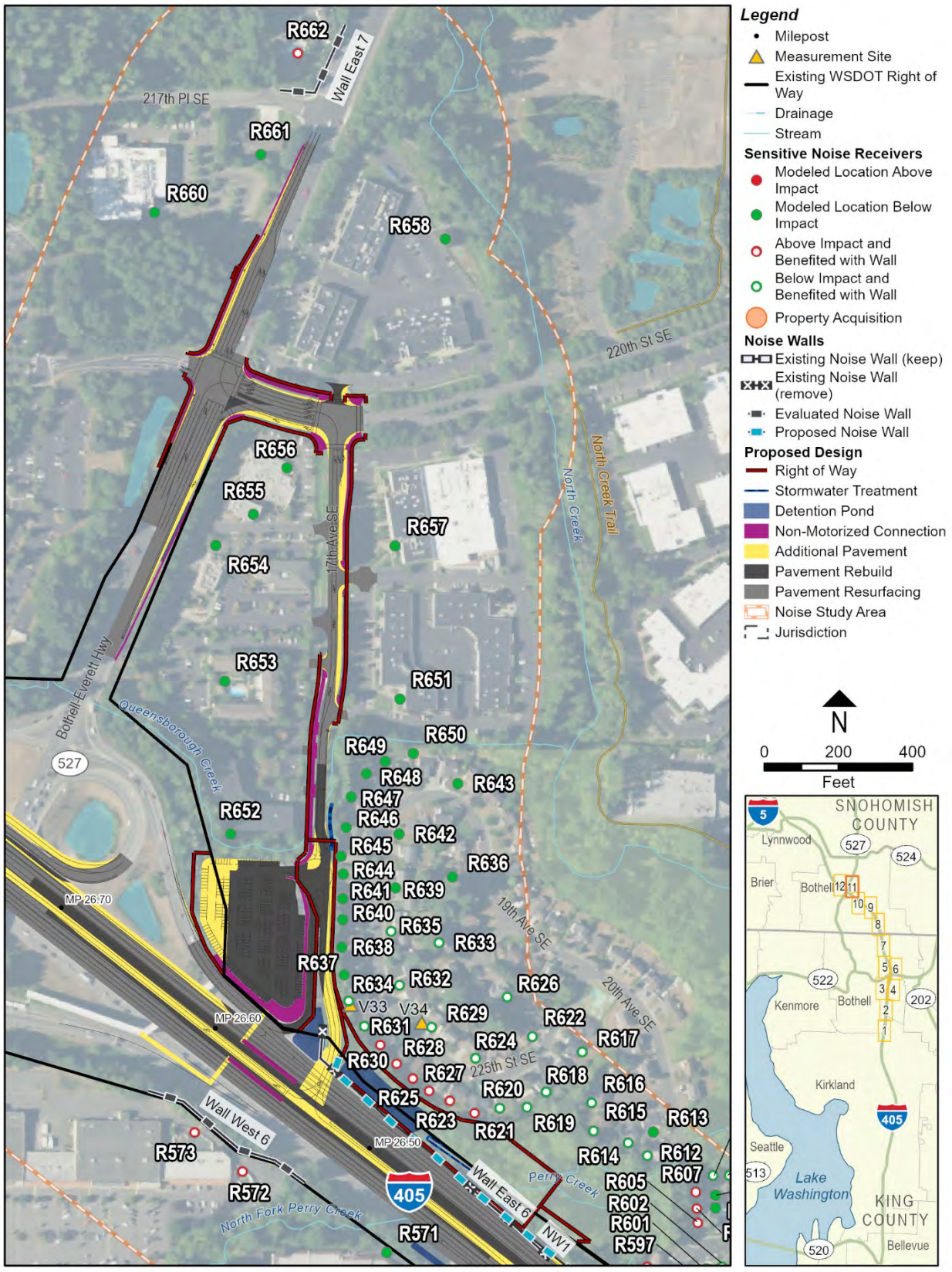
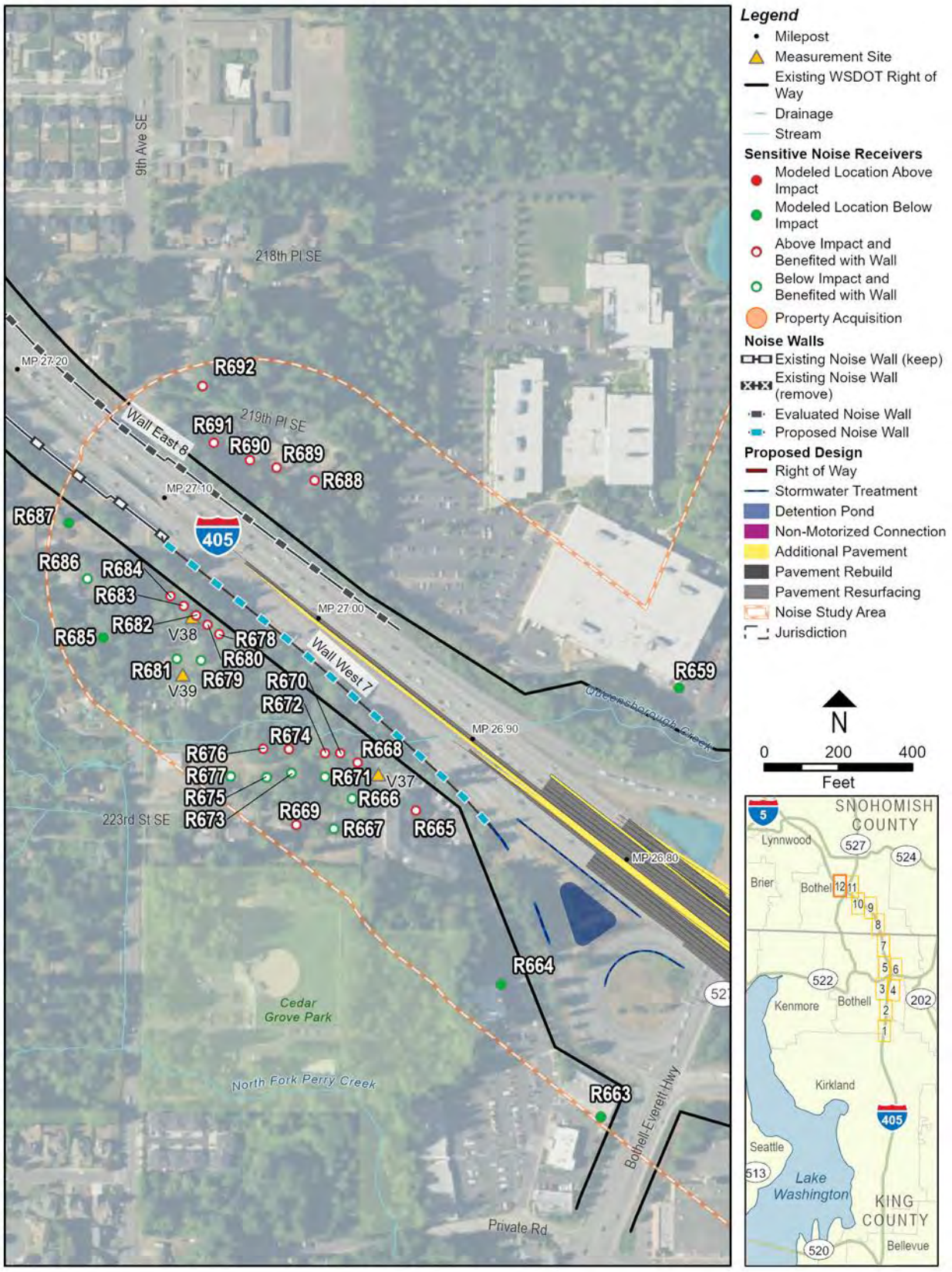


Exhibit 5-1. Traffic Noise Modeled Locations and Noise Wall Analysis, Sheet 12 of 12



5.1.1 Existing Noise Level (Year 2018)

Existing modeled loudest-hour traffic noise levels ranged from 37 to 75 dBA at residential receivers, 50 to 72 dBA at other outdoor uses in the study area, and 38 to 47 dBA at interior (Category D) receivers in the study area. Category D receivers were determined to be located inside large masonry buildings. Using the value given in Exhibit 6 of the WSDOT noise policy (WSDOT 2011) for single-glazed windows, WSDOT used a building noise reduction factor of 25 dB to determine interior noise levels at Category D receivers (FHWA 2011).

WSDOT modeled 989 receivers to assess impacts in the I-405 noise study area. The modeled noise levels at these receivers depend on the proximity of the receiver to I-405 and the variable terrain throughout the corridor; 190 receivers (representing 256 dwelling units) currently approach or exceed the FHWA NAC. These 190 receivers include 152 residential receivers (representing 214 residences), 29 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school outdoor garden, 1 neighborhood pool, 1 tennis court, and 1 hotel courtyard. Exhibit 5-2 shows the existing traffic noise levels for all modeled receivers.

5.1.2 Design Year Traffic Noise Level – No Build Alternative (Year 2045)

The No Build Alternative modeled loudest-hour traffic noise levels ranged from 38 to 75 dBA at residential receivers, 50 to 73 dBA at other outdoor use in the study area, and 38 to 48 dBA at interior (Category D) receivers in the study area. Noise levels are projected to increase by about up to 3 dBA over existing noise levels.

A total of 227 receivers (representing 307 dwelling units) would approach or exceed the FHWA NAC without the Project in 2045. These 227 receivers include 185 residential receivers (representing 259 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 place of worship playground, 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units), 1 tennis court, and 1 hotel courtyard. Exhibit 5-2 shows the No Build Alternative traffic noise levels for all modeled receivers.

5.1.3 Design Year Traffic Noise Level – Build Alternative (Year 2045)

The Build Alternative modeled loudest-hour traffic noise levels ranged from 38 to 75 dBA at residential receivers, 50 to 73 dBA at other outdoor use in the study area, and 37 to 49 at interior (Category D) receivers in the study area. Without noise abatement, noise levels are predicted to decrease in some areas up to 3 dBA over existing noise levels. Decreases in noise levels are due to redistribution of traffic, extension of the 35 mph speed limit zone on SR 522 through the I-405 interchange, and addition of concrete safety barriers and retaining walls with the proposed design. In other parts of the study area, without noise abatement, noise levels are predicted to increase from 1 to 7 dBA over existing noise levels and 1 to 6 dBA over No Build noise levels.

For the study area overall, Build Alternative noise levels with proposed noise walls (Section 5.3.1) are predicted to increase up to 3 dBA and decrease up to 10 dBA when compared with No Build Alternative noise levels.

A total of 221 receivers (representing 293 dwelling units) would experience future traffic noise levels at or above the NAC with the project in 2045 without noise abatement. These 221 receivers include 180 residential receivers (representing 246 residences), 31 trail receivers, 2 daycare receivers (representing 4 RE units), 2 neighborhood playground receivers (representing 4 RE units), 1 school playground (representing 2 RE units), 1 school outdoor garden, 1 neighborhood pool, 1 multifamily residential pool (representing 2 RE units), 1 tennis court, and 1 hotel courtyard.

Exhibit 5-2 shows the Build Alternative traffic noise levels without the evaluated and proposed noise walls for all modeled receivers. Each Traffic Noise Model (TNM) receiver shown on the exhibit can represent multiple units or floors. Upper floor balconies were included in the noise model when they were both large enough for a chair and either represented the only outdoor use for the individual units or were the more affected space when compared to common outdoor use for the property. In some cases, second floor balconies represent first-row receptors based on line-of-sight consideration to the Project roadways, such as when I-405 is in a cut section. Properties projected to approach or exceed the impact level under the Build Alternative are analyzed for noise abatement in Section 5, Traffic Noise Abatement.

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R1	Single-family	B	66	1	64	64	65	1
R2	Single-family	B	66	1	63	63	63	0
R3	Single-family	B	66	1	62	63	63	1
R4	Single-family	B	66	2	60	61	61	1
R5	Single-family	B	66	1	62	62	62	0
R6	Single-family	B	66	1	62	62	62	0
R7	Single-family	B	66	1	62	62	62	0
R8	Single-family	B	66	1	61	61	61	0
R9	Single-family	B	66	2	58	59	59	1
R10	Single-family	B	66	1	58	58	58	0
R11	Single-family	B	66	1	60	61	61	1
R12	Single-family	B	66	1	58	59	59	1
R13	Single-family	B	66	1	58	59	59	1
R14	Single-family	B	66	1	58	59	59	1
R15	Single-family	B	66	1	60	61	60	0
R16	Single-family	B	66	1	62	63	63	1
R17	Single-family	B	66	1	63	64	64	1
R18	Single-family	B	66	2	61	62	62	1
R19	Single-family	B	66	1	61	61	61	0
R20	Single-family	B	66	1	62	62	62	0
R21	Single-family	B	66	1	62	63	63	1
R22	Single-family	B	66	2	61	61	61	0
R23	Single-family	B	66	1	62	63	63	1
R24	Single-family	B	66	1	62	62	62	0
R25	Single-family	B	66	1	61	61	61	0
R26	Single-family	B	66	1	61	61	61	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R27	Single-family	B	66	1	60	61	61	1
R28	Single-family	B	66	1	59	60	60	1
R29	Single-family	B	66	1	61	62	62	1
R30	Single-family	B	66	2	62	62	62	0
R31	Single-family	B	66	1	62	62	62	0
R32	Single-family	B	66	1	62	63	62	0
R33	Single-family	B	66	3	59	60	59	0
R34	Single-family	B	66	2	61	61	61	0
R35	Single-family	B	66	1	61	62	61	0
R36	Single-family	B	66	1	60	61	61	1
R37	Single-family	B	66	2	59	60	60	1
R38	Single-family	B	66	1	60	61	61	1
R39	Single-family	B	66	1	57	58	58	1
R40	Single-family	B	66	1	59	60	60	1
R41	Single-family	B	66	1	59	60	60	1
R42	Single-family	B	66	2	59	59	59	0
R43	Single-family	B	66	1	60	61	60	0
R44	Single-family	B	66	1	59	60	59	0
R45	Single-family	B	66	2	59	59	59	0
R46	Single-family	B	66	1	58	59	59	1
R47	Single-family	B	66	1	57	58	58	1
R48	Single-family	B	66	2	57	58	57	0
R49	Single-family	B	66	2	59	60	60	1
R50	Single-family	B	66	1	58	58	58	0
R51	Single-family	B	66	1	59	60	59	0
R52	Single-family	B	66	1	60	61	61	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R53	Single-family	B	66	3	60	61	61	1
R54	Single-family	B	66	2	62	63	62	0
R55	Single-family	B	66	1	62	62	62	0
R56	Single-family	B	66	1	63	64	63	0
R57	Single-family	B	66	1	63	64	64	1
R58	Single-family	B	66	3	61	62	62	1
R59	Playground	C	66	2	**68**	**69**	**70**	2
R60	Tennis Court	C	66	1	**71**	**72**	**72**	1
R61	Pool	C	66	1	**68**	**69**	**70**	2
R62	Single-family	B	66	1	63	64	64	1
R63	Single-family	B	66	1	60	60	60	0
R64	Single-family	B	66	1	58	59	59	1
R65	Single-family	B	66	1	58	58	58	0
R66	Single-family	B	66	2	59	60	60	1
R67	Single-family	B	66	1	59	60	59	0
R68	Single-family	B	66	1	59	59	59	0
R69	Single-family	B	66	2	58	59	58	0
R70	Single-family	B	66	1	60	61	61	1
R71	Single-family	B	66	1	56	57	57	1
R72	Single-family	B	66	2	56	57	56	0
R73	Single-family	B	66	1	61	61	61	0
R74	Single-family	B	66	2	57	57	57	0
R75	Single-family	B	66	1	65	**66**	**66**	1
R76	Single-family	B	66	2	61	62	61	0
R77	Single-family	B	66	2	56	57	57	1
R78	Single-family	B	66	1	63	64	64	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R79	Single-family	B	66	2	58	58	58	0
R80	Single-family	B	66	1	63	63	63	0
R81	Single-family	B	66	1	62	63	63	1
R82	Single-family	B	66	2	60	60	60	0
R83	Single-family	B	66	1	62	63	63	1
R84	Single-family	B	66	3	55	56	55	0
R85	Single-family	B	66	1	62	63	63	1
R86	Single-family	B	66	2	60	61	60	0
R87	Single-family	B	66	1	62	63	63	1
R88	Single-family	B	66	2	55	56	55	0
R89	Single-family	B	66	1	62	63	63	1
R90	Single-family	B	66	2	60	60	60	0
R91	Single-family	B	66	1	61	62	61	0
R92	Single-family	B	66	2	55	56	56	1
R93	Single-family	B	66	1	61	61	61	0
R94	Single-family	B	66	2	59	59	59	0
R95	Single-family	B	66	1	62	63	62	0
R96	Single-family	B	66	1	62	63	62	0
R97	Single-family	B	66	3	54	55	54	0
R98	Single-family	B	66	2	56	57	57	1
R99	Single-family	B	66	1	63	63	63	0
R100	Single-family	B	66	1	59	60	60	1
R101	Single-family	B	66	1	58	59	58	0
R102	Single-family	B	66	1	62	63	63	1
R103	Single-family	B	66	1	57	58	58	1
R104	Single-family	B	66	2	54	55	55	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R105	Single-family	B	66	1	57	57	57	0
R106	Single-family	B	66	1	58	58	58	0
R107	Single-family	B	66	1	60	61	60	0
R108	Single-family	B	66	1	62	63	62	0
R109	Single-family	B	66	1	55	55	55	0
R110	Single-family	B	66	1	55	56	55	0
R111	Single-family	B	66	1	56	57	56	0
R112	Single-family	B	66	1	57	58	58	1
R113	Single-family	B	66	1	59	60	60	1
R114	Single-family	B	66	1	61	62	61	0
R115	Tolt Pipeline Trail	C	66	1	62	63	62	0
R116	Tolt Pipeline Trail	C	66	1	58	59	59	1
R117	Tolt Pipeline Trail	C	66	1	56	57	56	0
R118	Tolt Pipeline Trail	C	66	1	54	55	54	0
R119	Multifamily	B	66	4	52	53	52	0
R120	Multifamily	B	66	4	54	55	55	1
R121	Multifamily	B	66	4	55	56	56	1
R122	Multifamily	B	66	4	58	59	59	1
R123	Multifamily	B	66	4	60	61	60	0
R124	Multifamily	B	66	4	51	52	51	0
R125	Multifamily	B	66	4	53	53	53	0
R126	Multifamily	B	66	4	54	55	55	1
R127	Multifamily	B	66	4	62	63	62	0
R128-1	Multifamily	B	66	2	59	60	60	1
R128-2	Multifamily	B	66	2	62	63	63	1
R128-3	Multifamily	B	66	2	**67**	**68**	**68**	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R128-4	Multifamily	B	66	2	**71**	**72**	**72**	1
R129-1	Multifamily	B	66	1	56	57	56	0
R129-2	Multifamily	B	66	1	58	59	59	1
R129-3	Multifamily	B	66	1	62	63	63	1
R129-4	Multifamily	B	66	1	**67**	**68**	**68**	1
R130-1	Multifamily	B	66	2	53	54	54	1
R130-2	Multifamily	B	66	2	55	56	56	1
R130-3	Multifamily	B	66	2	58	59	59	1
R130-4	Multifamily	B	66	2	62	62	62	0
R131-1	Multifamily	B	66	2	60	61	61	1
R131-2	Multifamily	B	66	2	63	64	64	1
R131-3	Multifamily	B	66	2	**68**	**69**	**69**	1
R131-4	Multifamily	B	66	2	**71**	**72**	**72**	1
R132-1	Multifamily	B	66	2	55	56	55	0
R132-2	Multifamily	B	66	2	58	59	59	1
R132-3	Multifamily	B	66	2	62	62	62	0
R132-4	Multifamily	B	66	2	**66**	**67**	**67**	1
R133-1	Multifamily	B	66	4	45	46	45	0
R133-2	Multifamily	B	66	4	48	49	49	1
R133-3	Multifamily	B	66	4	50	51	51	1
R133-4	Multifamily	B	66	4	54	55	55	1
R134-1	Multifamily	B	66	2	61	62	62	1
R134-2	Multifamily	B	66	2	64	65	65	1
R134-3	Multifamily	B	66	2	**68**	**68**	**68**	0
R134-4	Multifamily	B	66	2	**71**	**71**	**71**	0
R135-1	Multifamily	B	66	2	62	63	63	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R135-2	Multifamily	B	66	2	65	**66**	**66**	1
R135-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R135-4	Multifamily	B	66	2	**70**	**71**	**71**	1
R136-1	Multifamily	B	66	1	58	59	59	1
R136-2	Multifamily	B	66	1	62	63	63	1
R136-3	Multifamily	B	66	1	64	65	65	1
R136-4	Multifamily	B	66	1	**66**	**67**	**67**	1
R137-1	Multifamily	B	66	2	56	57	57	1
R137-2	Multifamily	B	66	2	59	60	60	1
R137-3	Multifamily	B	66	2	61	62	62	1
R137-4	Multifamily	B	66	2	62	63	63	1
R138-1	Multifamily	B	66	2	64	65	65	1
R138-2	Multifamily	B	66	2	**67**	**68**	**68**	1
R138-3	Multifamily	B	66	2	**68**	**69**	**69**	1
R138-4	Multifamily	B	66	2	**69**	**70**	**70**	1
R139-1	Multifamily	B	66	1	59	59	59	0
R139-2	Multifamily	B	66	1	63	64	64	1
R139-3	Multifamily	B	66	1	64	65	65	1
R139-4	Multifamily	B	66	1	**66**	**67**	**67**	1
R140-1	Multifamily	B	66	2	56	57	57	1
R140-2	Multifamily	B	66	2	60	61	61	1
R140-3	Multifamily	B	66	2	62	63	63	1
R140-4	Multifamily	B	66	2	64	64	64	0
R141-1	Multifamily	B	66	2	64	65	65	1
R141-2	Multifamily	B	66	2	**67**	**67**	**67**	0
R141-3	Multifamily	B	66	2	**68**	**69**	**69**	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R141-4	Multifamily	B	66	2	**69**	**70**	**70**	1
R142-1	Multifamily	B	66	2	59	60	60	1
R142-2	Multifamily	B	66	2	62	62	63	1
R142-3	Multifamily	B	66	2	62	63	64	2
R142-4	Multifamily	B	66	2	63	64	64	1
R143-1	Multifamily	B	66	4	46	46	46	0
R143-2	Multifamily	B	66	4	48	49	49	1
R143-3	Multifamily	B	66	4	50	51	51	1
R143-4	Multifamily	B	66	4	52	53	53	1
R144-1	Multifamily	B	66	2	64	65	65	1
R144-2	Multifamily	B	66	2	**66**	**67**	**67**	1
R144-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R144-4	Multifamily	B	66	2	**68**	**69**	**69**	1
R145-1	Multifamily	B	66	2	62	63	64	2
R145-2	Multifamily	B	66	2	64	65	65	1
R145-3	Multifamily	B	66	2	65	**66**	**66**	1
R145-4	Multifamily	B	66	2	**66**	**67**	**67**	1
R146-1	Multifamily	B	66	1	58	59	59	1
R146-2	Multifamily	B	66	1	60	61	61	1
R146-3	Multifamily	B	66	1	61	62	62	1
R146-4	Multifamily	B	66	1	62	63	63	1
R147-1	Multifamily	B	66	2	55	56	56	1
R147-2	Multifamily	B	66	2	57	58	58	1
R147-3	Multifamily	B	66	2	58	59	59	1
R147-4	Multifamily	B	66	2	59	60	60	1
R148	Retail	F	--	0	61	62	62	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R149-1	Multifamily	B	66	2	54	55	54	0
R149-2	Multifamily	B	66	2	56	56	56	0
R149-3	Multifamily	B	66	2	58	59	58	0
R150	Multifamily	B	66	1	53	54	54	1
R151	Multifamily	B	66	2	45	46	46	1
R152-1	Multifamily	B	66	2	47	48	48	1
R152-2	Multifamily	B	66	2	50	51	51	1
R152-3	Multifamily	B	66	2	53	54	54	1
R153-1	Multifamily	B	66	2	45	46	46	1
R153-2	Multifamily	B	66	2	48	49	49	1
R153-3	Multifamily	B	66	2	51	52	51	0
R154-1	Multifamily	B	66	2	62	63	63	1
R154-2	Multifamily	B	66	2	**67**	**67**	**67**	0
R155-1	Multifamily	B	66	3	47	48	47	0
R155-2	Multifamily	B	66	3	49	49	49	0
R155-3	Multifamily	B	66	3	51	51	51	0
R156-1	Multifamily	B	66	2	51	52	52	1
R156-2	Multifamily	B	66	2	53	54	53	0
R157-1	Multifamily	B	66	2	48	49	49	1
R157-2	Multifamily	B	66	2	49	50	50	1
R158-1	Multifamily	B	66	2	49	49	49	0
R158-2	Multifamily	B	66	2	49	49	49	0
R158-3	Multifamily	B	66	2	51	52	52	1
R159-1	Multifamily	B	66	3	46	47	47	1
R159-2	Multifamily	B	66	3	49	49	49	0
R159-3	Multifamily	B	66	3	50	50	50	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R160-1	Multifamily	B	66	2	50	51	51	1
R160-2	Multifamily	B	66	2	54	54	54	0
R161-1	Multifamily	B	66	3	39	40	40	1
R161-2	Multifamily	B	66	3	43	43	43	0
R161-3	Multifamily	B	66	3	46	46	46	0
R162-1	Multifamily	B	66	2	49	50	49	0
R162-2	Multifamily	B	66	2	49	50	50	1
R162-3	Multifamily	B	66	2	51	52	52	1
R163-1	Multifamily	B	66	2	52	52	53	1
R163-2	Multifamily	B	66	2	54	55	55	1
R164-1	Multifamily	B	66	2	48	49	49	1
R164-2	Multifamily	B	66	2	48	49	49	1
R165-1	Multifamily	B	66	3	37	38	38	1
R165-2	Multifamily	B	66	3	41	42	42	1
R165-3	Multifamily	B	66	3	45	46	46	1
R166-1	Multifamily	B	66	2	54	55	56	2
R166-2	Multifamily	B	66	2	57	58	59	2
R167-1	Multifamily	B	66	2	56	56	57	1
R167-2	Multifamily	B	66	2	58	59	59	1
R167-3	Multifamily	B	66	2	62	62	62	0
R168-1	Multifamily	B	66	2	44	44	44	0
R168-2	Multifamily	B	66	2	46	47	47	1
R168-3	Multifamily	B	66	2	48	49	49	1
R169-1	Multifamily	B	66	2	50	51	51	1
R169-2	Multifamily	B	66	2	50	51	51	1
R169-3	Multifamily	B	66	2	53	54	54	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R170-1	Multifamily	B	66	2	42	43	42	0
R170-2	Multifamily	B	66	2	45	46	46	1
R170-3	Multifamily	B	66	2	47	48	48	1
R171-1	Multifamily	B	66	2	42	43	43	1
R171-2	Multifamily	B	66	2	46	46	47	1
R171-3	Multifamily	B	66	2	48	49	49	1
R172-1	Multifamily	B	66	2	63	64	65	2
R172-2	Multifamily	B	66	2	**70**	**71**	**71**	1
R173-1	Multifamily	B	66	2	46	46	46	0
R173-2	Multifamily	B	66	2	46	47	47	1
R173-3	Multifamily	B	66	2	48	49	49	1
R174-1	Multifamily	B	66	2	**66**	**66**	**67**	1
R174-2	Multifamily	B	66	2	**71**	**72**	**72**	1
R174-3	Multifamily	B	66	2	**74**	**75**	**75**	1
R175-1	Multifamily	B	66	2	50	50	51	1
R175-2	Multifamily	B	66	2	53	53	53	0
R175-3	Multifamily	B	66	2	55	56	56	1
R176	Office[a]	E	71	0	56	57	57	1
R177	Multifamily	B	66	4	59	60	60	1
R178	Multifamily	B	66	4	53	53	53	0
R179	Multifamily	B	66	3	56	57	57	1
R180	Multifamily	B	66	3	56	57	57	1
R181	Multifamily	B	66	6	58	59	59	1
R182	Multifamily	B	66	4	52	52	53	1
R183	Multifamily	B	66	4	56	57	57	1
R184	Multifamily	B	66	4	53	54	54	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R185	Multifamily	B	66	8	57	58	57	0
R186	Multifamily	B	66	4	57	58	58	1
R187	Multifamily	B	66	4	55	55	55	0
R188	Multifamily	B	66	4	49	50	50	1
R189	Multifamily	B	66	4	58	58	59	1
R190	Multifamily	B	66	4	53	54	54	1
R191	Multifamily	B	66	2	51	52	52	1
R192	Multifamily	B	66	4	58	59	59	1
R193	Multifamily	B	66	4	47	48	48	1
R194	Multifamily	B	66	6	58	58	58	0
R195	Multifamily	B	66	1	46	46	46	0
R196	Multifamily	B	66	1	49	50	50	1
R197	Multifamily	B	66	2	48	49	50	2
R198	Multifamily	B	66	2	51	51	51	0
R199	Multifamily	B	66	4	61	62	62	1
R200	Multifamily	B	66	4	61	62	62	1
R201	Multifamily	B	66	5	50	51	51	1
R202	Multifamily	B	66	5	51	52	52	1
R203	Multifamily	B	66	4	50	50	51	1
R204	Multifamily	B	66	6	61	62	62	1
R205	Multifamily	B	66	5	53	54	54	1
R206	Multifamily	B	66	4	47	47	48	1
R207	Multifamily	B	66	4	48	49	49	1
R208	Multifamily	B	66	4	48	49	49	1
R209	Cedar Park Christian	D	51	1	47	48	49	2
R210	Cedar Park Christian	C	66	1	**70**	**71**	**73**	3

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R211	Cedar Park Christian	C	66	2	65	**66**	**67**	2
R212	Single-family	B	66	1	57	57	58	1
R213	Single-family	B	66	1	59	59	60	1
R214	Single-family	B	66	1	65	65	**66**	1
R215	Single-family	B	66	1	65	65	**66**	1
R216	Single-family	B	66	1	63	64	65	2
R217	Single-family	B	66	1	**66**	**67**	**67**	1
R218	Single-family	B	66	1	**67**	**68**	**69**	2
R219	Single-family	B	66	1	**67**	**68**	**69**	2
R220	Single-family	B	66	1	**66**	**67**	**68**	2
R221	Single-family	B	66	1	63	64	65	2
R222	Single-family	B	66	1	**66**	**66**	**67**	1
R223	Single-family	B	66	1	**66**	**67**	**68**	2
R224	Single-family	B	66	1	**66**	**66**	**67**	1
R225	Single-family	B	66	1	64	65	**66**	2
R226	Single-family	B	66	1	65	**66**	**67**	2
R227	Single-family	B	66	1	65	65	**66**	1
R228	Single-family	B	66	1	65	**66**	**67**	2
R229	Single-family	B	66	1	**66**	**66**	**67**	1
R230	Single-family	B	66	1	65	**66**	**67**	2
R231	Single-family	B	66	1	58	59	59	1
R232	Single-family	B	66	1	57	58	58	1
R233	Single-family	B	66	1	**67**	**68**	**68**	1
R234	Single-family	B	66	1	59	60	61	2
R235	Single-family	B	66	1	57	59	59	2
R236	Single-family	B	66	1	57	58	58	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R237	Single-family	B	66	1	57	59	59	2
R238	Single-family	B	66	2	58	59	58	0
R239	Single-family	B	66	2	59	59	58	-1
R240	Single-family	B	66	3	58	58	58	0
R241	Single-family	B	66	2	59	59	59	0
R242	Single-family	B	66	2	59	59	59	0
R243	Single-family	B	66	2	58	59	58	0
R244	Single-family	B	66	4	58	59	58	0
R245	Single-family	B	66	2	59	60	59	0
R246	Single-family	B	66	2	58	59	59	1
R247	Single-family	B	66	2	59	60	59	0
R248	Single-family	B	66	2	59	60	59	0
R249	Single-family	B	66	2	60	61	60	0
R250	Single-family	B	66	2	60	61	60	0
R251	Single-family	B	66	1	61	62	61	0
R252	Single-family	B	66	2	61	62	62	1
R253	Single-family	B	66	4	58	59	59	1
R254	Single-family	B	66	2	61	62	61	0
R255	Single-family	B	66	2	61	62	62	1
R256	Single-family	B	66	2	61	62	62	1
R257	Single-family	B	66	2	61	62	62	1
R258	Single-family	B	66	2	61	62	62	1
R259	Single-family	B	66	2	62	63	62	0
R260	Single-family	B	66	2	62	63	63	1
R261	Single-family	B	66	2	62	63	62	0
R262	Single-family	B	66	2	62	63	63	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R263	Single-family	B	66	2	62	63	63	1
R264	Single-family	B	66	2	62	63	63	1
R265	Single-family	B	66	2	61	63	63	2
R266	Single-family	B	66	2	63	63	63	0
R267	Single-family	B	66	2	63	64	64	1
R268	Single-family	B	66	2	63	64	64	1
R269	Single-family	B	66	2	63	64	64	1
R270	Single-family	B	66	2	62	64	64	2
R271	Single-family	B	66	2	64	65	**66**	2
R272	Single-family	B	66	1	**70**	**71**	**71**	1
R273	Single-family	B	66	1	**71**	**72**	**72**	1
R274	Single-family	B	66	2	56	57	58	2
R275	Single-family	B	66	1	**71**	**72**	**72**	1
R276	Single-family	B	66	2	54	55	56	2
R277	Single-family	B	66	3	57	57	58	1
R278	Single-family	B	66	1	**71**	**72**	**72**	1
R279	Single-family	B	66	1	**71**	**71**	**72**	1
R280	Single-family	B	66	1	**71**	**72**	**72**	1
R281	Single-family	B	66	2	55	56	57	2
R282	Single-family	B	66	1	**70**	**71**	**71**	1
R283	Single-family	B	66	1	**69**	**70**	**70**	1
R284	Single-family	B	66	2	56	56	56	0
R285	Single-family	B	66	1	**70**	**71**	**71**	1
R286	Single-family	B	66	2	60	61	62	2
R287	Single-family	B	66	2	57	58	59	2
R288	Single-family	B	66	2	58	59	60	2

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R289	Single-family	B	66	2	62	64	65	3
R290	Single-family	B	66	2	**67**	**68**	**69**	2
R291	Single-family	B	66	2	62	63	65	3
R292	Single-family	B	66	2	59	60	62	3
R293	Single-family	B	66	2	60	62	63	3
R294	Single-family	B	66	1	64	65	**67**	3
R295	Industrial[b]	F	--	0	74	74		
R296	Single-family	B	66	1	**70**	**70**		
R297	Single-family	B	66	1	**67**	**68**	**67**	0
R298	Industrial	F	--	0	65	66	65	0
R299	Single-family	B	66	1	64	**66**	**67**	3
R300	Multifamily	B	66	1	59	62	61	2
R301-1	Multifamily	B	66	1	49	51	51	2
R301-2	Multifamily	B	66	1	53	56	55	2
R302-1	Multifamily	B	66	1	60	62	62	2
R302-2	Multifamily	B	66	1	63	**66**	**66**	3
R303-1	Multifamily	B	66	1	55	57	57	2
R303-2	Multifamily	B	66	1	60	62	62	2
R304-1	Multifamily	B	66	2	57	59	59	2
R304-2	Multifamily	B	66	2	61	63	63	2
R305-1	Multifamily	B	66	2	54	55	54	0
R305-2	Multifamily	B	66	2	56	56	55	-1
R306-1	Multifamily	B	66	1	54	55	54	0
R306-2	Multifamily	B	66	1	56	56	55	-1
R307-1	Multifamily	B	66	1	58	60	59	1
R307-2	Multifamily	B	66	1	61	64	63	2

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R308-1	Multifamily	B	66	1	55	56	55	0
R308-2	Multifamily	B	66	1	57	58	58	1
R309-1	Multifamily	B	66	1	56	58	59	3
R309-2	Multifamily	B	66	1	61	63	63	2
R310-1	Multifamily	B	66	2	54	56	56	2
R310-2	Multifamily	B	66	2	56	58	58	2
R311-1	Multifamily	B	66	1	56	56	55	-1
R311-2	Multifamily	B	66	1	56	57	56	0
R312-1	Multifamily	B	66	1	56	57	56	0
R312-2	Multifamily	B	66	1	57	57	57	0
R313-1	Multifamily	B	66	1	58	60	60	2
R313-2	Multifamily	B	66	1	62	64	64	2
R314-1	Multifamily	B	66	1	56	58	58	2
R314-2	Multifamily	B	66	1	59	61	61	2
R315-1	Multifamily	B	66	2	57	58	57	0
R315-2	Multifamily	B	66	2	58	59	59	1
R316	Multifamily	B	66	6	59	61	61	2
R317	Single-family	B	66	1	58	59	58	0
R318	Single-family	B	66	1	58	59	59	1
R319	Single-family	B	66	1	60	61	61	1
R320	Single-family	B	66	1	59	59	58	-1
R321	Single-family	B	66	1	62	64	63	1
R322	Single-family	B	66	1	62	63	62	0
R323	Single-family	B	66	1	60	61	60	0
R324	Single-family	B	66	1	60	61	60	0
R325	Sammamish River	C	66	1	63	64	64	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R326	Sammamish River	C	66	1	62	64	65	3
R327	Sammamish River	C	66	1	63	64	65	2
R328	Sammamish River	C	66	1	63	65	65	2
R329	Sammamish River	C	66	1	63	65	65	2
R330	Sammamish River	C	66	1	64	65	**66**	2
R331	Sammamish River	C	66	1	**66**	**66**	**67**	1
R332	Sammamish River	C	66	1	64	65	64	0
R333	Sammamish River	C	66	1	63	64	64	1
R334	Sammamish River	C	66	1	64	65	64	0
R335	Sammamish River	C	66	1	63	65	64	1
R336	Sammamish River	C	66	1	64	**66**	65	1
R337	Sammamish River	C	66	1	**66**	**69**	**68**	2
R338	Sammamish River	C	66	1	**69**	**71**	**70**	1
R339	Sammamish River	C	66	1	**71**	**72**	**72**	1
R340	Sammamish River	C	66	1	**69**	**71**	**71**	2
R341	Sammamish River	C	66	1	**68**	**71**	**72**	4
R342	North Creek Trail	C	66	1	63	65	63	0
R343	North Creek Trail	C	66	1	61	63	61	0
R344	Retail	F	--	0	63	64	65	2
R345	Northwest	D	51	1	38	38	37	-1
R346	Office[a]	E	71	0	67	67	67	0
R347	Industrial	F	--	0	70	70	70	0
R348	Office	E	71	2	62	63	62	0
R349	Office Area Bike Path	E	71	1	66	67	66	0
R350	Hotel	E	71	1	50	50	50	0
R351	Picnic Area	C	66	1	61	61	61	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R352	North Creek Trail	C	66	1	**66**	**67**	**67**	1
R353	Commercial	E	71	1	66	67	67	1
R354	North Creek Trail	C	66	1	**68**	**68**	**68**	0
R355	North Creek Trail	C	66	1	**68**	**69**	**69**	1
R356-3	Multifamily	B	66	2	**66**	**66**	**66**	0
R356-4	Multifamily	B	66	2	**67**	**67**	**67**	0
R356-5	Multifamily	B	66	2	**67**	**68**	**68**	1
R357-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R357-4	Multifamily	B	66	2	**68**	**69**	**69**	1
R357-5	Multifamily	B	66	2	**69**	**69**	**69**	0
R358-3	Multifamily	B	66	1	**70**	**71**	**71**	1
R358-4	Multifamily	B	66	1	**71**	**71**	**71**	0
R358-5	Multifamily	B	66	1	**71**	**72**	**72**	1
R359	North Creek Trail	C	66	1	**69**	**69**	**69**	0
R360-2	Multifamily	B	66	2	60	61	61	1
R360-4	Multifamily	B	66	2	63	63	63	0
R361	North Creek Trail	C	66	1	**67**	**68**	**68**	1
R362	Baseball Field	C	66	2	63	63	63	0
R363	Day Care Center	C	66	2	61	61	61	0
R364	Office[a]	E	71	0	65	66	66	1
R365	Tennis Court/Pool	C	66	2	59	59	60	1
R366-1	Multifamily	B	66	2	61	61	61	0
R366-2	Multifamily	B	66	2	63	64	64	1
R366-3	Multifamily	B	66	2	65	**66**	**66**	1
R367-1	Multifamily	B	66	2	60	61	61	1
R367-2	Multifamily	B	66	2	64	64	64	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R367-3	Multifamily	B	66	2	**66**	**67**	**67**	1
R368-1	Multifamily	B	66	2	59	60	60	1
R368-2	Multifamily	B	66	2	63	63	63	0
R368-3	Multifamily	B	66	2	**66**	**67**	**67**	1
R369-1	Multifamily	B	66	2	61	61	61	0
R369-2	Multifamily	B	66	2	65	**66**	**66**	1
R369-3	Multifamily	B	66	2	**71**	**71**	**71**	0
R370-1	Multifamily	B	66	2	57	58	58	1
R370-2	Multifamily	B	66	2	58	59	59	1
R370-3	Multifamily	B	66	2	62	63	63	1
R371-1	Multifamily	B	66	2	61	61	61	0
R371-2	Multifamily	B	66	2	65	65	65	0
R371-3	Multifamily	B	66	2	**70**	**71**	**71**	1
R372-1	Multifamily	B	66	2	60	60	60	0
R372-2	Multifamily	B	66	2	63	63	63	0
R372-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R373-1	Multifamily	B	66	2	59	60	60	1
R373-2	Multifamily	B	66	2	62	63	63	1
R373-3	Multifamily	B	66	2	**67**	**67**	**67**	0
R374-1	Multifamily	B	66	2	59	59	60	1
R374-2	Multifamily	B	66	2	62	63	63	1
R374-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R375-1	Multifamily	B	66	2	61	62	62	1
R375-2	Multifamily	B	66	2	65	**66**	**66**	1
R375-3	Multifamily	B	66	2	**71**	**72**	**72**	1
R376-1	Multifamily	B	66	2	60	60	61	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R376-2	Multifamily	B	66	2	63	64	64	1
R376-3	Multifamily	B	66	2	**69**	**70**	**70**	1
R377-1	Multifamily	B	66	2	60	61	61	1
R377-2	Multifamily	B	66	2	63	64	64	1
R377-3	Multifamily	B	66	2	**69**	**69**	**69**	0
R378-1	Multifamily	B	66	2	57	57	57	0
R378-2	Multifamily	B	66	2	58	59	59	1
R378-3	Multifamily	B	66	2	62	62	63	1
R379-1	Multifamily	B	66	2	58	59	59	1
R379-2	Multifamily	B	66	2	60	61	61	1
R379-3	Multifamily	B	66	2	64	65	65	1
R380-1	Multifamily	B	66	2	62	62	62	0
R380-2	Multifamily	B	66	2	64	65	65	1
R380-3	Multifamily	B	66	2	**68**	**69**	**69**	1
R381-1	Multifamily	B	66	2	60	61	61	1
R381-2	Multifamily	B	66	2	63	63	63	0
R381-3	Multifamily	B	66	2	65	**66**	**66**	1
R382-1	Multifamily	B	66	2	62	63	63	1
R382-2	Multifamily	B	66	2	64	65	65	1
R382-3	Multifamily	B	66	2	**67**	**68**	**68**	1
R383-1	Multifamily	B	66	2	61	62	62	1
R383-2	Multifamily	B	66	2	63	64	64	1
R383-3	Multifamily	B	66	2	65	**66**	**66**	1
R384	Industrial	F	--	0	66	67	66	0
R385	Single-family	B	66	1	62	63	63	1
R386	Office[a]	E	71	0	64	64	62	-2

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R387	Single-family	B	66	1	**68**	**68**	**68**	0
R388	North Creek Trail	C	66	1	63	64	63	0
R389	Office[a]	E	71	0	65	66	64	-1
R390	Islamic Center of Bothell Playground	C	66	1	**67**	**68**	65	-2
R391	Churchome - Bothell	D	51	1	39	40	39	0
R392	Office[a]	E	71	0	63	64	63	0
R393	North Creek Trail	C	66	1	**66**	**68**	**67**	1
R394	Single-family	B	66	1	64	**66**	65	1
R395	North Creek Trail	C	66	1	**67**	**69**	**69**	2
R396	North Creek Trail	C	66	1	**67**	**69**	**68**	1
R397	Single-family	B	66	1	64	65	65	1
R398	North Creek Trail	C	66	1	**67**	**69**	**69**	2
R399	Single-family	B	66	1	62	63	62	0
R400	North Creek Trail	C	66	1	**67**	**69**	**68**	1
R401	Single-family	B	66	1	58	60	60	2
R402	Single-family	B	66	2	59	60	60	1
R403	North Creek Trail	C	66	1	**67**	**69**	**69**	2
R404	Single-family	B	66	2	57	58	58	1
R405	North Creek Trail	C	66	1	**68**	**69**	**69**	1
R406	Single-family	B	66	1	62	63	62	0
R407	North Creek Trail	C	66	1	**69**	**70**	**70**	1
R408	Single-family	B	66	1	**66**	**67**	**67**	1
R409	North Creek Trail	C	66	1	**69**	**71**	**71**	2
R410	Single-family	B	66	1	63	64	64	1
R411	Canyon Park Middle	C	66	3	62	63	62	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R412	Single-family	B	66	1	65	**66**	**66**	1
R413	North Creek Trail	C	66	1	**68**	**69**	**69**	1
R414	Single-family	B	66	1	**66**	**67**	**66**	0
R415	Single-family	B	66	1	62	63	63	1
R416	Single-family	B	66	2	54	55	54	0
R417	North Creek Trail	C	66	1	**68**	**70**	**69**	1
R418	Single-family	B	66	1	59	60	59	0
R419	North Creek Trail	C	66	1	**68**	**69**	**69**	1
R420	Single-family	B	66	1	63	64	64	1
R421	North Creek Trail	C	66	1	**67**	**68**	**68**	1
R422	Single-family	B	66	1	61	62	62	1
R423	Single-family	B	66	1	60	61	61	1
R424	Single-family	B	66	2	54	55	55	1
R425	Single-family	B	66	2	53	54	54	1
R426	Single-family	B	66	2	52	53	53	1
R427	Single-family	B	66	1	**69**	**70**	**70**	1
R428	Single-family	B	66	1	**69**	**70**	**70**	1
R429	Single-family	B	66	1	54	54	54	0
R430	Single-family	B	66	2	53	54	54	1
R431	Single-family	B	66	1	65	**66**	**66**	1
R432	Single-family	B	66	1	65	**66**	**66**	1
R433	Single-family	B	66	2	57	57	57	0
R434	Single-family	B	66	1	62	63	62	0
R435	Single-family	B	66	1	**70**	**70**	**71**	1
R436	Single-family	B	66	1	**67**	**68**	**67**	0
R437	Single-family	B	66	2	60	61	61	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R438	Single-family	B	66	1	**70**	**70**	**70**	0
R439	Single-family	B	66	1	**71**	**72**	**71**	0
R440	Single-family	B	66	2	61	61	61	0
R441	Single-family	B	66	2	58	59	59	1
R442	Single-family	B	66	1	61	62	62	1
R443	Single-family	B	66	2	61	62	62	1
R444	Single-family	B	66	1	**72**	**73**	**73**	1
R445	Single-family	B	66	1	57	58	58	1
R446	Single-family	B	66	1	61	61	62	1
R447	Single-family	B	66	1	59	60	60	1
R448	Single-family	B	66	1	63	64	64	1
R449	Single-family	B	66	1	**70**	**71**	**71**	1
R450	Single-family	B	66	1	59	60	60	1
R451	Single-family	B	66	1	**72**	**73**	**73**	1
R452	Single-family	B	66	1	62	63	63	1
R453	Single-family	B	66	1	60	61	61	1
R454	Single-family	B	66	1	**70**	**71**	**71**	1
R455	Single-family	B	66	1	**67**	**68**	**68**	1
R456	Single-family	B	66	1	65	**66**	**66**	1
R457	Single-family	B	66	1	62	62	62	0
R458	Single-family	B	66	1	63	64	63	0
R459	North Creek Trail	C	66	1	**66**	**68**	**68**	2
R460	Single-family	B	66	1	55	56	55	0
R461	Single-family	B	66	1	61	62	61	0
R462	Single-family	B	66	1	62	63	62	0
R463	North Creek Trail	C	66	1	**67**	**68**	**67**	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R464	Single-family	B	66	1	59	60	59	0
R465	Single-family	B	66	2	60	61	60	0
R466	Single-family	B	66	2	52	52	52	0
R467	Single-family	B	66	1	59	60	60	1
R468	Single-family	B	66	2	52	53	53	1
R469	North Creek Trail	C	66	1	**68**	**70**	**68**	0
R470	Single-family	B	66	1	65	**67**	**66**	1
R471	Single-family	B	66	2	57	58	57	0
R472	Single-family	B	66	2	55	56	55	0
R473	Single-family	B	66	1	58	59	59	1
R474	Single-family	B	66	3	51	52	52	1
R475	Single-family	B	66	1	57	59	59	2
R476	Single-family	B	66	2	58	59	59	1
R477	Single-family	B	66	1	58	59	59	1
R478	Single-family	B	66	2	54	56	55	1
R479	Single-family	B	66	1	63	64	63	0
R480	North Creek Trail	C	66	1	**67**	**69**	**68**	1
R481	Single-family	B	66	1	58	59	59	1
R482	Single-family	B	66	1	58	60	60	2
R483	Single-family	B	66	1	58	60	60	2
R484	Single-family	B	66	3	57	58	58	1
R485	Single-family	B	66	1	60	61	61	1
R486	North Creek Trail	C	66	1	**66**	**68**	**68**	2
R487	Single-family	B	66	2	58	60	60	2
R488	Single-family	B	66	3	59	61	61	2
R489	Multifamily	B	66	3	59	60	59	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R490	Multifamily	B	66	2	62	63	63	1
R491-1	Multifamily	B	66	2	59	61	61	2
R491-2	Multifamily	B	66	2	62	64	63	1
R491-3	Multifamily	B	66	2	63	65	64	1
R492	North Creek Trail	C	66	1	65	**67**	**67**	2
R493	Multifamily	B	66	2	58	59	59	1
R494-1	Multifamily	B	66	2	51	52	52	1
R494-2	Multifamily	B	66	2	54	55	55	1
R494-3	Multifamily	B	66	2	60	61	60	0
R495-1	Multifamily	B	66	2	58	60	60	2
R495-2	Multifamily	B	66	2	61	62	62	1
R495-3	Multifamily	B	66	2	62	63	63	1
R496	Multifamily	B	66	2	56	57	57	1
R497-1	Multifamily	B	66	2	51	52	52	1
R497-2	Multifamily	B	66	2	53	54	54	1
R497-3	Multifamily	B	66	2	58	58	58	0
R498-1	Multifamily	B	66	2	53	54	54	1
R498-2	Multifamily	B	66	2	59	59	59	0
R498-3	Multifamily	B	66	2	62	63	63	1
R499-1	Multifamily	B	66	2	53	54	55	2
R499-2	Multifamily	B	66	2	55	57	57	2
R499-3	Multifamily	B	66	2	57	58	58	1
R500-1	Multifamily	B	66	2	51	52	52	1
R500-2	Multifamily	B	66	2	55	56	56	1
R500-3	Multifamily	B	66	2	60	61	61	1
R501-1	Multifamily	B	66	2	58	58	58	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R501-2	Multifamily	B	66	2	61	62	62	1
R501-3	Multifamily	B	66	2	63	63	63	0
R502-1	Multifamily	B	66	2	56	57	56	0
R502-2	Multifamily	B	66	2	59	59	59	0
R502-3	Multifamily	B	66	2	60	61	61	1
R503-1	Multifamily	B	66	2	51	52	52	1
R503-2	Multifamily	B	66	2	52	54	54	2
R503-3	Multifamily	B	66	2	54	56	56	2
R504-1	Multifamily	B	66	2	54	55	55	1
R504-2	Multifamily	B	66	2	55	56	56	1
R504-3	Multifamily	B	66	2	58	58	58	0
R505-1	Multifamily	B	66	2	43	45	45	2
R505-2	Multifamily	B	66	2	46	48	48	2
R505-3	Multifamily	B	66	2	50	52	52	2
R506-1	Multifamily	B	66	2	44	45	45	1
R506-2	Multifamily	B	66	2	46	47	47	1
R506-3	Multifamily	B	66	2	48	50	50	2
R507-1	Multifamily	B	66	2	54	55	55	1
R507-2	Multifamily	B	66	2	57	57	57	0
R507-3	Multifamily	B	66	2	58	59	59	1
R508-1	Multifamily	B	66	2	44	46	46	2
R508-2	Multifamily	B	66	2	48	49	49	1
R508-3	Multifamily	B	66	2	52	53	53	1
R509-1	Multifamily	B	66	2	55	56	56	1
R509-2	Multifamily	B	66	2	57	58	58	1
R509-3	Multifamily	B	66	2	60	60	60	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R510-1	Multifamily	B	66	2	58	58	58	0
R510-2	Multifamily	B	66	2	59	60	60	1
R510-3	Multifamily	B	66	2	61	62	62	1
R511-1	Multifamily	B	66	2	46	47	47	1
R511-2	Multifamily	B	66	2	48	49	49	1
R511-3	Multifamily	B	66	2	52	53	53	1
R512-1	Multifamily	B	66	2	46	47	47	1
R512-2	Multifamily	B	66	2	47	49	49	2
R512-3	Multifamily	B	66	2	49	50	51	2
R513-1	Multifamily	B	66	2	44	45	45	1
R513-2	Multifamily	B	66	2	46	47	48	2
R513-3	Multifamily	B	66	2	51	52	52	1
R514-1	Multifamily	B	66	4	44	45	45	1
R514-2	Multifamily	B	66	4	43	45	45	2
R514-3	Multifamily	B	66	4	46	47	47	1
R515-1	Multifamily	B	66	2	47	48	48	1
R515-2	Multifamily	B	66	2	48	49	49	1
R515-3	Multifamily	B	66	2	50	50	51	1
R516-1	Multifamily	B	66	2	60	60	60	0
R516-2	Multifamily	B	66	2	61	62	62	1
R516-3	Multifamily	B	66	2	63	64	64	1
R517-1	Multifamily	B	66	2	42	43	43	1
R517-2	Multifamily	B	66	2	45	46	47	2
R517-3	Multifamily	B	66	2	49	50	51	2
R518-1	Multifamily	B	66	4	47	48	48	1
R518-2	Multifamily	B	66	4	48	49	49	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R518-3	Multifamily	B	66	4	50	51	51	1
R519-1	Multifamily	B	66	2	59	60	60	1
R519-2	Multifamily	B	66	2	61	62	62	1
R519-3	Multifamily	B	66	2	63	64	64	1
R520-1	Multifamily	B	66	2	42	43	44	2
R520-2	Multifamily	B	66	2	45	46	46	1
R520-3	Multifamily	B	66	2	48	49	49	1
R521-1	Multifamily	B	66	2	55	56	56	1
R521-2	Multifamily	B	66	2	57	57	58	1
R521-3	Multifamily	B	66	2	61	61	61	0
R522-1	Multifamily	B	66	2	53	54	54	1
R522-2	Multifamily	B	66	2	54	55	55	1
R522-3	Multifamily	B	66	2	56	57	57	1
R523-1	Multifamily	B	66	2	49	50	50	1
R523-2	Multifamily	B	66	2	50	51	51	1
R523-3	Multifamily	B	66	2	53	53	53	0
R524-1	Multifamily	B	66	2	48	49	49	1
R524-2	Multifamily	B	66	2	50	51	51	1
R524-3	Multifamily	B	66	2	52	53	53	1
R525-1	Multifamily	B	66	2	**67**	**68**	65	-2
R525-2	Multifamily	B	66	2	**69**	**70**	**69**	0
R525-3	Multifamily	B	66	2	**70**	**71**	**71**	1
R526-1	Multifamily	B	66	2	65	**66**	63	-2
R526-2	Multifamily	B	66	2	**68**	**68**	**66**	-2
R526-3	Multifamily	B	66	2	**68**	**69**	**68**	0
R527-1	Multifamily	B	66	2	62	63	62	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R527-2	Multifamily	B	66	2	65	**66**	63	-2
R527-3	Multifamily	B	66	2	**66**	**67**	65	-1
R528-1	Multifamily	B	66	2	62	62	61	-1
R528-2	Multifamily	B	66	2	64	65	62	-2
R528-3	Multifamily	B	66	2	**66**	**66**	64	-2
R529	Single-family	B	66	1	**69**	**69**	**69**	0
R530	Single-family	B	66	1	**67**	**68**	**68**	1
R531	Single-family	B	66	1	65	**66**	**66**	1
R532	Single-family	B	66	1	**71**	**72**	**71**	0
R533	Single-family	B	66	2	64	65	64	0
R534	Single-family	B	66	1	**72**	**73**	**73**	1
R535	Single-family	B	66	2	**70**	**71**	**71**	1
R536	Single-family	B	66	2	59	60	60	1
R537	Single-family	B	66	1	**75**	**75**	**75**	0
R538	Single-family	B	66	2	64	65	65	1
R539	Single-family	B	66	2	55	56	56	1
R540	Single-family	B	66	1	**75**	**75**	**75**	0
R541	Single-family	B	66	2	62	63	63	1
R542	Single-family	B	66	1	**69**	**70**	**69**	0
R543	Single-family	B	66	1	**74**	**75**	**74**	0
R544	Single-family	B	66	1	63	64	63	0
R545	Single-family	B	66	2	58	59	59	1
R546	Single-family	B	66	1	**66**	**67**	**66**	0
R547	Single-family	B	66	1	**70**	**70**	**69**	-1
R548	Single-family	B	66	2	61	62	61	0
R549	Single-family	B	66	1	**67**	**68**	**66**	-1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R550	Single-family	B	66	2	58	59	58	0
R551	Single-family	B	66	1	65	**66**	65	0
R552	Single-family	B	66	1	64	64	64	0
R553	Single-family	B	66	2	60	61	60	0
R554	Single-family	B	66	1	62	62	62	0
R555	Single-family	B	66	2	59	60	60	1
R556	Single-family	B	66	1	63	64	63	0
R557	Single-family	B	66	1	64	64	64	0
R558	Single-family	B	66	1	63	64	64	1
R559	Single-family	B	66	1	**66**	**67**	**66**	0
R560	Playground	C	66	2	**70**	**71**	**71**	1
R561	Multifamily	B	66	1	**69**	**70**	**70**	1
R562	Multifamily	B	66	1	**70**	**70**	**71**	1
R563	Multifamily	B	66	1	**72**	**72**	**72**	0
R564	Multifamily	B	66	1	60	61	60	0
R565	Multifamily	B	66	1	61	62	62	1
R566	Multifamily	B	66	1	65	**66**	**66**	1
R567-1	Multifamily	B	66	2	60	61	60	0
R567-2	Multifamily	B	66	2	62	63	62	0
R567-3	Multifamily	B	66	2	64	65	64	0
R568-1	Multifamily	B	66	2	53	54	54	1
R568-2	Multifamily	B	66	2	55	56	55	0
R569-1	Multifamily	B	66	2	64	65	65	1
R569-2	Multifamily	B	66	2	**67**	**68**	**68**	1
R569-3	Multifamily	B	66	2	**68**	**69**	**69**	1
R570-1	Multifamily	B	66	2	64	65	65	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R570-2	Multifamily	B	66	2	**67**	**67**	**67**	0
R570-3	Multifamily	B	66	2	**68**	**68**	**68**	0
R571	Industrial	F	--	0	74	75	73	-1
R572	Day Care Center	C	66	2	**72**	**73**	**71**	-1
R573	Day Care Center	C	66	2	**72**	**72**	**71**	-1
R574	Single-family	B	66	1	65	**66**	**66**	1
R575	Single-family	B	66	1	**66**	**67**	**66**	0
R576	Multifamily	B	66	2	64	**66**	**66**	2
R577	Multifamily	B	66	3	**66**	**67**	63	-3
R578	Multifamily	B	66	3	**66**	**67**	65	-1
R579	Multifamily	B	66	2	**71**	**72**	**68**	-3
R580	Multifamily	B	66	2	**72**	**73**	**69**	-3
R581-1	Multifamily	B	66	1	57	58	60	3
R581-2	Multifamily	B	66	1	59	60	63	4
R581-3	Multifamily	B	66	1	60	61	63	3
R582-1	Multifamily	B	66	1	65	**66**	**67**	2
R582-2	Multifamily	B	66	1	**67**	**68**	**68**	1
R582-3	Multifamily	B	66	1	**68**	**69**	**69**	1
R583-1	Multifamily	B	66	1	52	54	56	4
R583-2	Multifamily	B	66	1	55	57	59	4
R583-3	Multifamily	B	66	1	57	58	60	3
R584-1	Multifamily	B	66	1	50	52	54	4
R584-2	Multifamily	B	66	1	54	56	58	4
R584-3	Multifamily	B	66	1	56	57	59	3
R585-1	Multifamily	B	66	1	65	**66**	65	0
R585-2	Multifamily	B	66	1	**67**	**68**	**67**	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R585-3	Multifamily	B	66	1	**68**	**69**	**68**	0
R586-1	Multifamily	B	66	1	49	50	50	1
R586-2	Multifamily	B	66	1	51	52	53	2
R586-3	Multifamily	B	66	1	57	58	58	1
R587-1	Multifamily	B	66	1	48	49	50	2
R587-2	Multifamily	B	66	1	51	52	53	2
R587-3	Multifamily	B	66	1	58	59	59	1
R588-1	Multifamily	B	66	1	58	59	55	-3
R588-2	Multifamily	B	66	1	59	60	57	-2
R588-3	Multifamily	B	66	1	61	62	61	0
R589-1	Multifamily	B	66	1	58	59	59	1
R589-2	Multifamily	B	66	1	62	63	64	2
R589-3	Multifamily	B	66	1	64	65	65	1
R590-1	Multifamily	B	66	1	55	57	57	2
R590-2	Multifamily	B	66	1	59	60	61	2
R590-3	Multifamily	B	66	1	62	63	62	0
R591-1	Multifamily	B	66	1	55	55	55	0
R591-2	Multifamily	B	66	1	58	59	59	1
R591-3	Multifamily	B	66	1	61	62	61	0
R592-1	Multifamily	B	66	1	54	55	55	1
R592-2	Multifamily	B	66	1	56	57	58	2
R592-3	Multifamily	B	66	1	60	60	60	0
R593-1	Multifamily	B	66	1	62	63	61	-1
R593-2	Multifamily	B	66	1	65	**66**	63	-2
R593-3	Multifamily	B	66	1	**67**	**68**	65	-2
R594-1	Multifamily	B	66	1	61	62	60	-1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R594-2	Multifamily	B	66	1	63	64	62	-1
R594-3	Multifamily	B	66	1	65	**66**	64	-1
R595-1	Multifamily	B	66	1	**70**	**71**	**70**	0
R595-2	Multifamily	B	66	1	**72**	**73**	**71**	-1
R595-3	Multifamily	B	66	1	**74**	**75**	**73**	-1
R596-1	Multifamily	B	66	1	51	53	54	3
R596-2	Multifamily	B	66	1	56	57	59	3
R596-3	Multifamily	B	66	1	59	60	61	2
R597-1	Multifamily	B	66	1	56	57	56	0
R597-2	Multifamily	B	66	1	58	59	59	1
R597-3	Multifamily	B	66	1	62	63	62	0
R598-1	Multifamily	B	66	1	**70**	**71**	**68**	-2
R598-2	Multifamily	B	66	1	**71**	**72**	**70**	-1
R598-3	Multifamily	B	66	1	**74**	**75**	**72**	-2
R599-1	Multifamily	B	66	1	**68**	**69**	**67**	-1
R599-2	Multifamily	B	66	1	**70**	**71**	**69**	-1
R599-3	Multifamily	B	66	1	**73**	**74**	**71**	-2
R600-1	Multifamily	B	66	1	**67**	**68**	**66**	-1
R600-2	Multifamily	B	66	1	**69**	**70**	**68**	-1
R600-3	Multifamily	B	66	1	**71**	**72**	**70**	-1
R601-1	Multifamily	B	66	1	58	59	59	1
R601-2	Multifamily	B	66	1	62	63	62	0
R601-3	Multifamily	B	66	1	64	65	64	0
R602-1	Multifamily	B	66	1	57	58	58	1
R602-2	Multifamily	B	66	1	60	61	61	1
R602-3	Multifamily	B	66	1	62	63	63	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R603-1	Multifamily	B	66	1	53	54	54	1
R603-2	Multifamily	B	66	1	55	56	56	1
R603-3	Multifamily	B	66	1	59	60	59	0
R604-1	Multifamily	B	66	1	54	54	54	0
R604-2	Multifamily	B	66	1	56	56	56	0
R604-3	Multifamily	B	66	1	60	61	60	0
R605-1	Multifamily	B	66	1	63	64	63	0
R605-2	Multifamily	B	66	1	**66**	**67**	65	-1
R605-3	Multifamily	B	66	1	**67**	**68**	**66**	-1
R606-1	Multifamily	B	66	1	63	64	63	0
R606-2	Multifamily	B	66	1	65	**66**	65	0
R606-3	Multifamily	B	66	1	**67**	**68**	**66**	-1
R607-1	Multifamily	B	66	1	63	63	62	-1
R607-2	Multifamily	B	66	1	65	**66**	65	0
R607-3	Multifamily	B	66	1	**66**	**67**	**66**	0
R608-1	Multifamily	B	66	1	51	52	56	5
R608-2	Multifamily	B	66	1	54	55	60	6
R608-3	Multifamily	B	66	1	57	58	61	4
R609-1	Multifamily	B	66	1	50	51	55	5
R609-2	Multifamily	B	66	1	54	54	58	4
R609-3	Multifamily	B	66	1	56	57	60	4
R610-1	Multifamily	B	66	1	56	57	55	-1
R610-2	Multifamily	B	66	1	57	58	57	0
R610-3	Multifamily	B	66	1	60	61	59	-1
R611	Single-family	B	66	1	**67**	**68**	**66**	-1
R612	Single-family	B	66	1	62	63	63	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R613	Single-family	B	66	1	61	62	61	0
R614	Single-family	B	66	1	62	63	62	0
R615	Single-family	B	66	1	62	62	63	1
R616	Single-family	B	66	1	60	61	62	2
R617	Single-family	B	66	2	59	59	60	1
R618	Single-family	B	66	2	60	61	62	2
R619	Single-family	B	66	1	61	61	63	2
R620	Single-family	B	66	1	61	61	64	3
R621	Single-family	B	66	1	61	62	**66**	5
R622	Single-family	B	66	2	57	58	61	4
R623	Single-family	B	66	1	61	62	**67**	6
R624	Single-family	B	66	2	59	59	62	3
R625	Single-family	B	66	1	61	62	**68**	7
R626	Single-family	B	66	3	57	57	61	4
R627	Single-family	B	66	1	61	62	**68**	7
R628	Single-family	B	66	1	61	61	**67**	6
R629	Single-family	B	66	2	59	60	63	4
R630	Single-family	B	66	1	60	61	**66**	6
R631	Single-family	B	66	1	60	61	65	5
R632	Single-family	B	66	2	59	59	62	3
R633	Single-family	B	66	3	58	59	61	3
R634	Single-family	B	66	1	60	61	65	5
R635	Single-family	B	66	2	56	57	61	5
R636	Single-family	B	66	3	57	58	59	2
R637	Single-family	B	66	1	58	59	63	5
R638	Single-family	B	66	1	58	59	61	3

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R639	Single-family	B	66	2	56	56	59	3
R640	Single-family	B	66	1	56	57	60	4
R641	Single-family	B	66	1	56	57	59	3
R642	Single-family	B	66	2	55	56	57	2
R643	Single-family	B	66	2	57	58	58	1
R644	Single-family	B	66	1	56	56	59	3
R645	Single-family	B	66	1	55	56	59	4
R646	Single-family	B	66	1	55	56	58	3
R647	Single-family	B	66	1	55	56	58	3
R648	Single-family	B	66	1	55	56	58	3
R649	Single-family	B	66	1	55	55	57	2
R650	Single-family	B	66	1	54	55	56	2
R651	Commercial	E	71	1	56	57	58	2
R652	Office[a]	E	71	0	62	63	64	2
R653	Hotel	E	71	1	58	59	59	1
R654	Commercial	E	71	5	64	65	65	1
R655	Commercial	E	71	4	53	54	55	2
R656	Commercial	E	71	3	57	59	61	4
R657	Canyon Hills	C	66	4	58	59	61	3
R658	Office	E	71	3	55	56	56	1
R659	Office[a]	E	71	0	66	67	67	1
R660	Office[a]	E	71	0	58	59	59	1
R661	Fire Department	F	--	0	65	66	66	1
R662	Multifamily	C	66	2	65	**66**	**66**	1
R663	Commercial	E	71	3	66	66	67	1
R664	Commercial[a]	E	71	0	66	67	67	1

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R665	Hotel	E	71	1	**71**	**72**	**72**	1
R666	Single-family	B	66	2	64	65	65	1
R667	Single-family	B	66	2	64	65	65	1
R668	Single-family	B	66	1	**71**	**71**	**71**	0
R669	Single-family	B	66	3	65	**66**	**66**	1
R670	Single-family	B	66	1	**69**	**70**	**70**	1
R671	Single-family	B	66	1	65	65	65	0
R672	Single-family	B	66	1	**68**	**68**	**68**	0
R673	Single-family	B	66	2	64	65	65	1
R674	Single-family	B	66	1	**67**	**68**	**67**	0
R675	Single-family	B	66	2	65	65	65	0
R676	Single-family	B	66	1	**66**	**66**	**66**	0
R677	Single-family	B	66	3	63	63	63	0
R678	Single-family	B	66	1	**70**	**71**	**71**	1
R679	Single-family	B	66	1	65	65	65	0
R680	Single-family	B	66	1	**70**	**71**	**70**	0
R681	Single-family	B	66	2	63	64	64	1
R682	Single-family	B	66	1	**69**	**70**	**70**	1
R683	Single-family	B	66	1	**69**	**70**	**70**	1
R684	Single-family	B	66	1	**68**	**69**	**68**	0
R685	Single-family	B	66	1	63	63	62	-1
R686	Single-family	B	66	1	64	65	64	0
R687	Single-family	B	66	1	64	65	64	0
R688	Single-family	B	66	1	**67**	**68**	**68**	1
R689	Single-family	B	66	1	**68**	**68**	**68**	0
R690	Single-family	B	66	1	**69**	**70**	**69**	0

Exhibit 5-2. Modeled Noise Results

Receiver #	Land Use	FHWA Category	NAC (Leq) (dBA)	Dwelling or RE Units	Existing (2018) Leq (dBA)	No Build Alternative (2045) Leq (dBA)	Build Alternative (2045) Leq (dBA)	Difference Build Alternative (2045)– Existing (2018) (dBA)
R691	Single-family	B	66	1	**71**	**72**	**72**	1
R692	Single-family	B	66	2	**68**	**68**	**68**	0

dBA = A-weighted decibels; dB = decibels; FHWA = Federal Highway Administration; NAC = Noise Abatement Criteria; RE = residential equivalency

Bold numbers represent noise levels at or above FHWA and WSDOT NAC levels.

Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

a Receiver does not have an outdoor use area; therefore, it represents 0 units and would not be considered affected for this analysis. These receivers were modeled to provide additional information on predicted traffic noise levels with the Project.

b Receiver would be acquired with the Project.

5.2 Traffic Noise Abatement

Noise abatement is considered only where there is (1) an expected noise level that approaches (within 1 dB) or exceeds the FHWA NAC (66 dBA or higher for Categories B and C, 52 dBA and higher for Category D, and 71 dBA or higher for Category E) in the design year Build Alternative, and (2) an increase of 10 dBA over existing conditions. Noise levels can be reduced by the following types of abatement:

- Traffic management, such as restrictions on the types of vehicles and the time they may use a certain roadway.
- Change in vertical or horizontal alignment of the roadway.
- Property acquisition.
- Construction of noise barriers, such as noise walls.

Reduced speeds would not be effective abatement because a substantial decrease in speed is necessary to provide a significant noise reduction. A 10 mph reduction in speed would result in only a 2 decibel decrease in noise level. Restricting truck usage on I-405 is not practical as truck traffic is a primary function of this interstate highway, and diversion of truck traffic to other roadways would increase noise levels in those areas. Design criteria, project limits, and the existing alignment and land uses preclude substantial horizontal and vertical alignment shifts that could potentially produce noticeable changes in the projected acoustical environment, and cost restrictions typically limit property acquisition. Therefore, noise barriers were the only abatement considered for the Project.

Abatement was considered for the traffic noise impacts related to the Project because an impact was identified at 180 Category B, 40 Category C and 1 Category E receivers (representing 246 Category B residences, 46 Category C RE units, and 1 Category E RE unit). There were no substantial noise increases between existing conditions and the Build Alternative.

5.2.1 Noise Abatement Criteria

Abatement must be both feasible and reasonable for it to be recommended for construction.

Feasibility

Feasibility is a combination of acoustic and engineering considerations. WSDOT evaluates many factors to determine whether noise walls would be feasible. All of the following must occur for abatement (e.g., noise wall) to be considered feasible:

- Abatement must be physically constructible.
- The majority of first-row impacted receivers (closest to the roadway) must obtain a minimum 5 dBA of noise reduction with abatement (insertion loss), thus, ensuring that every reasonable effort will be made to assess outdoor use areas as appropriate.

Reasonableness

When noise abatement is determined feasible, the reasonableness of the abatement is then evaluated. WSDOT constructs noise walls, or other types of abatement, if the noise walls have been determined reasonable after thoroughly evaluating the criteria. The reasonableness criteria of a noise barrier depend on the noise level at the sensitive receivers that would benefit from the barrier. To be reasonable, the proposed wall must be cost effective and it must also meet the design goal for noise reduction. The noise barrier area may not exceed the sum of the total allowed area per household, for all households that would benefit by at least 5 dBA, and 7 dBA at one location, as a result of the barrier. The allowed area per household is a function of the predicted future noise level during the loudest hour. For receivers other than single-family residences, WSDOT calculates Residential Equivalency (see section below).

Cost Effectiveness

The cost of noise abatement sufficient to provide at least the minimum feasible noise reductions must be equal to or less than the allowable cost of abatement for each noise wall location analyzed. Based on noise wall costs from 2007 to 2010, the current average cost in Washington is $51.61 per square foot. The cost is applied to the allowed wall surface area (square feet) to generate the allowable cost per qualified resident, as described in Exhibit 5-3.

Either wall surface area (in square footage) or cost can be used to evaluate cost effectiveness, unless costs for the wall exceed the cost of a standard design noise wall; then cost must be used to compare the wall cost to the allowable cost.

WSDOT evaluated standard noise wall designs and used the surface area associated with each noise wall to describe the cost effectiveness for all noise walls except one where costs exceed the cost of a standard design noise wall (Wall East 6). Exhibit 5-3 presents the allowable surface area and cost per receiver, based on Build Alternative traffic noise levels. The same reasonableness value that is applied to receivers with Build Alternative noise levels of 66 dBA is applied to benefited receivers below the NAC in the Build Alternative.

Exhibit 5-3. Reasonableness Allowances for Noise Walls

Column A	Column B	Column C	Column D
Design Year Traffic Sound Decibel Level (dBA)	Noise Level Increase Because of a Transportation Project (dBA)[a]	Allowed Wall Surface Area per Qualified Residence or Residential Equivalent (square feet)	Allowed Cost per Qualified Residence or Residential Equivalent[b] ($)
66		700	36,127
67		768	39,636
68		836	43,146
69		904	46,655
70		972	50,165
71	10 (substantial, step 1)[c]	1040	53,674
72	11 (substantial, step 1)	1108	57,184
73	12 (substantial, step 1)	1176	60,693
74	13 (substantial, step 1)	1244	64,203
75	14 (substantial, step 1)	1312	67,712
76	15 (substantial, step 2)[d]	1380	71,222

dBA = A-weighted decibels

[a] If the noise level increases 10 dBA or more as the result of a project (Column B), follow the allowed wall surface and cost for the level of increase in Columns C and D, respectively, in lieu of the total design year sound decibel level in Column A. For total highway-related sound levels at 76 or more dBA or if the project results in an increase of 15 or more decibels, continue increasing the allowance at the rate provided herein unless circumstances determined on a case-by-case basis require a methodology for determining the allowance.

[b] Current costs are based on $51.61 per square foot constructed cost developed in 2011.

[c] Step 1 – when the noise levels are 10 to 14 dBA over future No Build Alternative traffic noise as a result of a transportation project.

[d] Step 2 – when the noise levels are 15 or more dBA over existing traffic noise because of the transportation project (or total highway-related noise levels are between 76 and 79 decibels). Additional consideration for abatement may be considered under these circumstances.

Design Goal Achievement

The design goal for abatement on all transportation projects for reasonableness is at least 7 dBA of reduction for at least one receiver. Noise walls cannot be recommended if they do not achieve the design goal. In addition to the design goal requirement, WSDOT makes a reasonable effort to get 10 dBA or greater noise reduction at the first row of receivers for all projects where abatement is recommended.

The reasonableness evaluation exhibits in this report describe the allowable surface area or cost per receiver for the barrier size that achieves the design goal.

Desire for Abatement from Public

Public involvement must occur when traffic noise abatement is recommended for Type 1 projects, even when public involvement is not required as part of the National Environmental Policy Act (NEPA) or State Environmental Policy Act (SEPA) processes. Public opinion must be considered when making a determination of reasonableness for traffic noise abatement. Noise

abatement will not be planned if more than 50 percent of eligible property owners oppose the proposed noise abatement.

Residential Equivalency

WSDOT calculates reasonableness based on the number of residences that benefit from a noise wall. For noise-sensitive uses other than residences, an RE of the users is calculated based on the usage factor and number of users, according to WSDOT's *Traffic Noise Policy and Procedures* (WSDOT 2011). Residences are assumed to be in use at all times, but many other facilities, such as schools, have specific hours of operation. The usage factor accounts for the times of operation (Attachment C, Residential Equivalency, shows typical usage factors). In Washington, the average household has 2.55 members, so for sites other than residential, the usage factor is multiplied by the number of users and then divided by 2.55 to convert to an equivalent number of households (Census 2017). Attachment C, Residential Equivalency, presents the RE for receivers in the noise study area that include sensitive uses (other than single-family and multifamily residences) that approached or exceeded the NAC.

5.3 Noise Wall Analysis

5.3.1 Proposed Noise Walls

WSDOT evaluated noise walls at 17 different locations to determine whether abatement could sufficiently reduce traffic noise levels. Three of the 17 locations were found to be feasible and reasonable. Wall East 2 would be located along the northbound I-405 off-ramp to NE 160th Street. Wall East 6 would be located along northbound I-405 on either side of 228th Street SE. Wall West 7 would be located on the west side of southbound I-405, north of SR 527 near 9th Avenue SE. Noise wall abatement was evaluated at every location where noise levels were predicted to approach or to exceed the NAC. Each location is presented from south to north and is identified by which side of I-405 it is located. Noise wall heights on roadway bridge structures were limited to 8 feet to account for feasibility considerations related to bridge maintenance needs. This section summarizes the feasibility and reasonableness of each proposed noise wall.

1. Wall East 1 (Feasible, Not Reasonable)

Wall East 1 was evaluated along the WSDOT right of way along northbound I-405 because traffic noise impacts are predicted at three active outdoor use areas in the High Woodlands private neighborhood park. Build Alternative noise levels at these receivers would range between 70 and 72 dBA without a wall (Exhibit 5-4).

Exhibit 5-4. Wall East 1 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R59	**70**	65	Yes	*5*	100%
R60	**72**	65	Yes	*7*	
R61	**70**	65	No	*5*	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 1 would have an area of 26,026 square feet at a length of 1,201 feet ranging in height from 18 to 22 feet. The noise reduction would range from 5 to 7 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-5, the allowable area of Wall East 1 would be 4,024 square feet, which is less than the 26,026 square foot wall needed to meet minimum design goals. Therefore, Wall East 1 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-5. Wall East 1 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R59	2	**69**	**70**	972	1,944	4,024	26,026	*5*
R60	1	**71**	**72**	972	972			*7*
R61	1	**68**	**70**	1,108	1,108			*5*
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

2. Wall East 2 (Feasible and Reasonable)

Wall East 2 was evaluated along the WSDOT right of way along northbound I-405 because traffic noise impacts are predicted at upper floor balconies at Verdeaux condominium. Build Alternative noise levels at receivers behind the noise wall would range between 46 and 71 dBA without a wall (Exhibit 5-6).

Exhibit 5-6. Wall East 2 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R135-1	63	58	No	*5*	
R135-2	**66**	61	Yes	*5*	
R135-3	**68**	**67**	No	1	
R135-4	**71**	**71**	No	0	
R136-1	59	54	No	*5*	
R136-2	63	56	No	*7*	
R136-3	65	61	No	4	
R136-4	**67**	**66**	No	1	
R137-1	57	51	No	*6*	
R137-2	60	53	No	*7*	
R137-3	62	55	No	*7*	
R137-4	63	59	No	4	
R138-1	65	58	No	*7*	
R138-2	**68**	61	Yes	*7*	
R138-3	**69**	**67**	No	2	
R138-4	**70**	**70**	No	0	100%
R139-1	59	55	No	4	
R139-2	64	57	No	*7*	
R139-3	65	60	No	*5*	
R139-4	**67**	65	No	2	
R140-1	57	53	No	4	
R140-2	61	55	No	*6*	
R140-3	63	57	No	*6*	
R140-4	64	61	No	3	
R141-1	65	58	No	*7*	
R141-2	**67**	61	Yes	*6*	
R141-3	**69**	**67**	No	2	
R141-4	**70**	**69**	No	1	
R142-1	60	51	No	*9*	
R142-2	63	54	No	*9*	
R142-3	64	60	No	4	
R142-4	64	64	No	0	

Exhibit 5-6. Wall East 2 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R143-1	46	46	No	0	100%
R143-2	49	49	No	0	
R143-3	51	51	No	0	
R143-4	53	53	No	0	
R144-1	65	58	No	*7*	
R144-2	**67**	62	Yes	5	
R144-3	**68**	**67**	No	1	
R144-4	**69**	**69**	No	0	
R145-1	64	57	No	*7*	
R145-2	65	58	Yes	*7*	
R145-3	**66**	60	No	*6*	
R145-4	**67**	65	No	2	
R146-1	59	54	No	*5*	
R146-2	61	58	No	3	
R146-3	62	61	No	1	
R146-4	63	63	No	0	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall East 2 would have an area of 9,507 square feet at 528 feet long and 18 feet high. The noise reduction would range from 0 to 9 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-7, the allowable area of Wall East 2 would be 29,244 square feet, which is more than the 9,507-square-foot wall needed to meet minimum design goals. Therefore, Wall East 2 would meet WSDOT's reasonableness requirement and is recommended for construction.

Exhibit 5-7. Wall East 2 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R135-1	2	62	63	700	1,400			*5*
R135-2	2	65	**66**	700	1,400			*5*
R135-3	2	**67**	**68**	0	0			1
R135-4	2	**70**	**71**	0	0			0
R136-1	1	58	59	700	700			*5*
R136-2	1	62	63	700	700			*7*
R136-3	1	64	65	0	0			4
R136-4	1	**66**	**67**	0	0			1
R137-1	2	56	57	700	1,400			*6*
R137-2	2	59	60	700	1,400			*7*
R137-3	2	61	62	700	1,400			*7*
R137-4	2	62	63	0	0			4
R138-1	2	64	65	700	1,400			*7*
R138-2	2	**67**	**68**	836	1,672			*7*
R138-3	2	**68**	**69**	0	0	29,244	9,507	2
R138-4	2	**69**	**70**	0	0			0
R139-1	1	59	59	0	0			4
R139-2	1	63	64	700	700			*7*
R139-3	1	64	65	700	700			*5*
R139-4	1	**66**	**67**	0	0			2
R140-1	2	56	57	0	0			4
R140-2	2	60	61	700	1,400			*6*
R140-3	2	62	63	700	1,400			*6*
R140-4	2	64	64	0	0			3
R141-1	2	64	65	700	1,400			*7*
R141-2	2	**67**	**67**	768	1,536			*6*
R141-3	2	**68**	**69**	0	0			2
R141-4	2	**69**	**70**	0	0			1
R142-1	2	59	60	700	1,400			*9*

Exhibit 5-7. Wall East 2 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft²)	Area per Modeled Receiver (ft²)	Total Allowable Wall Area (ft²)	Total Wall Area (ft²)	Insertion Loss (dBA)
R142-2	2	62	63	700	1,400			*9*
R142-3	2	62	64	0	0			4
R142-4	2	63	64	0	0			0
R143-1	4	46	46	0	0			0
R143-2	4	48	49	0	0			0
R143-3	4	50	51	0	0			0
R143-4	4	52	53	0	0			0
R144-1	2	64	65	700	1,400			*7*
R144-2	2	**66**	**67**	768	1,536			*5*
R144-3	2	**67**	**68**	0	0	29,244	9,507	1
R144-4	2	**68**	**69**	0	0			0
R145-1	2	62	64	700	1,400			*7*
R145-2	2	64	65	700	1,400			*7*
R145-3	2	65	**66**	700	1,400			*6*
R145-4	2	**66**	**67**	0	0			2
R146-1	1	58	59	700	700			*5*
R146-2	1	60	61	0	0			3
R146-3	1	61	62	0	0			1
R146-4	1	62	63	0	0			0
						Design Goal Achieved?	Yes	
						Cost Effective?	Yes	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

3. Wall West 1 (Feasible, Not Reasonable)

Wall West 1 was evaluated along the WSDOT right of way and shoulder along southbound I-405 because traffic noise impacts are predicted at balconies at multifamily residential buildings and outdoor use areas at Cedar Park Christian School. Build Alternative noise levels at receivers behind the noise wall would range between 38 and 75 dBA without a wall (Exhibit 5-8).

Exhibit 5-8. Wall West 1 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R154-1	63	57	No	*6*	
R154-2	**67**	61	Yes	*6*	
R155-1	47	47	No	0	
R155-2	49	49	No	0	
R155-3	51	51	No	0	
R156-1	52	49	No	3	
R156-2	53	51	No	2	
R157-1	49	47	No	2	
R157-2	50	47	No	3	
R158-1	49	48	No	1	
R158-2	49	48	No	1	
R158-3	52	51	No	1	
R159-1	47	47	No	0	
R159-2	49	49	No	0	
R159-3	50	50	No	0	
R160-1	51	47	No	4	
R160-2	54	50	No	4	100%
R161-1	40	40	No	0	
R161-2	43	43	No	0	
R161-3	46	46	No	0	
R162-1	49	48	No	1	
R162-2	50	49	No	1	
R162-3	52	51	No	1	
R163-1	53	49	No	4	
R163-2	55	51	No	4	
R164-1	49	46	No	3	
R164-2	49	46	No	3	
R165-1	38	38	No	0	
R165-2	42	42	No	0	
R165-3	46	46	No	0	
R166-1	56	51	No	*5*	
R166-2	59	53	No	*6*	

Exhibit 5-8. Wall West 1 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R167-1	57	50	No	*7*	
R167-2	59	53	No	*6*	
R167-3	62	55	No	*7*	
R168-1	44	44	No	0	
R168-2	47	46	No	1	
R168-3	49	48	No	1	
R169-1	51	49	No	2	
R169-2	51	49	No	2	
R169-3	54	51	No	3	
R170-1	42	42	No	0	
R170-2	46	46	No	0	
R170-3	48	48	No	0	
R171-1	43	42	No	1	
R171-2	47	46	No	1	
R171-3	49	48	No	1	100%
R172-1	65	58	No	*7*	
R172-2	**71**	61	Yes	*10*	
R173-1	46	45	No	1	
R173-2	47	46	No	1	
R173-3	49	48	No	1	
R174-1	**67**	58	No	*9*	
R174-2	**72**	62	Yes	*10*	
R174-3	**75**	65	No	*10*	
R175-1	51	47	No	4	
R175-2	53	50	No	3	
R175-3	56	53	No	3	
R209	49	35	Yes	*14*	
R210	**73**	60	Yes	*13*	
R211	**67**	62	Yes	*5*	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall West 1 would have an area of 42,192 square feet at a length of 1,624 feet and a height of 26 feet. The noise reduction would range from 0 to 14 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-9, the allowable area of Wall West 1 would be 23,204 square feet, which is less than the 42,192-square-foot wall needed to meet minimum design goals. Therefore, Wall West 1 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-9. Wall West 1 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R154-1	2	62	63	700	1400			*6*
R154-2	2	**67**	**67**	768	1536			*6*
R155-1	3	47	47	0	0			0
R155-2	3	49	49	0	0			0
R155-3	3	51	51	0	0			0
R156-1	2	51	52	0	0			3
R156-2	2	53	53	0	0			2
R157-1	2	48	49	0	0			2
R157-2	2	49	50	0	0			3
R158-1	2	49	49	0	0			1
R158-2	2	49	49	0	0			1
R158-3	2	51	52	0	0	23,204	42,192	1
R159-1	3	46	47	0	0			0
R159-2	3	49	49	0	0			0
R159-3	3	50	50	0	0			0
R160-1	2	50	51	0	0			4
R160-2	2	54	54	0	0			4
R161-1	3	39	40	0	0			0
R161-2	3	43	43	0	0			0
R161-3	3	46	46	0	0			0
R162-1	2	49	49	0	0			1
R162-2	2	49	50	0	0			1
R162-3	2	51	52	0	0			1

Exhibit 5-9. Wall West 1 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R163-1	2	52	53	0	0			4
R163-2	2	54	55	0	0			4
R164-1	2	48	49	0	0			3
R164-2	2	48	49	0	0			3
R165-1	3	37	38	0	0			0
R165-2	3	41	42	0	0			0
R165-3	3	45	46	0	0			0
R166-1	2	54	56	700	1400			*5*
R166-2	2	57	59	700	1400			*6*
R167-1	2	56	57	700	1400			*7*
R167-2	2	58	59	700	1400			*6*
R167-3	2	62	62	700	1400			*7*
R168-1	2	44	44	0	0			0
R168-2	2	46	47	0	0			1
R168-3	2	48	49	0	0	23,204	42,192	1
R169-1	2	50	51	0	0			2
R169-2	2	50	51	0	0			2
R169-3	2	53	54	0	0			3
R170-1	2	42	42	0	0			0
R170-2	2	45	46	0	0			0
R170-3	2	47	48	0	0			0
R171-1	2	42	43	0	0			1
R171-2	2	46	47	0	0			1
R171-3	2	48	49	0	0			1
R172-1	2	63	65	700	1400			*7*
R172-2	2	**70**	**71**	1040	2080			*10*
R173-1	2	46	46	0	0			1
R173-2	2	46	47	0	0			1
R173-3	2	48	49	0	0			1

Exhibit 5-9. Wall West 1 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft²)	Area per Modeled Receiver (ft²)	Total Allowable Wall Area (ft²)	Total Wall Area (ft²)	Insertion Loss (dBA)
R174-1	2	**66**	**67**	768	1536	23,204	42,192	*9*
R174-2	2	**71**	**72**	1108	2216			*10*
R174-3	2	**74**	**75**	1312	2624			*10*
R175-1	2	50	51	0	0			4
R175-2	2	53	53	0	0			3
R175-3	2	55	56	0	0			3
R209	1	47	49	700	700			*14*
R210	1	**70**	**73**	1176	1176			*13*
R211	2	65	**67**	768	1536			*5*
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq} = equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

4. Wall East 3a (Feasible, Not Reasonable)

Wall East 3a was evaluated along the WSDOT right of way along northbound I-405 because traffic noise impacts are predicted at single-family homes. For Wall East 3a, Build Alternative noise levels at receivers behind the noise wall would range between 56 and 72 dBA without a wall (Exhibit 5-10).

Exhibit 5-10. Wall East 3a Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R212	58	55	No	3	100%
R213	60	56	Yes	4	
R214	**66**	61	Yes	*5*	
R215	**66**	61	Yes	*5*	
R216	65	59	No	*6*	
R217	**67**	61	Yes	*6*	
R218	**69**	63	Yes	*6*	
R219	**69**	62	Yes	*7*	
R220	**68**	61	Yes	*7*	
R221	65	58	No	*7*	
R222	**67**	62	Yes	*5*	
R223	**68**	62	Yes	*6*	
R224	**67**	62	Yes	*5*	
R225	**66**	61	Yes	*5*	
R226	**67**	61	Yes	*6*	
R227	**66**	61	Yes	*5*	
R228	**67**	61	Yes	*6*	
R229	**67**	62	Yes	*5*	
R230	**67**	62	Yes	*5*	
R271	**66**	64	No	2	
R272	**71**	**66**	Yes	*5*	
R273	**72**	65	Yes	*7*	
R274	58	57	No	1	
R275	**72**	63	Yes	*9*	
R276	56	55	No	1	
R277	58	57	No	1	
R278	**72**	62	Yes	*10*	
R279	**72**	61	Yes	*11*	
R280	**72**	59	Yes	*13*	
R281	57	56	No	1	
R282	**71**	58	Yes	*13*	
R283	**70**	59	Yes	*11*	

Exhibit 5-10. Wall East 3a Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R284	56	55	No	1	100%
R285	**71**	59	Yes	*12*	
R286	62	60	No	2	
R287	59	59	No	0	
R288	60	58	Yes	2	
R289	65	60	Yes	*5*	
R290	**69**	64	Yes	*5*	
R291	65	64	No	1	
R292	62	62	No	0	
R293	63	63	No	0	
R294	**67**	**66**	No	1	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 3a would have an area of 66,520 square feet at 2,724 feet long and a height ranging from 10 to 30 feet. Noise reduction would range from 0 to 13 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-11, the allowable area of Wall East 3a would be 25,896 square feet, which is less than the 66,520-square-foot wall needed to meet minimum design goals. Therefore, Wall East 3a would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-11. Wall East 3a Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R212	1	57	58	0	0			3
R213	1	59	60	0	0			4
R214	1	65	**66**	700	700			*5*
R215	1	65	**66**	700	700			*5*
R216	1	63	65	700	700			*6*
R217	1	**66**	**67**	768	768			*6*
R218	1	**67**	**69**	904	904			*6*
R219	1	**67**	**69**	904	904			*7*
R220	1	**66**	**68**	836	836			*7*
R221	1	63	65	700	700			*7*
R222	1	**66**	**67**	768	768			*5*
R223	1	**66**	**68**	836	836			*6*
R224	1	**66**	**67**	768	768			*5*
R225	1	64	**66**	700	700			*5*
R226	1	65	**67**	768	768	25,896	66,520	*6*
R227	1	65	**66**	700	700			*5*
R228	1	65	**67**	768	768			*6*
R229	1	**66**	**67**	768	768			*5*
R230	1	65	**67**	768	768			*5*
R271	2	64	**66**	0	0			2
R272	1	**70**	**71**	1,040	1,040			*5*
R273	1	**71**	**72**	1,108	1,108			*7*
R274	2	56	58	0	0			1
R275	1	**71**	**72**	1,108	1,108			*9*
R276	2	54	56	0	0			1
R277	3	57	58	0	0			1
R278	1	**71**	**72**	1,108	1,108			*10*
R279	1	**71**	**72**	1,108	1,108			*11*
R280	1	**71**	**72**	1,108	1,108			*13*

Exhibit 5-11. Wall East 3a Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R281	2	55	57	0	0	25,896	66,520	1
R282	1	**70**	**71**	1,040	1,040			*13*
R283	1	**69**	**70**	972	972			*11*
R284	2	56	56	0	0			1
R285	1	**70**	**71**	1040	1040			*12*
R286	2	60	62	0	0			2
R287	2	57	59	0	0			0
R288	2	58	60	0	0			2
R289	2	62	65	700	1,400			*5*
R290	2	**67**	**69**	904	1,808			*5*
R291	2	62	65	0	0			1
R292	2	59	62	0	0			0
R293	2	60	63	0	0			0
R294	1	64	**67**	0	0			1
						Design Goal Achieved?		Yes
						Cost Effective?		No

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

5. Wall East 3b (Feasible, Not Reasonable)

Wall East 3b was evaluated along the WSDOT right of way along northbound I-405 and the shoulder of eastbound SR 522 because traffic noise impacts are predicted at single-family homes and Sammamish River Trail receivers. For Wall East 3b, the Build Alternative noise levels at the receivers behind the noise wall would range between 64 and 72dBA without a wall (Exhibit 5-12).

Exhibit 5-12. Wall East 3b Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R297	**67**	**67**	Yes	0	83%
R298	65	64	No	1	
R299	**67**	61	No	*6*	
R332	64	62	Yes	2	
R333	64	61	Yes	3	
R334	64	61	Yes	3	
R335	64	61	Yes	3	
R336	65	61	Yes	4	
R337	**68**	61	Yes	*7*	
R338	**70**	61	Yes	*9*	
R339	**72**	61	Yes	*11*	
R340	**71**	61	Yes	*10*	
R341	**72**	62	Yes	*10*	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 3b would have an area of 42,817 square feet at 3,352 feet long and 18 to 22 feet high, with an 8-foot noise wall on the bridge structure. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-13, the allowable area of Wall East 3b would be 5,832 square feet, which is less than the 42,817-square-foot wall needed to meet minimum design goals. Therefore, Wall East 3b would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-13. Wall East 3c Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R297	1	**67**	**67**	0	0			0
R298	0	65	65	0	0			1
R299	1	64	**67**	768	768			*6*
R332	1	64	64	0	0			2
R333	1	63	64	0	0			3
R334	1	64	64	0	0			3
R335	1	63	64	0	0	5,832	42,817	3
R336	1	64	65	0	0			4
R337	1	**66**	**68**	836	836			*7*
R338	1	**69**	**70**	972	972			*9*
R339	1	**71**	**72**	1,108	1,108			*11*
R340	1	**69**	**71**	1,040	1,040			*10*
R341	1	**68**	**72**	1,108	1,108			*10*
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

6. Wall West 2 (Feasible, Not Reasonable)

Wall West 2 was evaluated along the WSDOT right of way and shoulder along southbound I-405 because traffic noise impact is predicted at a single-family home. Build Alternative noise levels at receivers behind the noise wall would range between 58 and 68 dBA without a wall (Exhibit 5-14).

Exhibit 5-14. Wall West 2 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R231	59	58	Yes	1	100%
R232	58	57	No	1	
R233	**68**	61	Yes	7	
R234	61	60	No	1	
R235	59	58	No	1	
R236	58	58	No	0	
R237	59	58	No	1	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall West 2 would have an area of 15,872 square feet at 545 feet long and a height ranging from 26 to 30 feet. The noise reduction would range from 1 to 7 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-15, the allowable area of Wall West 2 would be 836 square feet, which is less than the 15,872-square-foot wall needed to meet minimum design goals. Therefore, Wall West 2 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-15. Wall West 2 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R231	1	58	59	0	0	836	15,872	1
R232	1	57	58	0	0			1
R233	1	**67**	**68**	836	836			*7*
R234	1	59	61	0	0			1
R235	1	57	59	0	0			1
R236	1	57	58	0	0			0
R237	1	57	59	0	0			1
Design Goal Achieved?							Yes	
Cost Effective?							No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

7. Wall West 3 (Not Feasible)

Wall West 3 was evaluated along the WSDOT shoulder along southbound I-405 and eastbound SR 522 because traffic noise impacts are predicted at a second floor balcony of a multifamily residential building and trail receivers along the Sammamish River Trail. Build Alternative noise levels at receivers behind the noise wall would range between 51 and 67 dBA without a wall (Exhibit 5-16).

Exhibit 5-16. Wall West 3 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R251	61	59	No	2	0%
R252	62	59	No	3	
R253	59	56	Yes	3	
R254	61	59	No	2	
R255	62	60	No	2	
R256	62	59	No	3	
R257	62	60	No	2	
R258	62	59	No	3	
R259	62	59	No	3	
R260	63	60	No	3	

Exhibit 5-16. Wall West 3 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R261	62	59	Yes	3	0%
R262	63	61	No	2	
R263	63	60	No	3	
R264	63	60	No	3	
R265	63	59	No	4	
R266	63	61	Yes	2	
R267	64	63	No	1	
R268	64	62	No	2	
R269	64	62	No	2	
R270	64	61	No	3	
R300	61	55	Yes	*6*	
R301-1	51	44	No	*7*	
R301-2	55	48	No	*7*	
R302-1	62	56	Yes	*6*	
R302-2	**66**	58	No	*8*	
R303-1	57	52	No	*5*	
R303-2	62	55	No	*7*	
R304-1	59	52	No	*7*	
R304-2	63	55	No	*8*	
R305-1	54	53	No	1	
R305-2	55	54	No	1	
R306-1	54	53	No	1	
R306-2	55	54	No	1	
R307-1	59	54	No	*5*	
R307-2	63	56	No	*7*	
R308-1	55	53	No	2	
R308-2	58	55	No	3	
R309-1	59	50	No	*9*	
R309-2	63	53	Yes	*10*	
R310-1	56	50	No	*6*	
R310-2	58	50	No	*8*	
R311-1	55	54	No	1	

Exhibit 5-16. Wall West 3 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R311-2	56	55	No	1	
R312-1	56	55	No	1	
R312-2	57	55	No	2	
R313-1	60	56	No	4	
R313-2	64	58	Yes	*6*	
R314-1	58	54	No	4	
R314-2	61	55	No	*6*	
R315-1	57	55	No	2	
R315-2	59	55	No	4	
R316	61	57	Yes	4	
R317	58	57	No	1	
R318	59	57	No	2	
R319	61	58	Yes	3	0%
R320	58	57	No	1	
R321	63	60	Yes	3	
R322	62	59	No	3	
R323	60	58	No	2	
R324	60	58	No	2	
R325	64	60	Yes	4	
R326	65	60	Yes	*5*	
R327	65	62	Yes	3	
R328	65	63	Yes	2	
R329	65	63	Yes	2	
R330	**66**	65	Yes	1	
R331	**67**	**67**	Yes	0	
				Feasible?	No

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall West 3 would have an area of 38,178 square feet at 2,114 feet long and a height of 24 feet, with an 8-foot noise wall on the bridge structure. The noise reduction would range from 1 to 9 dBA. A noise wall of this size would not achieve WSDOT's feasibility goal of a 5 dBA reduction

at a majority of front-row impacted receivers. Therefore, the wall would not be feasible and is not recommended for construction.

8. Wall West 4 (Not Feasible)

Wall West 4 was evaluated along the WSDOT right of way and shoulder along southbound I-405 because traffic noise impacts are predicted at upper-floor balconies at The Villas at Beardslee apartments and North Creek Trail receivers along NE 195th Street. Build Alternative noise levels at receivers behind the noise wall would range between 61 and 72 dBA without a wall (Exhibit 5-17).

Exhibit 5-17. Wall West 4 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R352	**67**	65	Yes	2	0%
R353	**67**	65	No	2	
R354	**68**	**66**	Yes	2	
R355	**69**	**66**	Yes	3	
R356-3	**66**	62	No	4	
R356-4	**67**	62	No	5	
R356-5	**68**	63	No	5	
R357-3	**68**	64	No	4	
R357-4	**69**	65	No	4	
R357-5	**69**	**66**	No	3	
R358-3	**71**	**69**	No	2	
R358-4	**71**	**69**	No	2	
R358-5	**72**	**71**	No	1	
R359	**69**	**66**	Yes	3	
R360-2	61	61	No	0	
R360-4	63	63	No	0	
				Feasible?	No

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall West 4 would have an area of 48,783 square feet at 1,626 feet long and 30 feet high. A noise wall of this size would not achieve WSDOT's feasibility goal of 5 dBA reduction at a majority of front-row impacted receivers, or WSDOT's design goal of reducing traffic noise levels by at least 7 dBA. The front-row North Creek Trail receivers would not benefit from the proposed

noise wall because of roadway traffic noise on NE 195th Street. Therefore, the wall would not be feasible and is not recommended for construction.

9. Wall East 4 (Not Feasible)

Wall East 4 was evaluated along the WSDOT right of way and shoulder along northbound I-405 because traffic noise impacts are predicted at one North Creek Trail receiver along NE 195th Street. The Build Alternative noise levels at receivers behind the noise wall would range between 61 and 68 dBA without a wall (Exhibit 5-18).

Exhibit 5-18. Wall East 4 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R361	**68**	**67**	Yes	1	0%
R362	63	59	Yes	4	
R363	61	57	No	4	
				Feasible?	No

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded value.

Wall East 4 would have an area of 24,585 square feet at 820 feet long and 30 feet high. A noise wall of this size would not achieve WSDOT's feasibility goal of 5 dBA reduction at a majority of front-row impacted receivers, or WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver. The front-row North Creek Trail receiver would not benefit from the proposed noise wall because of roadway traffic noise on NE 195th Street. Therefore, the wall would not be feasible and is not recommended for construction.

10. Wall East 5 (Not Feasible)

Wall East 5 was evaluated along the northbound I-405 shoulder because traffic noise impacts are predicted at North Creek Trail receivers and single-family homes along 27th Avenue SE. Build Alternative noise levels at receivers behind the noise wall would range between 39 and 71 dBA without a wall (Exhibit 5-19).

Exhibit 5-19. Wall East 5 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R390	65	64	Yes	1	
R391	39	34	No	*5*	
R392	63	57	Yes	*6*	
R393	**67**	65	Yes	2	
R394	65	63	No	2	
R395	**69**	**67**	Yes	2	
R396	**68**	**67**	Yes	1	
R397	65	62	No	3	
R398	**69**	**67**	Yes	2	
R399	62	57	No	*5*	
R400	**68**	**67**	Yes	1	
R401	60	59	No	1	
R402	60	55	No	*5*	
R403	**69**	**67**	Yes	2	
R404	58	55	No	3	
R405	**69**	**68**	Yes	1	
R406	62	58	No	4	6%
R407	**70**	**67**	Yes	3	
R408	**67**	61	No	*6*	
R409	**71**	**66**	Yes	*5*	
R412	**66**	61	No	*5*	
R413	**69**	**66**	Yes	3	
R414	**66**	62	No	4	
R415	63	55	No	*8*	
R416	54	50	No	4	
R417	**69**	**67**	Yes	2	
R418	59	52	No	*7*	
R419	**69**	**67**	Yes	2	
R420	64	57	No	*7*	
R421	**68**	**67**	Yes	1	
R459	**68**	**67**	Yes	1	
R460	55	51	No	4	

Exhibit 5-19. Wall East 5 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R461	61	58	No	3	6%
R462	62	58	No	4	
R463	**67**	**66**	Yes	1	
R464	59	57	No	2	
R465	60	54	No	*6*	
R466	52	49	No	3	
R467	60	58	No	2	
R468	53	50	No	3	
R469	**68**	**66**	Yes	2	
R470	**66**	64	No	2	
R471	57	54	No	3	
R472	55	51	No	4	
R473	59	56	No	3	
R474	52	49	No	3	
R475	59	58	No	1	
R476	59	55	No	4	
R477	59	59	No	0	
R478	55	53	No	2	
				Feasible?	No

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 5 would have an area of 101,431 square feet at 3,380 feet long and 30 feet high. The noise reduction would range from 0 to 8 dBA. A noise wall of this size would not achieve WSDOT's feasibility goal of 5 dBA reduction at a majority of front-row impacted receivers. The front-row North Creek Trail receivers would not benefit from the proposed noise wall because of roadway traffic noise on 27th Avenue SE. Therefore, the wall would not be feasible and is not recommended for construction.

11. Wall West 5a (Feasible, Not Reasonable)

Wall West 5a was evaluated along the WSDOT right of way along southbound I-405 because traffic noise impacts are predicted at single-family residential buildings. Build Alternative noise levels at these receivers would range between 53 and 71 dBA without a wall (Exhibit 5-20).

Exhibit 5-20. Wall West 5a Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R422	62	62	Yes	0	
R423	61	60	Yes	1	
R424	55	54	No	1	
R425	54	54	No	0	
R426	53	53	No	0	
R427	**70**	63	Yes	*7*	
R428	**70**	62	Yes	*8*	
R429	54	53	No	1	
R430	54	54	No	0	
R431	**66**	59	No	*7*	100%
R432	**66**	64	No	2	
R433	57	56	No	1	
R434	62	58	No	4	
R435	**71**	65	Yes	*6*	
R436	**67**	62	No	*5*	
R437	61	59	No	2	
R438	**70**	65	Yes	*5*	
R439	**71**	65	Yes	*6*	
R440	61	61	No	0	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall West 5a would have an area of 9,161 square feet at 820 feet long and a height ranging from 8 to 14 feet. The noise reduction would range from 0 to 8 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-21, the allowable area of Wall West 5a would be 6,464 square feet, which is less than the 9,161-square-foot wall needed to meet minimum design goals. Therefore, Wall West 5a would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-21. Wall West 5a Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R422	1	61	62	0	0			0
R423	1	60	61	0	0			1
R424	2	54	55	0	0			1
R425	2	53	54	0	0			0
R426	2	52	53	0	0			0
R427	1	**69**	**70**	972	972			*7*
R428	1	**69**	**70**	972	972			*8*
R429	1	54	54	0	0			1
R430	2	53	54	0	0			0
R431	1	65	**66**	700	700	6,464	9,161	*7*
R432	1	65	**66**	0	0			2
R433	2	57	57	0	0			1
R434	1	62	62	0	0			4
R435	1	**70**	**71**	1,040	1,040			*6*
R436	1	**67**	**67**	768	768			*5*
R437	2	60	61	0	0			2
R438	1	**70**	**70**	972	972			*5*
R439	1	**71**	**71**	1,040	1,040			*6*
R440	2	61	61	0	0			0
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

12. Wall West 5b (Feasible, Not Reasonable)

Wall West 5b was evaluated along the WSDOT right of way along southbound I-405 because traffic noise impacts are predicted at single-family and multifamily residential buildings, as well as one playground. Wall West 5b was also examined with an 8-foot tall noise wall on the bridge structure over 228th Street SE and additional length and height north of 228th Street SE. However, 5 dBA of traffic noise reduction was still not achievable for the playground and multifamily residences adjacent to 228th Street SE because of roadway traffic noise on the local road. For that reason, a shorter barrier length is presented below for the traffic noise impacts south of the existing noise wall NW2. Build Alternative noise levels at these receivers would range between 56 and 75 dBA without a wall (Exhibit 5-22).

Exhibit 5-22. Wall West 5b Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R441	59	58	No	1	100%
R442	62	57	Yes	*5*	
R443	62	59	No	3	
R444	**73**	60	Yes	*13*	
R445	58	55	No	3	
R446	62	59	No	3	
R447	60	58	No	2	
R448	64	61	No	3	
R449	**71**	64	Yes	*7*	
R450	60	55	No	*5*	
R451	**73**	**68**	Yes	*5*	
R452	63	58	No	*5*	
R453	61	57	No	4	
R454	**71**	63	Yes	*8*	
R455	**68**	60	No	*8*	
R456	**66**	58	No	*8*	
R457	62	56	No	*6*	
R458	63	57	No	*6*	
R529	**69**	62	Yes	*7*	
R530	**68**	60	No	*8*	
R531	**66**	59	No	*7*	
R532	**71**	60	Yes	*11*	
R533	64	59	No	*5*	

Exhibit 5-22. Wall West 5b Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R534	**73**	59	Yes	*14*	100%
R535	**71**	62	No	*9*	
R536	60	56	No	4	
R537	**75**	66	Yes	*9*	
R538	65	60	No	*5*	
R539	56	56	No	0	
R540	**75**	65	Yes	*10*	
R541	63	60	No	3	
R542	**69**	63	No	*6*	
R543	**74**	**69**	Yes	*5*	
R544	63	61	No	2	
R545	59	59	No	0	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall West 5b would have an area of 33,866 square feet at 1,987 feet long and a height ranging from 12 to 20 feet. The noise reduction would range from 0 to 14 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-23, the allowable area of Wall West 5b would be 23,776 square feet, which is less than the 33,866-square-foot wall needed to meet minimum design goals. Therefore, Wall West 5b would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Shorter length walls of Wall West 5b were also analyzed in this area for separate neighborhoods with predicted traffic noise impact, but none were found to be reasonable.

Exhibit 5-23. Wall West 5b Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R441	2	58	59	0	0			1
R442	1	61	62	700	700			*5*
R443	2	61	62	0	0			3
R444	1	**72**	**73**	1,176	1,176			*13*
R445	1	57	58	0	0			3
R446	1	61	62	0	0			3
R447	1	59	60	0	0			2
R448	1	63	64	0	0			3
R449	1	**70**	**71**	1,040	1,040			*7*
R450	1	59	60	700	700			*5*
R451	1	**72**	**73**	1,176	1,176			*5*
R452	1	62	63	700	700			*5*
R453	1	60	61	0	0			4
R454	1	**70**	**71**	1,040	1,040			*8*
R455	1	**67**	**68**	836	836	27,616	52,026	*8*
R456	1	65	**66**	700	700			*8*
R457	1	62	62	700	700			*6*
R458	1	63	63	700	700			*6*
R529	1	**69**	**69**	904	904			*7*
R530	1	**67**	**68**	836	836			*8*
R531	1	65	**66**	700	700			*7*
R532	1	**71**	**71**	1,040	1,040			*11*
R533	2	64	64	700	1,400			*5*
R534	1	**72**	**73**	1,176	1,176			*14*
R535	2	**70**	**71**	1,040	2,080			*9*
R536	2	59	60	0	0			4
R537	1	**75**	**75**	1,312	1,312			*9*
R538	2	64	65	700	1,400			*5*
R539	2	55	56	0	0			0

Exhibit 5-23. Wall West 5b Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R540	1	**75**	**75**	1,312	1,312	27,616	52,026	*10*
R541	2	62	63	0	0			3
R542	1	**69**	**69**	904	904			*6*
R543	1	**74**	**74**	1,244	1,244			*5*
R544	1	63	63	0	0			2
R545	2	58	59	0	0			0
Design Goal Achieved?							Yes	
Cost Effective?							No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

13. Wall East 6 (Feasible and Reasonable)

Wall East 6 was evaluated as a two-barrier system along the northbound I-405 shoulder, north and south of 228th Street SE, because traffic noise impacts are predicted at single-family homes and multifamily residences, including ground and upper floor balconies at Salmon Run at Perry Creek apartments. Build Alternative noise levels at these receivers would range between 50 and 73 dBA without a wall (Exhibit 5-24).

Exhibit 5-24. Wall East 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R574	**66**	65	No	1	60%
R575	**66**	65	No	1	
R576	**66**	**66**	No	0	
R577	63	60	Yes	3	
R578	65	60	Yes	*5*	
R579	**68**	63	Yes	*5*	
R580	**69**	**66**	Yes	3	
R581-1	60	60	No	0	
R581-2	63	62	No	1	

Exhibit 5-24. Wall East 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R581-3	63	63	No	0	
R582-1	**67**	**66**	No	1	
R582-2	**68**	**68**	No	0	
R582-3	**69**	**68**	No	1	
R583-1	56	56	No	0	
R583-2	59	59	No	0	
R583-3	60	60	No	0	
R584-1	54	53	No	1	
R584-2	58	57	No	1	
R584-3	59	59	No	0	
R585-1	65	64	No	1	
R585-2	**67**	**67**	No	0	
R585-3	**68**	**67**	No	1	
R586-1	50	48	No	2	
R586-2	53	50	No	3	
R586-3	58	56	No	2	
R587-1	50	48	No	2	60%
R587-2	53	50	No	3	
R587-3	59	56	No	3	
R588-1	55	55	No	0	
R588-2	57	56	No	1	
R588-3	61	59	No	2	
R589-1	59	58	No	1	
R589-2	64	63	No	1	
R589-3	65	63	No	2	
R590-1	57	55	No	2	
R590-2	61	60	No	1	
R590-3	62	61	No	1	
R591-1	55	54	No	1	
R591-2	59	58	No	1	
R591-3	61	60	No	1	
R592-1	55	52	No	3	

Exhibit 5-24. Wall East 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R592-2	58	56	No	2	60%
R592-3	60	58	No	2	
R593-1	61	58	No	3	
R593-2	63	61	No	2	
R593-3	65	63	No	2	
R594-1	60	57	No	3	
R594-2	62	59	No	3	
R594-3	64	61	No	3	
R595-1	**70**	**70**	No	0	
R595-2	**71**	**71**	No	0	
R595-3	**73**	**71**	Yes	2	
R596-1	54	53	No	1	
R596-2	59	58	No	1	
R596-3	61	60	No	1	
R597-1	56	54	No	2	
R597-2	59	58	No	1	
R597-3	62	60	No	2	
R598-1	**68**	**67**	No	1	
R598-2	**70**	**69**	No	1	
R598-3	**72**	**70**	Yes	2	
R599-1	**67**	65	No	2	
R599-2	**69**	**67**	No	2	
R599-3	**71**	**68**	Yes	3	
R600-1	**66**	64	No	2	
R600-2	**68**	65	No	3	
R600-3	**70**	**67**	Yes	3	
R601-1	59	52	No	*7*	
R601-2	62	54	No	*8*	
R601-3	64	56	No	*8*	
R602-1	58	52	No	*6*	
R602-2	61	54	No	*7*	
R602-3	63	56	No	*7*	

Exhibit 5-24. Wall East 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R603-1	54	51	No	3	
R603-2	56	53	No	3	
R603-3	59	57	No	2	
R604-1	54	51	No	3	
R604-2	56	53	No	3	
R604-3	60	57	No	3	
R605-1	63	59	No	4	
R605-2	65	60	No	*5*	
R605-3	**66**	62	No	4	
R606-1	63	59	No	4	
R606-2	65	60	No	*5*	
R606-3	**66**	61	No	*5*	
R607-1	62	58	No	4	
R607-2	65	60	No	*5*	
R607-3	**66**	61	No	*5*	
R608-1	56	51	No	*5*	
R608-2	60	54	No	*6*	60%
R608-3	61	56	No	*5*	
R609-1	55	50	No	*5*	
R609-2	58	53	No	*5*	
R609-3	60	55	No	*5*	
R610-1	55	51	No	4	
R610-2	57	53	No	4	
R610-3	59	56	No	3	
R611	**66**	61	Yes	*5*	
R612	63	58	Yes	*5*	
R613	61	57	No	4	
R614	62	57	Yes	*5*	
R615	63	57	Yes	*6*	
R616	62	57	No	*5*	
R617	60	55	No	*5*	
R618	62	56	No	*6*	

Exhibit 5-24. Wall East 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R619	63	57	Yes	*6*	60%
R620	64	57	Yes	*7*	
R621	**66**	58	Yes	*8*	
R622	61	54	No	*7*	
R623	**67**	59	Yes	*8*	
R624	62	57	No	*5*	
R625	**68**	59	Yes	*9*	
R626	61	55	No	*6*	
R627	**68**	59	Yes	*9*	
R628	**67**	59	Yes	*8*	
R629	63	57	No	*6*	
R630	**66**	59	Yes	*7*	
R631	65	58	Yes	*7*	
R632	62	56	No	*6*	
R633	61	56	No	*5*	
R634	65	58	Yes	*7*	
R635	61	56	No	*5*	
R636	59	56	No	3	
R637	63	59	No	4	
R638	61	59	No	2	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall East 6 would have an area of 31,776 square feet at 1,793 feet long and a height range of 15 to 18 feet. The noise reduction would range from 0 to 9 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver. However, the single- and multifamily residences adjacent to 228th Street SE would not benefit from the proposed noise wall because of roadway traffic noise on the local road.

A portion of this noise wall would sit on retaining wall, resulting in costs that exceed the cost of a standard design noise wall. For that reason, this noise wall was evaluated based on allowable cost, and an additional cost of $189,200 was included in the total cost to account for moment

slab required for the noise wall on retaining wall. As shown in Exhibit 5-25, the allowable cost of Wall East 6 would be $2,094,333, which is more than the $1,829,183 wall needed to meet minimum design goals. Therefore, Wall East 6 would meet WSDOT's reasonableness requirement and is recommended for construction.

Exhibit 5-25. Wall East 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Cost per Household ($)	Cost per Modeled Receiver ($)	Total Allowable Wall Cost ($)	Total Wall Cost($)	Insertion Loss (dBA)
R574	1	65	**66**	0	0	2,094,333	1,829,183	1
R575	1	**66**	**66**	0	0			2
R576	2	64	**66**	0	0			1
R577	3	**66**	63	0	0			4
R578	3	**66**	65	36,127	108,381			*5*
R579	2	**71**	**68**	43,146	86,292			*5*
R580	2	**72**	**69**	0	0			3
R581-1	1	57	60	0	0			0
R581-2	1	59	63	0	0			1
R581-3	1	60	63	0	0			0
R582-1	1	65	**67**	0	0			1
R582-2	1	**67**	**68**	0	0			0
R582-3	1	**68**	**69**	0	0			1
R583-1	1	52	56	0	0			0
R583-2	1	55	59	0	0			0
R583-3	1	57	60	0	0			0
R584-1	1	50	54	0	0			1
R584-2	1	54	58	0	0			1
R584-3	1	56	59	0	0			0
R585-1	1	65	65	0	0			1
R585-2	1	**67**	**67**	0	0			0
R585-3	1	**68**	**68**	0	0			1
R586-1	1	49	50	0	0			2
R586-2	1	51	53	0	0			3
R586-3	1	57	58	0	0			2
R587-1	1	48	50	0	0			2

Exhibit 5-25. Wall East 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Cost per Household ($)	Cost per Modeled Receiver ($)	Total Allowable Wall Cost ($)	Total Wall Cost($)	Insertion Loss (dBA)
R587-2	1	51	53	0	0			3
R587-3	1	58	59	0	0			3
R588-1	1	58	55	0	0			0
R588-2	1	59	57	0	0			1
R588-3	1	61	61	0	0			2
R589-1	1	58	59	0	0			1
R589-2	1	62	64	0	0			1
R589-3	1	64	65	0	0			2
R590-1	1	55	57	0	0			2
R590-2	1	59	61	0	0			1
R590-3	1	62	62	0	0			1
R591-1	1	55	55	0	0			1
R591-2	1	58	59	0	0			1
R591-3	1	61	61	0	0			1
R592-1	1	54	55	0	0	2,094,333	1,829,183	3
R592-2	1	56	58	0	0			2
R592-3	1	60	60	0	0			2
R593-1	1	62	61	0	0			3
R593-2	1	65	63	0	0			2
R593-3	1	**67**	65	0	0			2
R594-1	1	61	60	0	0			3
R594-2	1	63	62	0	0			3
R594-3	1	65	64	0	0			3
R595-1	1	**70**	**70**	0	0			0
R595-2	1	**72**	**71**	0	0			0
R595-3	1	**74**	**73**	0	0			2
R596-1	1	51	54	0	0			1
R596-2	1	56	59	0	0			1
R596-3	1	59	61	0	0			1

Exhibit 5-25. Wall East 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Cost per Household ($)	Cost per Modeled Receiver ($)	Total Allowable Wall Cost ($)	Total Wall Cost($)	Insertion Loss (dBA)
R597-1	1	56	56	0	0			2
R597-2	1	58	59	0	0			1
R597-3	1	62	62	0	0			2
R598-1	1	**70**	**68**	0	0			1
R598-2	1	**71**	**70**	0	0			1
R598-3	1	**74**	**72**	0	0			2
R599-1	1	**68**	**67**	0	0			2
R599-2	1	**70**	**69**	0	0			2
R599-3	1	**73**	**71**	0	0			3
R600-1	1	**67**	**66**	0	0			2
R600-2	1	**69**	**68**	0	0			3
R600-3	1	**71**	**70**	0	0			3
R601-1	1	58	59	36,127	36,127			*7*
R601-2	1	62	62	36,127	36,127			*8*
R601-3	1	64	64	36,127	36,127	2,094,333	1,829,183	*8*
R602-1	1	57	58	36,127	36,127			*6*
R602-2	1	60	61	36,127	36,127			*7*
R602-3	1	62	63	36,127	36,127			*7*
R603-1	1	53	54	0	0			3
R603-2	1	55	56	0	0			3
R603-3	1	59	59	0	0			2
R604-1	1	54	54	0	0			3
R604-2	1	56	56	0	0			3
R604-3	1	60	60	0	0			3
R605-1	1	63	63	0	0			4
R605-2	1	**66**	65	36,127	36,127			*5*
R605-3	1	**67**	**66**	0	0			4
R606-1	1	63	63	0	0			4
R606-2	1	65	65	36,127	36,127			*5*

Exhibit 5-25. Wall East 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Cost per Household ($)	Cost per Modeled Receiver ($)	Total Allowable Wall Cost ($)	Total Wall Cost($)	Insertion Loss (dBA)
R606-3	1	**67**	**66**	36,127	36,127			5
R607-1	1	63	62	0	0			4
R607-2	1	65	65	36,127	36,127			5
R607-3	1	**66**	**66**	36,127	36,127			5
R608-1	1	51	56	36,127	36,127			5
R608-2	1	54	60	36,127	36,127			6
R608-3	1	57	61	36,127	36,127			5
R609-1	1	50	55	36,127	36,127			5
R609-2	1	54	58	36,127	36,127			5
R609-3	1	56	60	36,127	36,127			5
R610-1	1	56	55	0	0			4
R610-2	1	57	57	0	0			4
R610-3	1	60	59	0	0			3
R611	1	**67**	**66**	36,127	36,127			5
R612	1	62	63	36,127	36,127	2,094,333	1,829,183	5
R613	1	61	61	0	0			4
R614	1	62	62	36,127	36,127			5
R615	1	62	63	36,127	36,127			6
R616	1	60	62	36,127	36,127			5
R617	2	59	60	36,127	72,254			5
R618	2	60	62	36,127	72,254			6
R619	1	61	63	36,127	36,127			6
R620	1	61	64	36,127	36,127			7
R621	1	61	**66**	36,127	36,127			8
R622	2	57	61	36,127	72,254			7
R623	1	61	**67**	39,636	39,636			8
R624	2	59	62	36,127	72,254			5
R625	1	61	**68**	43,146	43,146			9
R626	3	57	61	36,127	108,381			6

Exhibit 5-25. Wall East 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Cost per Household ($)	Cost per Modeled Receiver ($)	Total Allowable Wall Cost ($)	Total Wall Cost($)	Insertion Loss (dBA)
R627	1	61	**68**	43,146	43,146	2,094,333	1,829,183	*9*
R628	1	61	**67**	39,636	39,636			*8*
R629	2	59	63	36,127	72,254			*6*
R630	1	60	**66**	36,127	36,127			*7*
R631	1	60	65	36,127	36,127			*7*
R632	2	59	62	36,127	72,254			*6*
R633	3	58	61	36,127	108,381			*5*
R634	1	60	65	36,127	36,127			*7*
R635	2	56	61	36,127	72,254			*5*
R636	3	57	59	0	0			3
R637	1	58	63	0	0			4
R638	1	58	61	0	0			2
Design Goal Achieved?							Yes	
Cost Effective?							Yes	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

14. Wall West 6 (Feasible, Not Reasonable)

Wall West 6 was evaluated along the WSDOT right of way along southbound I-405 because traffic noise impacts are predicted at two receivers representing playgrounds at Kiddie Academy daycare. Build Alternative noise levels at these receivers would be 71 dBA without a wall (Exhibit 5-26).

Exhibit 5-26. Wall West 6 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R572	**71**	65	Yes	*6*	100%
R573	**71**	64	Yes	*7*	
Feasible?					Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall West 6 would have an area of 5,295 square feet at 500 feet long and at a height ranging from 10 to 12 feet. The noise reduction would range from 6 to 7 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-27, the allowable area of Wall West 6 would be 4,160 square feet, which is less than the 5,295-square-foot wall needed to meet minimum design goals. Therefore, Wall West 6 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-27. Wall West 6 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft²)	Area per Modeled Receiver (ft²)	Total Allowable Wall Area (ft²)	Total Wall Area (ft²)	Insertion Loss (dBA)
R572	2	**72**	**71**	1,040	2,080	4,160	5,295	*6*
R573	2	**72**	**71**	1,040	2,080			*7*
Design Goal Achieved?							Yes	
Cost Effective?							No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

15. Wall West 7 (Feasible and Reasonable)

Wall West 7 was evaluated along southbound I-405 because traffic noise impacts are predicted at single-family homes in the Cedar Park North development. Build Alternative noise levels at receivers behind the noise wall would range between 62 and 72 dBA without a wall (Exhibit 5-28).

Exhibit 5-28. Wall West 7 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R665	**72**	**66**	Yes	*6*	
R666	65	58	No	*7*	
R667	65	59	No	*6*	
R668	**71**	63	Yes	*8*	
R669	**66**	59	No	*7*	
R670	**70**	62	Yes	*8*	
R671	65	58	No	*7*	
R672	**68**	62	Yes	*6*	
R673	65	59	No	*6*	
R674	**67**	61	No	*6*	
R675	65	59	No	*6*	
R676	**66**	61	No	*5*	100%
R677	63	58	No	*5*	
R678	**71**	62	Yes	*9*	
R679	65	59	No	*6*	
R680	**70**	61	Yes	*9*	
R681	64	58	No	*6*	
R682	**70**	61	Yes	*9*	
R683	**70**	61	Yes	*9*	
R684	**68**	61	Yes	*7*	
R685	62	58	No	4	
R686	64	59	No	*5*	
R687	64	60	Yes	4	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall West 7 would have an area of 14,396 square feet at 1,200 feet long and a height of 12 feet. The noise reduction would range from 4 to 9 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-29, the allowable area of Wall West 7 would be 23,516 square feet, which is more than the 14,396-square-foot wall needed to meet minimum design goals. Therefore, Wall West 7 would meet WSDOT's reasonableness requirement and is recommended for construction.

Exhibit 5-29. Wall West 7 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R665	1	**71**	**72**	1,108	1,108			*6*
R666	2	64	65	700	1,400			*7*
R667	2	64	65	700	1,400			*6*
R668	1	**71**	**71**	1,040	1,040			*8*
R669	3	65	**66**	700	2,100			*7*
R670	1	**69**	**70**	972	972			*8*
R671	1	65	65	700	700			*7*
R672	1	**68**	**68**	836	836			*6*
R673	2	64	65	700	1,400			*6*
R674	1	**67**	**67**	768	768			*6*
R675	2	65	65	700	1,400			*6*
R676	1	**66**	**66**	700	700	23,516	14,396	*5*
R677	3	63	63	700	2,100			*5*
R678	1	**70**	**71**	1,040	1,040			*9*
R679	1	65	65	700	700			*6*
R680	1	**70**	**70**	972	972			*9*
R681	2	63	64	700	1,400			*6*
R682	1	**69**	**70**	972	972			*9*
R683	1	**69**	**70**	972	972			*9*
R684	1	**68**	**68**	836	836			*7*
R685	1	63	62	0	0			4
R686	1	64	64	700	700			*5*
R687	1	64	64	0	0			4
						Design Goal Achieved?	Yes	
						Cost Effective?	Yes	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

16. Wall East 7 (Feasible, Not Reasonable)

Wall East 7 was evaluated along westbound SR 527 because traffic noise impacts are predicted at a multifamily residential pool at Providence Apartments. The Build Alternative noise level at the affected receiver would be 66 dBA without a wall (Exhibit 5-30).

Exhibit 5-30. Wall East 7 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R662	**66**	59	Yes	7	100%
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 7 would have an area of 2,576 square feet at 295 feet long and a height ranging from 6 to 10 feet. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for the affected receiver.

As shown in Exhibit 5-31, the allowable area of Wall East 7 would be 1,400 square feet, which is less than the 2,576-square-foot wall needed to meet minimum design goals. Therefore, Wall East 7 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-31. Wall East 7 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R662	2	65	**66**	700	1,400	1,400	2,576	7
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency

Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

17. Wall East 8 (Feasible, Not Reasonable)

Wall East 8 was evaluated along northbound I-405 because traffic noise impacts are predicted at single-family homes north of SR 527 and south of 9th Avenue SE. Build Alternative noise levels at these receivers would range between 68 and 72 dBA without a wall (Exhibit 5-32).

Exhibit 5-32. Wall East 8 Feasibility Analysis

Receiver	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	2045 Build Alternative with Wall (L_{eq}) (dBA)	First-Row Receiver?	Insertion Loss (dBA)	% First-Row Receiver ≥5 dBA
R688	**68**	61	Yes	7	100%
R689	**68**	61	Yes	7	
R690	**69**	63	Yes	*6*	
R691	**72**	65	Yes	7	
R692	**68**	63	No	*5*	
				Feasible?	Yes

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

Wall East 8 would have an area of 26,674 square feet at 1,634 feet long and a height ranging from 14 to 18 feet, with an 8-foot noise wall on the bridge structure. The noise reduction would range from 5 to 7 dBA. A noise wall of this size would achieve WSDOT's design goal of reducing traffic noise levels by at least 7 dBA for one receiver.

As shown in Exhibit 5-33, the allowable area of Wall East 8 would be 5,356 square feet, which is less than the 26,674-square-foot wall needed to meet minimum design goals. Therefore, Wall East 8 would not meet WSDOT's reasonableness requirement and is not recommended for construction.

Exhibit 5-33. Wall East 8 Reasonableness Evaluation

Receiver	Dwelling or RE Units	2018 Existing (L_{eq}) (dBA)	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Reasonableness Allowance			Minimum Design Goal Noise Wall	
				Area per Household (ft^2)	Area per Modeled Receiver (ft^2)	Total Allowable Wall Area (ft^2)	Total Wall Area (ft^2)	Insertion Loss (dBA)
R688	1	**67**	**68**	836	836	5,356	26,674	7
R689	1	**68**	**68**	836	836			7
R690	1	**69**	**69**	904	904			*6*
R691	1	**71**	**72**	1,108	1,108			7
R692	2	**68**	**68**	836	1672			*5*
						Design Goal Achieved?	Yes	
						Cost Effective?	No	

dBA = A-weighted decibels; L_{eq}= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.

5.3.2 Existing Noise Walls

Existing noise walls within the project corridor were evaluated to determine if the receivers behind the walls would maintain future noise levels below the NAC with the Project (FHWA 2017). There are nine existing noise walls in the noise study area. Out of these nine existing noise walls, four walls would not maintain the noise level below the NAC of 66 dBA at receivers behind the wall. These four noise walls will remain in place with the Project, are currently benefiting receivers behind the wall, and are meeting feasibility and reasonableness criteria. Because impacts are identified behind these four existing noise walls with the Project, an analysis was conducted for each wall to determine if additional abatement is feasible and reasonable, and the results are discussed in the next sections.

One of the existing noise walls, NW1, may need to be removed and replaced to accommodate the Project design. Wall NW1 may be replaced along the existing alignment and on the retaining wall along northbound I-405 north of the 228th Street SE bridge, where it would then connect to the northbound 17th Avenue SE retaining wall as part of proposed Wall East 6 (discussed in Section 5.3.1, Proposed Noise Walls, and shown on Exhibit 5-1, Sheets 10 and 11). There is also a neighborhood screening wall currently attached to Wall NW1 that would be removed with the Project. The proposed elevation of 17th Avenue SE with a retaining wall and 3.5-foot parapet would provide noise shielding to the neighborhood in place of the screening wall, and traffic noise levels with the Project are not predicted to approach or exceed the NAC in the area of this removed wall. Therefore, no additional abatement or replacement is recommended. Existing noise walls discussed in this section are shown on Exhibit 5-1.

1. Existing Noise Wall NW16

Wall NW16 is an existing noise wall along the WSDOT right of way along northbound I-405 that provides noise reduction to single-family and multifamily residences south of NE 160th Street. There are 23 receivers that exceed the FWHA NAC behind the existing noise wall, including 1 single-family home and 22 second-, third- and fourth-floor balconies at the Verdeaux condominium. Ground floor use areas are the primary area of concern when providing noise abatement, and noise walls are not typically designed to reduce noise levels at upper floors. When considering additional abatement for this wall, the primary areas of concern are the ground floor and second floor balconies because the second floor qualifies as the first row of receivers in this area where I-405 is in a cut section, and line-of-sight considerations indicate more noise exposure for the second floor balconies.

One single-family home (R75) and one second floor balcony (R135-2) are impacted behind NW16. For the existing wall, reasonableness for additional abatement is determined by calculating the total area of the existing wall and multiplying by the current planning level cost ($51.61) to get $1,671,029, then multiplying the total area of the proposed taller wall required to reduce the impacted receivers below the NAC of 66 dBA by the same cost to get $1,753,863. The proposed wall noise levels are compared to the noise levels without the existing wall to determine beneficiaries, or those residence that will achieve at least a 5 dB noise reduction with the proposed wall. Each benefiting receiver is assigned a cost allowance based on their noise levels without the existing wall. As shown in Exhibit 5-34, the total allowance for beneficiaries is

$2,876,115. Since the difference between the existing wall cost and the cost of new beneficiaries is $1,205,086, which is less than the cost of the proposed wall, it is not reasonable to provide additional abatement, and the height of this wall would remain unchanged.

Exhibit 5-34. Reasonableness Analysis for Existing Wall NW16

Existing Wall			Reasonableness				
Receiver	Dwelling or RE Units	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Cost per Modeled Receiver ($)	2045 Build w/ Existing Wall (L_{eq}) dBA)	Insertion Loss (dBA)	2045 Build w/ Proposed Wall (L_{eq}) dBA)	Insertion Loss (dBA)
R73	1	**66**	36,127	61	*5*	61	*5*
R74	2	59	0	57	2	57	2
R75	1	**72**	57,184	**66**	*6*	65	*7*
R76	2	65	0	61	4	61	4
R77	2	60	0	57	3	56	4
R78	1	**69**	46,655	64	*5*	64	*5*
R79	2	61	0	58	3	58	3
R80	1	**68**	43,146	63	*5*	63	*5*
R81	1	**69**	46,655	63	*6*	63	*6*
R82	2	62	0	60	2	60	2
R83	1	**69**	46,655	63	*6*	63	*6*
R84	3	59	0	55	4	55	4
R85	1	**71**	53,674	63	*8*	63	*8*
R86	2	63	0	60	3	60	3
R87	1	**72**	57,184	63	*9*	63	*9*
R88	2	58	0	55	3	55	3
R89	1	**72**	57,184	63	*9*	62	*10*
R90	2	64	0	60	4	60	4
R91	1	**69**	46,655	61	*8*	61	*8*
R92	2	59	0	55	4	55	4
R93	1	**68**	43,146	61	*7*	61	*7*
R94	2	63	0	59	4	59	4
R95	1	**71**	53,674	62	*9*	62	*9*
R96	1	**71**	53,674	62	*9*	62	*9*
R97	3	56	0	54	2	54	2
R98	2	61	0	57	4	57	4

Exhibit 5-34. Reasonableness Analysis for Existing Wall NW16

Existing Wall			Reasonableness				
Receiver	Dwelling or RE Units	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Cost per Modeled Receiver ($)	2045 Build w/ Existing Wall (L_{eq}) dBA)	Insertion Loss (dBA)	2045 Build w/ Proposed Wall (L_{eq}) dBA)	Insertion Loss (dBA)
R99	1	**73**	60,693	63	*10*	63	*10*
R100	1	**68**	43,146	60	*8*	60	*8*
R101	1	64	36,127	58	*6*	58	*6*
R102	1	**74**	64,203	63	*11*	63	*11*
R103	1	63	36,127	58	*5*	58	*5*
R104	2	59	0	55	4	55	4
R105	1	62	36,127	57	*5*	57	*5*
R106	1	63	36,127	58	*5*	58	*5*
R107	1	**69**	46,655	60	*9*	60	*9*
R108	1	**73**	60,693	62	*11*	62	*11*
R109	1	59	0	55	4	55	4
R110	1	60	36,127	55	*5*	55	*5*
R111	1	62	36,127	56	*6*	56	*6*
R112	1	64	36,127	58	*6*	58	*6*
R113	1	**68**	43,146	60	*8*	60	*8*
R114	1	**72**	57,184	61	*11*	61	*11*
R115	1	**74**	64,203	62	*12*	62	*12*
R116	1	**66**	36,127	59	*7*	59	*7*
R117	1	62	36,127	56	*6*	53	*9*
R118	1	59	36,127	54	*5*	54	*5*
R119	4	56	0	52	4	52	4
R120	4	59	0	55	4	55	4
R121	4	60	0	56	4	56	4
R122	4	65	144,508	59	*6*	58	*7*
R123	4	**68**	172,584	60	*8*	60	*8*
R124	4	55	0	51	4	51	4
R125	4	57	0	53	4	53	4
R126	4	59	0	55	4	55	4

Exhibit 5-34. Reasonableness Analysis for Existing Wall NW16

Existing Wall			Reasonableness				
Receiver	Dwelling or RE Units	2045 Build Alternative w/o Wall (L_{eq}) (dBA)	Cost per Modeled Receiver ($)	2045 Build w/ Existing Wall (L_{eq}) dBA)	Insertion Loss (dBA)	2045 Build w/ Proposed Wall (L_{eq}) dBA)	Insertion Loss (dBA)
R127	4	**73**	242,772	62	*11*	62	*11*
R128-1	2	**66**	72,254	60	*6*	60	*6*
R128-2	2	**71**	107,348	63	*8*	62	*9*
R129-1	1	62	36,127	56	*6*	56	*6*
R129-2	1	**67**	39,636	59	*8*	59	*8*
R130-1	2	58	0	54	4	54	4
R130-2	2	63	72,254	56	*7*	56	*7*
R131-1	2	**67**	79,272	61	*6*	61	*6*
R131-2	2	**72**	114,368	64	*8*	63	*9*
R132-1	2	61	72,254	55	*6*	55	*6*
R132-2	2	**66**	72,254	59	*7*	58	*8*
R133-1	4	46	0	45	1	46	0
R133-2	4	51	0	49	2	49	2
R134-1	2	**66**	0	62	4	62	4
R134-2	2	**71**	107,348	65	*6*	64	*7*
R135-1	2	**66**	0	63	3	63	3
R135-2	2	**70**	100,330	66	4	65	*5*
R136-1	1	60	0	59	1	59	1
R136-2	1	65	0	63	2	63	2
R137-1	2	57	0	57	0	57	0
R137-2	2	61	0	60	1	60	1

Existing Wall Cost	$1,671,029
Proposed Wall Cost	$1,753,863
Total Allowable Cost	$2,876,115
Total Allowable – Existing Cost	$1,205,086
Reasonable?	*No*

dBA = A-weighted decibels; Leq= equivalent (average) noise level during a specified period of time; RE = residential equivalency
Impacts are noted by bolded values. Receivers with 5 dBA or more noise reduction are noted by bolded and italicized values.
Receiver floor is represented by the appended number; for example, an entry of R128-2 would represent the second floor for receiver R128.

Wall East 2, described in Section 5.3.1 and proposed for construction, is located adjacent to this existing noise wall due to second-floor impacts at the Verdeaux condominium.

2. Existing Noise Wall NB3

Wall NB3 is an existing noise wall along the WSDOT right of way along southbound I-405 that provides noise reduction to single-family residences and multifamily residences at North Creek Heights apartments. There are 35 receivers that exceed the FWHA NAC behind the existing Wall NB3, including 1 single-family home and 34 second- and third-floor balconies at the North Creek Heights apartments. Ground floor use areas are the primary area of concern when providing noise abatement, and noise walls are not typically designed to reduce noise levels at upper floors.

The only affected ground-floor first-row receiver behind the noise wall is the single-family home at the north end of the noise wall (R387). Increasing the noise wall height to 30 feet would not reduce noise levels below the NAC of 66 dBA for this one residence (R387)

Additional abatement in the form of an extension to NB3 was also analyzed for this single-family home. The Build Alternative noise level at R387 would be 68 dBA with the existing wall. An extension 200 feet in length and 30 feet in height would not reduce noise levels below the NAC or provide 5 dB of noise reduction for R387. Therefore, extending existing Wall NB3 would not be feasible or reasonable, and the height of this wall would remain unchanged.

3. Existing Noise Wall NB7

Wall NB7 is an existing noise wall along the WSDOT right of way along northbound I-405 that provides noise reduction to the multifamily residences at Stonemeadow Farms apartments. There are upper-floor balconies at Stonemeadow Farms and three North Creek Trail receivers that exceed the FHWA NAC behind the existing noise wall. Additional wall height for these impacts would not be feasible because the upper-floor balconies and North Creek Trail receivers are not first-row receivers, and North Creek Trail receivers would not benefit from the proposed noise wall because of roadway traffic noise on 27th Avenue SE. Furthermore, ground-floor use areas are the primary area of concern when providing noise abatement, and noise walls are not typically designed to reduce noise levels at upper floors. Therefore, upgrading existing Wall NB7 would not be feasible or reasonable, and the height of this wall would remain unchanged.

4. Existing Noise Wall NW2

Wall NW2 is an existing noise wall along the WSDOT shoulder along southbound I-405 that protects single-family residences south of 228th Street SE. Three residential receivers exceed the FHWA NAC directly behind the existing noise wall. Increasing the noise wall height to 30 feet would not reduce noise levels below the NAC of 66 dBA for one residence (R547); therefore, upgrading existing Wall NW2 with additional height would not be feasible or reasonable, and the height of this wall would remain unchanged.

5.4 Construction Noise

Construction creates temporary noise and is usually carried out in reasonably discrete steps, each with its own mix of equipment and noise characteristics. Roadway construction typically involves clearing, cut-and-fill (grading) activities, removing old roadways, importing and compacting fill, paving, and pile driving.

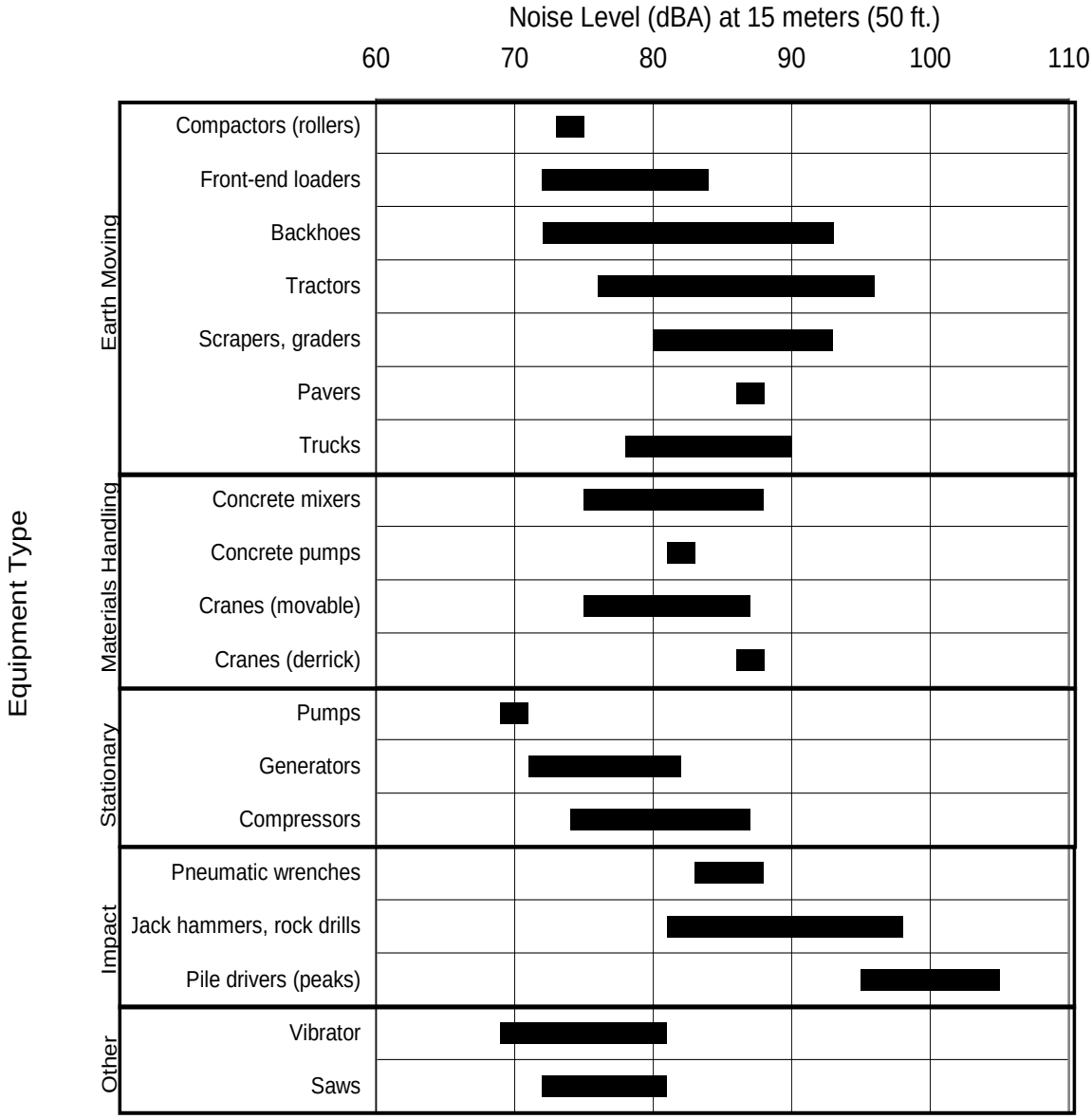
The most constant noise source at construction sites is usually engine noise. Mobile equipment generally operates intermittently or in cycles of operation, while stationary equipment, such as generators and compressors, generally operates at fairly constant sound levels. Trucks are present during most phases of construction and are not confined to one area, so noise from trucks may affect more receivers than other construction noise. Other common noise sources typically include impact equipment, which could be pneumatic, hydraulic, or electric-powered.

As noted in the list below, noise levels during the construction period depend on the type, amount, and location of construction activities.

- The type of construction methods establishes the maximum noise levels.
- The amount of construction activity establishes how often certain construction noises occur throughout the day.
- The location of construction equipment relative to adjacent properties determines the effect of distance in reducing construction noise levels.

The maximum noise levels of construction equipment are expected to be similar to the maximum construction equipment noise levels presented in Exhibit 5-35 and typically range from 69 to 106 dBA at 50 feet. As a point source, construction noise decreases by 6 dBA per doubling of distance from the source moving away from the equipment. The various pieces of equipment are almost never operating simultaneously at full power, and some would be powered off, idling, or operating at less than full power at any time. Therefore, the average L_{eq} noise levels would be less than aggregate of the maximum noise levels in Exhibit 5-35.

Exhibit 5-35. Construction Equipment Noise Ranges



Source: EPA, 1971 and WSDOT, 1991.

Construction noise is exempt from state and local property line regulations during daytime hours. If nighttime construction is required for the Project, WSDOT would apply for variances or exemptions from local noise ordinances for the night work from the local jurisdictions (WAC 173-60). Such noise variances or exemptions require construction noise abatement measures that vary by jurisdiction. If night work is necessary for the Project, noise variances or exemption may be needed from the following jurisdictions:

- Snohomish County
- King County
- City of Bothell

SECTION 6 MEASURES TO AVOID AND MINIMIZE EFFECTS

6.1 Operational Mitigation

Of the 17 locations where noise walls were evaluated along the project corridor, three noise walls were found to be reasonable and feasible using FHWA's noise abatement criteria (NAC). The proposed noise walls would reduce traffic noise levels below the NAC at 34 modeled receivers representing 43 residences.

- Wall East 2
- Wall East 6
- Wall West 7

The noise walls analyzed in this report were based on preliminary design and costs and should not be considered final. If conditions change substantially in final design, abatement measures would be reanalyzed. Final abatement decisions would also depend on the eligible property owners' desire for abatement.

6.2 Construction Mitigation

To reduce construction noise at nearby receptors, WSDOT will incorporate the following measures, where practicable, into construction plans and specifications:

- Construct proposed noise walls before other construction activities in specific areas.
- Equip construction equipment engines with mufflers, intake silencers, and engine enclosures, as appropriate.
- Turn off construction equipment during prolonged periods of nonuse to reduce noise.
- Locate stationary equipment away from receiving properties to decrease noise.
- Maintain all equipment and train equipment operators in good practices to reduce noise levels.
- Use Occupational Safety and Health Act-approved ambient sound-sensing backup alarms that could reduce disturbances from backup alarms during quieter periods.

SECTION 7 REFERENCES

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ATTACHMENT A ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
ADA	Americans with Disabilities Act
CFR	Code of Federal Regulations
dB	decibels
dBA	A-weighted decibel
EA	Environmental Assessment
EDNA	Environmental Designation for Noise Abatement
EPA	Environmental Protection Agency
ETL	express toll lane
FHWA	Federal Highway Administration
ft^2	square feet
HOV	high-occupancy vehicle
I-405	Interstate 405
L_{eq}	equivalent (average) noise level during a specified period of time
$L_{eq(h)}$	equivalent (average) noise level for an hourly period
L_{max}	maximum sound level
L_{min}	minimum sound level
L_n	n representing the percent of time that a sound level is exceeded
MP	milepost
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
OEO	Office of Equal Opportunity
RE	residential equivalency
SEPA	State Environmental Policy Act
SR	State Route
TNM	Traffic Noise Model
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

ATTACHMENT B TRAFFIC NOISE ANALYSIS AND ABATEMENT PROCESS

When are noise reports and/or recommendations final?

The noise abatement process, from preparation of a noise wall to the final noise wall design (or decision not to build), can be confusing. The following process attempts to provide some clarification to project teams and outlines a recommended "standard" process but acknowledges that variations to this process are likely because of the differences between projects.

Environmental Discipline Reports

The noise analyst works with the project team to model project elements affecting noise that include traffic, topography, and the location of noise-sensitive receivers. If traffic noise impacts are discovered through modeling, then abatement is evaluated.

Abatement is compared to the feasibility (constructability, effectiveness) and reasonableness (allowable barrier size/cost) for a "standard" project. If abatement is feasible and reasonable, the report recommends the optimal (cost to benefit) noise barrier.

After completion of the above, the traffic noise discipline report can be finalized.

Design Phase

The Design Phase steps described below and the Public Involvement steps described in the following section may be incorporated before the discipline report is finalized.

The project office reviews the recommended noise wall height and horizontal alignment to determine if there are any conflicts that were not realized when the discipline report was prepared.

If conflicts from utilities, steep slopes, etc. are present, the project team provides the details and costs of the conflicts to the noise analyst. The noise analyst will then add any additional ("but for" the noise wall) costs to the reasonableness evaluation. If noise wall costs, including accommodation of conflicts, are still less than the allowable costs for the noise wall, the barrier height and/or alignment are re-evaluated and a new barrier will be recommended. If barrier costs plus the new costs exceed the allowable costs, the barrier may not be recommended by the WSDOT Air, Noise, and Energy (ANE) Program.

If a noise wall is recommended, the ANE Program will review and confirm noise wall dimensions throughout the design process.

Public Involvement

If noise abatement is recommended in the Traffic Noise Discipline Report, public outreach to determine public desires for abatement must occur. The noise wall discussion may be introduced to the public before the Design Phase, but should happen after the noise wall

alignment, height, and length (or other abatement description) is established so that people can understand any impacts of the noise wall (or other abatement) on their community.

The final determination whether to construct a noise wall or other abatement that traffic noise analysis recommends cannot be made until public outreach has occurred.

Final Steps

Any updates to the Traffic Noise Discipline Report to clarify changes that occurred during the Design Phase or from Public Involvement can be made at the project engineering offices discretion. An addendum or supplementary memorandum to clarify changes can also be added to the discipline report or project file.

The noise wall is constructed or a letter from the ANE Program is added to the project file clarifying why a noise wall was not constructed.

Exhibit B-1. Measured Traffic Volumes during Validation Measurements

Measurement Site ID	Date of Measurement	Start Time	Count Duration (minutes)	Roadway of Measurement	Traffic Counts During Measurement							
					NB/EB				SB/WB			
					Total	Cars	MT	HT	Total	Cars	MT	HT
1	8/27/2018	10:25 a.m.	15	405: 160th St. overpass west	*4,284*	3,924	164	196	*4,436*	4,000	276	160
2	8/27/2018	10:24 a.m.	15	405: 160th St. overpass west	*4,284*	3,924	164	196	*4,436*	4,000	276	160
3	8/27/2018	11:01 a.m.	15	405: 160th St. overpass west	*4,284*	3,924	164	196	*4,436*	4,000	276	160
4	8/27/2018	11:03 a.m.	15	405: 160th St. overpass west	*4,284*	3,924	164	196	*4,436*	4,000	276	160
5	8/27/2018	1:02 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
6	8/27/2018	12:57 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
7	8/27/2018	1:38 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
8	8/27/2018	1:35 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
9	8/27/2018	2:29 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
10	8/27/2018	2:26 p.m.	15	405: 160th St. overpass east	*5,100*	4,792	140	168	*4,412*	4,140	148	124
11	8/28/2018	11:25 a.m.	15	405: Juanita Drive I/C	*5,156*	4,756	168	232	*3,964*	3,572	248	144
12	8/28/2018	12:11 p.m.	15	405: S. of Juanita Drive I/C	*5,156*	4,756	168	232	*3,964*	3,572	248	144
13	8/28/2018	12:12 p.m.	15	405: S. of Juanita Drive I/C	*5,156*	4,756	168	232	*3,964*	3,572	248	144
14	8/28/2018	1:50 p.m.	15	405: N of Juanita Drive I/C	*5,080*	4,900	84	96	*5,264*	4,928	200	136
15	8/28/2018	1:53 p.m.	15	405: N of Juanita Drive I/C	*5,080*	4,900	84	96	*5,264*	4,928	200	136
16	8/29/2018	12:25 p.m.	15	405: MP 23.93	*4,544*	4,120	164	260	*3,608*	3,276	108	224
17	8/29/2018	1:15 p.m.	15	405: MP 24.52	*4,356*	3,980	200	176	*3,584*	3,340	112	132
18	8/29/2018	1:55 p.m.	15	405 MP 24.52	*4,448*	4,136	100	212	*3,912*	3,716	96	100
19	8/29/2018	2:43 p.m.	15	405 MP 24.52	*4,444*	4,148	120	176	*5,044*	4,868	88	88
20	8/29/2018	3:05 p.m.	15	405 MP 24.52	*4,444*	4,148	120	176	*5,044*	4,868	88	88
21	9/4/2018	10:00 a.m.	15	405 MP 24.52	*2,960*	2,708	108	144	*3,808*	3,520	116	172
22	9/4/2018	10:18 a.m.	15	405 MP 24.52	*3,288*	2,952	124	212	*3,768*	3,392	176	200

Exhibit B-1. Measured Traffic Volumes during Validation Measurements

Measurement Site ID	Date of Measurement	Start Time	Count Duration (minutes)	Roadway of Measurement	Traffic Counts During Measurement							
					NB/EB				SB/WB			
					Total	Cars	MT	HT	Total	Cars	MT	HT
23	9/4/2018	10:57 a.m.	15	405 MP 24.52	*3,652*	3,192	196	264	*2,648*	2,332	164	152
24	9/4/2018	10:59 a.m.	15	405 MP 24.52	*3,652*	3,192	196	264	*2,648*	2,332	164	152
25	9/4/2018	12:15 p.m.	15	405 MP 24.52	*3,720*	3,412	156	152	*3,032*	2,756	140	136
26	9/4/2018	12:07 p.m.	15	405 MP 24.52	*3,692*	3,364	164	164	*2,728*	2,480	108	140
27	9/4/2018	12:58 p.m.	15	405 MP 24.52	*3,552*	3,224	112	216	*3,112*	2,872	124	116
28	9/4/2018	1:01 p.m.	15	405 MP 24.52	*3,552*	3,224	112	216	*3,112*	2,872	124	116
29	9/5/2018	10:03 a.m.	15	405 MP 26.18	*3,376*	2,984	168	224	*4,148*	3,832	156	160
30	9/5/2018	10:28 a.m.	15	405 MP 26.18	*3,320*	3,004	168	148	*3,908*	3,560	140	208
31	9/5/2018	11:05 a.m.	15	405 MP 26.18	*3,552*	3,244	156	152	*3,896*	3,612	108	176
32	9/5/2018	11:30 a.m.	15	405 MP 26.18	*3,820*	3,496	164	160	*3,852*	3,568	128	156
33	9/5/2018	12:36 p.m.	15	405 MP 24.52	*3,888*	3,560	204	124	*3,716*	3,436	144	136
34	9/5/2018	13:03 p.m.	15	405 MP 24.52	*3,888*	3,560	204	124	*3,716*	3,436	144	136
35	9/6/2018	10:56 a.m.	15	405 MP 24.52	*3,708*	3,288	196	224	*2,624*	2,328	168	128
36	9/6/2018	12:28 p.m.	15	405 MP 24.52	*3,884*	3,548	164	172	*3,156*	2,908	124	124
37	9/6/2018	1:08 p.m.	15	405 MP 24.52	*3,924*	3,712	120	92	*3,968*	3,684	200	84
38	9/6/2018	1:48 p.m.	15	405 SR 527 Interchange	*3,924*	3,712	120	92	*3,968*	3,684	200	84
39	9/6/2018	2:08 p.m.	15	405 SR 527 Interchange	*3,924*	3,712	120	92	*3,968*	3,684	200	84
40	9/10/2018	10:17 a.m.	15	405 MP 26.74	*2,472*	2,164	144	164	*2,856*	2,556	140	160
41	9/10/2018	10:18 a.m.	15	405 MP 26.74	*2,472*	2,164	144	164	*2,856*	2,556	140	160
42	9/10/2018	11:14 a.m.	15	405 MP 26.74	*2,792*	2,512	108	172	*2,632*	2,284	152	196
43	9/10/2018	11:15 a.m.	15	405 MP 26.74	*2,792*	2,512	108	172	*2,632*	2,284	152	196
49	9/13/2018	11:34 a.m.	15	405 195th Interchange	*2,824*	2,684	84	56	*2,944*	2,736	148	60

Exhibit B-1. Measured Traffic Volumes during Validation Measurements

Measurement Site ID	Date of Measurement	Start Time	Count Duration (minutes)	Roadway of Measurement	Traffic Counts During Measurement							
					NB/EB				SB/WB			
					Total	Cars	MT	HT	Total	Cars	MT	HT
54	8/28/2018	11:25 a.m.	15	405: S. of Juanita Drive I/C	*5,156*	4,756	168	232	*3,964*	3,572	248	144

EB = eastbound; NB = northbound, SB = southbound, WB = westbound

Exhibit B-2. Modeled Hourly Traffic Volumes for Existing Conditions

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
MAINLINE										
SR 522 I-405 to SR 202	*3,554*	3,412	71	71	60	*3,133*	3,008	63	63	60
SR 522 Campus Way to I-405	*1,686*	1,618	34	34	35	*806*	774	16	16	35
I-405 HOV NE 132nd St to NE 160th St	*2,104*	2,104	-	-	60	*1,120*	1,120	-	-	60
I-405 HOV NE 160th St to SR 522	*1,133*	1,133	-	-	60	*892*	892	-	-	60
I-405 HOV SR 522 to NE 195th St	*1,183*	1,183	-	-	60	*910*	910	-	-	60
I-405 HOV NE 195th St to SR 527	*1,092*	1,092	-	-	60	*933*	933	-	-	60
I-405 HOV SR 527 to I-5	*1,146*	1,146	-	-	60	*851*	851	-	-	60
I-405 NE 132nd St to NE 160th St	*4,812*	4,523	144	144	60	*4,265*	4,009	128	128	60
I-405 NE 160th St to SR 522	*3,437*	3,265	86	86	60	*5,023*	4,772	126	126	60
I-405 SR 522 to NE 195th St	*3,103*	2,948	78	78	60	*3,865*	3,633	116	116	60
I-405 NE 195th St to SR 527	*4,312*	4,139	86	86	60	*3,574*	3,360	107	107	60
I-405 SR 527 to I-5	*3,574*	3,431	71	71	60	*3,546*	3,334	106	106	60
RAMPS										

Exhibit B-2. Modeled Hourly Traffic Volumes for Existing Conditions

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
NB Off-Ramp to NE 160th St	*413*	400	6	6	40	-	-	-	-	-
NB On-Ramp from NE 160th St	*430*	417	6	6	60	-	-	-	-	-
NB On-Ramp from NE 160th St to SR 522	*478*	464	7	7	40	-	-	-	-	-
NB Off-Ramp to SR 522	*2,226*	2,137	45	45	40	-	-	-	-	-
SB Off-Ramp to NE 160th St	-	-	-	-	-	*880*	836	22	22	40
SB On-Ramp from NE 160th St	-	-	-	-	-	337	324	7	7	60
NB I-405 to EB SR 522	1,897	1,821	38	38	40	-	-	-	-	-
NB I-405 to WB SR 522	703	682	11	11	40	-	-	-	-	-
WB SR 522 to NB I-405	-	-	-	-	-	822	798	12	12	40
EB SR 522 to NB I-405	113	110	2	2	25	-	-	-	-	-
SB I-405 to WB SR 522	-	-	-	-	-	115	109	3	3	50
SB I-405 to EB SR 522	-	-	-	-	-	808	768	20	20	30
EB SR 522 to SB I-405	723	687	18	18	35	-	-	-	-	-
WB SR 522 to SB I-405	-	-	-	-	-	1,506	1,430	38	38	50
NB CD Off-Ramp to SR 522	2,600	2,496	52	52	40	-	-	-	-	-
NB Off-Ramp to 195th Street	595	571	12	12	35	-	-	-	-	-
NB CD from NB I-405 and WB SR 522	1,290	1,238	26	26	40	-	-	-	-	-
NB 405 Off-Ramp to NE 195th St/SR 522 CD	468	449	9	9	35	-	-	-	-	-
NB On-Ramp from WB SR 522 at NE 195th St	695	668	14	14	60	-	-	-	-	-
NB On-Ramp from NE 195th St	559	542	8	8	60	-	-	-	-	-

Exhibit B-2. Modeled Hourly Traffic Volumes for Existing Conditions

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
SB Off-Ramp to NE 195th St	-	-	-	-	-	326	310	8	8	40
SB On-Ramp from NE 195th St	-	-	-	-	-	651	618	16	16	60
NB Off-Ramp to SR 527	1,634	1,585	25	25	50/45	-	-	-	-	-
NB On-Ramp from EB SR 527	463	449	7	7	20	-	-	-	-	-
NB On-Ramp from WB SR 527	466	453	7	7	60	-	-	-	-	-
SB Off-Ramp to SR 527	-	-	-	-	-	979	931	24	24	55/20
SB On-Ramp from WB SR 527	-	-	-	-	-	*705*	677	14	14	20
SB On-Ramp from EB SR 527	-	-	-	-	-	*408*	392	8	8	20/60
LOCAL ROADS										
SR 527 from 220th to 214th	1,925	1,867	29	29	45	1,385	1,343	21	21	45
SR 527 from NB Ramps to 220th	1,930	1,872	29	29	45	2,345	2,275	35	35	45
SR 527 from SB Ramps to NB Ramps	1,510	1,465	23	23	40	2,290	2,221	34	34	40
SR 527 from 228th to SB Ramps	1,620	1,571	24	24	40	2,230	2,163	33	33	40
17th from Business Driveways to 220th	335	335	-	-	30	225	225	-	-	30
17th Park and Ride to Business Driveways	150	150	-	-	30	60	60	-	-	30
17th Park and Ride	-	-	-	-	-	25	25	-	-	30
220th from 527 to 17th	330	314	8	8	25	900	873	14	14	25
27th Ave from SE 35th Ave to 228th	395	383	6	6	30	280	272	4	4	30
195th from NB Ramps to North Creek Pkwy	975	946	15	15	30	1,525	1,479	23	23	30
195th from SB Ramps to NB Ramps	620	601	9	9	30	1,250	1,213	19	19	30

Exhibit B-2. Modeled Hourly Traffic Volumes for Existing Conditions

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
195th from 112th Ave to SB Ramps	595	577	9	9	30	775	752	12	12	30
160th from NB Ramps to 116th Ave	935	907	14	14	35	1,225	1,176	25	25	35
160th from SB Ramps to NB Ramps	1,110	1,077	17	17	35	765	742	11	11	35
NE 160th St from Driveways to SB Ramps	795	771	12	12	35	1,055	1,023	16	16	35
228th Street West of 19th Ave	962	942	10	10	30	1,368	1,352	8	8	30
228th Street East of 19th Ave	905	887	9	9	35	1,269	1,257	6	6	35

EB = eastbound; NB = northbound, SB = southbound, WB = westbound

Exhibit B-3. Modeled Hourly Traffic Volumes for No Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
MAINLINE										
SR 522 I-405 to SR 202	*5,479*	5,260	110	110	60	*4,715*	4,526	94	94	60
SR 522 Campus Way to I-405	*3,152*	3,024	64	64	35	*2,062*	1,978	42	42	35
I-405 HOV NE 132nd St to NE 160th St	*3,719*	3,719	-	-	60	*2,014*	2,014	-	-	60
I-405 HOV NE 160th St to SR 522	*1,996*	1,996	-	-	60	*1,252*	1,252	-	-	60
I-405 HOV SR 522 to NE 195th St	*2,008*	2,008	-	-	60	*1,252*	1,252	-	-	60
I-405 HOV NE 195th St to SR 527	*1,528*	1,528	-	-	60	*1,483*	1,483	-	-	60

Exhibit B-3. Modeled Hourly Traffic Volumes for No Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
I-405 HOV SR 527 to I-5	*1,528*	1,528	-	-	60	*1,069*	1,069	-	-	60
I-405 NE 132nd St to NE 160th St	*5,075*	4,771	152	152	60	*4,204*	3,952	126	126	60
I-405 NE 160th St to SR 522	*3,846*	3,654	96	96	60	*5,498*	5,223	137	137	60
I-405 SR 522 to NE 195th St	*3,341*	3,174	84	84	60	*4,124*	3,918	103	103	60
I-405 NE 195th St to SR 527	*5,357*	5,143	107	107	60	*3,640*	3,422	109	109	60
I-405 SR 527 to I-5	*4,247*	4,077	85	85	60	*3,809*	3,580	114	114	60
RAMPS										
NB Off-Ramp to NE 160th	*797*	781	8	8	40	-	-	-	-	-
NB On-Ramp from NE 160th	*381*	370	6	6	60	-	-	-	-	-
NB On-Ramp from NE 160th to SR 522	*589*	571	9	9	40	-	-	-	-	-
NB Off-Ramp to SR 522	*2,537*	2,461	38	38	40	-	-	-	-	-
SB Off-Ramp to NE 160th	-	-	-	-	-	*885*	841	22	22	40
SB On-Ramp from NE 160th	-	-	-	-	-	*354*	343	5	5	60
NB I-405 to EB SR 522	*2,199*	2,133	33	33	40	-	-	-	-	-
NB I-405 to WB SR 522	*926*	898	14	14	40	-	-	-	-	-
WB SR 522 to NB I-405	-	-	-	-	-	*874*	848	13	13	40
EB SR 522 to NB I-405	*126*	122	2	2	25	-	-	-	-	-
SB I-405 to WB SR 522	-	-	-	-	-	*151*	143	4	4	50
SB I-405 to EB SR 522	-	-	-	-	-	*983*	934	25	25	30
EB SR 522 to SB I-405	*727*	698	15	15	35	-	-	-	-	-

Exhibit B-3. Modeled Hourly Traffic Volumes for No Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
WB SR 522 to SB I-405	-	-	-	-	-	*1,781*	1,710	36	36	50
NB CD Off to SR 522	*3,126*	3,032	47	47	40	-	-	-	-	-
NB Off to NE 195th Street	*619*	600	9	9	35	-	-	-	-	-
NB CD from NB I-405 and WB SR 522	*1,493*	1,448	22	22	40	-	-	-	-	-
NB 405 Off-Ramp to NE 195th St/SR 522 CD	*619*	600	9	9	35	-	-	-	-	-
NB On-Ramp from WB SR 522 at NE 195th St	*874*	848	13	13	60	-	-	-	-	-
NB On-Ramp from NE 195th St	*662*	642	10	10	60	-	-	-	-	-
SB Off-Ramp to NE 195th St	-	-	-	-	-	*422*	401	11	11	40
SB On-Ramp from NE 195th St	-	-	-	-	-	*675*	648	14	14	60
NB Off-Ramp to SR 527	*2,022*	1,961	30	30	50/45	-	-	-	-	-
NB On-Ramp from EB SR 527	*457*	444	7	7	20	-	-	-	-	-
NB On-Ramp from WB SR 527	*455*	442	7	7	60	-	-	-	-	-
SB Off-Ramp to SR 527	-	-	-	-	-	*1,142*	1,085	29	29	55/20
SB On-Ramp from WB SR 527	-	-	-	-	-	*843*	809	17	17	20
SB On-Ramp from EB SR 527	-	-	-	-	-	*544*	522	11	11	20/60
LOCAL ROADS										
SR 527 from 220th to 214th	2,400	2,352	24	24	45	1,708	1,688	10	10	45
SR 527 from NB Ramps to 220th	2,232	2,190	21	21	45	2,776	2,748	14	14	45
SR 527 from SB Ramps to NB Ramps	1,655	1,605	25	25	40	2,760	2,677	41	41	40
SR 527 from 228th to SB Ramps	1,880	1,824	28	28	40	2,645	2,566	40	40	40

Exhibit B-3. Modeled Hourly Traffic Volumes for No Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
17th from Business Driveways to 220th	500	500	-	-	30	315	315	-	-	30
17th Park and Ride to Business Driveways	150	150	-	-	30	60	60	-	-	30
17th Park and Ride Lane	-	-	-	-	-	25	25	-	-	-
220th from 527 to 17th	525	499	13	13	25	1,175	1,140	18	18	25
27th Ave from SE 35th Ave to 228th	610	592	9	9	30	485	470	7	7	30
195th from NB Ramps to North Creek Pkwy	980	951	15	15	30	1,595	1,547	24	24	30
195th from SB Ramps to NB Ramps	730	708	11	11	30	1,330	1,290	20	20	30
195th from 112th Ave to SB Ramps	750	728	11	11	30	945	917	14	14	30
160th from NB Ramps to 116th Ave	1,275	1,237	19	19	35	1,450	1,392	29	29	35
160th from SB Ramps to NB Ramps	1,400	1,358	21	21	35	1,090	1,057	16	16	35
160th from Driveways to SB Ramps	1,065	1,033	16	16	35	1,290	1,251	19	19	35
228th Street West of 19th Ave	1,156	1,132	12	12	30	1,526	1,510	8	8	30
228th Street East of 19th Ave	1,490	1,460	15	15	35	1,694	1,678	8	8	35

EB = eastbound; NB = northbound, SB = southbound, WB = westbound

Exhibit B-4. Modeled Hourly Traffic Volumes for Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
MAINLINE										
SR 522 I-405 to SR 202	5,825	5,614	106	106	60	4,837	4,653	92	92	60
SR 522 Campus Way to I-405	3,050	2,938	56	56	35	3,094	2,974	60	60	35
I-405 HOV NE 132nd St to NE 160th St	3,797	3,797	-	-	60	2,058	2,058	-	-	60
I-405 NE 132nd St to NE 160th St	5,507	5,240	134	134	60	4,290	4,041	125	125	60
I-405 HOV NE 160th St to SR 522	3,500	3,500	-	-	60	1,672	1,672	-	-	60
I-405 NE 160th St to SR 522	3,413	3,248	82	82	60	5,191	4,912	139	139	60
I-405 HOV SR 522 to NE 195th St	2,495	2,495	-	-	60	1,377	1,377	-	-	60
I-405 SR 522 to NE 195th St	3,126	2,975	75	75	60	4,114	3,898	108	108	60
I-405 HOV NE 195th St to SR 527	2,519	2,519	-	-	60	1,498	1,498	-	-	60
I-405 SR 527 to I-5	4,039	3,874	83	83	60	3,647	3,439	104	104	60
I-405 HOV SR 527 to I-5	1,709	1,709	-	-	60	1,157	1,157	-	-	60
I-405 NE 195th St to SR 527	4,648	4,448	100	100	60	3,725	3,515	105	105	60
RAMPS										
NB Off-Ramp to NE 160th	761	747	7	7	40	-	-	-	-	-
NB On-Ramp from NE 160th	410	397	6	6	60	-	-	-	-	-
NB On-Ramp from NE 160th to SR 522	775	752	11	11	40	-	-	-	-	-
NB Off-Ramp to SR 522	2,039	1,944	48	48	40	-	-	-	-	-
SB Off-Ramp to NE 160th St	-	-	-	-	-	878	837	21	21	40
SB On-Ramp from NE 160th St	-	-	-	-	-	363	352	6	6	60

Exhibit B-4. Modeled Hourly Traffic Volumes for Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
NB I-405 to EB SR 522	1,977	1,892	42	42	40	-	-	-	-	-
NB I-405 to WB SR 522	*837*	806	16	16	40	-	-	-	-	-
WB SR 522 to NB I-405	-	-	-	-	-	*777*	750	14	14	40
EB SR 522 to NB I-405	*122*	118	2	2	25	-	-	-	-	-
NB Direct Access Off-Ramp to SR 522	*906*	906	-	-	40	-	-	-	-	-
NB Direct Access On-Ramp from SR 522	*279*	279	-	-	40	-	-	-	-	-
SB Direct Access Off-Ramp to SR 522	-	-	-	-	-	*260*	260	-	-	40
SB Direct Access On-Ramp from SR 522	-	-	-	-	-	*503*	503	-	-	40
SB I-405 to WB SR 522	*138*	130	4	4	50	-	-	-	-	-
SB I-405 to EB SR 522	*834*	786	24	24	30	-	-	-	-	-
EB SR 522 to SB I-405	*639*	606	17	17	35	-	-	-	-	-
WB SR 522 to SB I-405	-	-	-	-	-	*1,462*	1,376	43	43	50
NB CD Off to SR 522	*2,814*	2,701	56	56	40	-	-	-	-	-
NB Off-Ramp to NE 195th Street	*664*	651	7	7	35	-	-	-	-	-
NB CD from NB I-405 and WB SR 522	*1,563*	1,516	23	23	40	-	-	-	-	-
NB 405 Off-Ramp to NE 195th St/SR 522 CD	*664*	651	7	7	35	-	-	-	-	-
NB On-Ramp from WB SR 522 at NE 195th	*899*	863	18	18	60	-	-	-	-	-
NB On-Ramp from NE 195th	*647*	627	10	10	60	-	-	-	-	-
SB Off-Ramp to NE 195th	-	-	-	-	-	*431*	411	10	10	40
SB On-Ramp from NE 195th	-	-	-	-	-	*699*	671	14	14	60

Exhibit B-4. Modeled Hourly Traffic Volumes for Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
NB Off-Ramp to SR 527	*1,659*	1,609	25	25	50	-	-	-	-	-
NB On-Ramp from EB SR 527	*387*	375	6	6	20	-	-	-	-	-
NB On-Ramp from WB SR 527	*346*	336	5	5	60	-	-	-	-	-
SB Off-Ramp to SR 527	-	-	-	-	-	*966*	920	23	23	55
SB On-Ramp from WB SR 527	-	-	-	-	-	*668*	637	15	15	20
SB On-Ramp from EB SR 527	-	-	-	-	-	*477*	460	9	9	20
NB Direct Access Off-Ramp to Canyon Park	*622*	609	12	-	30	-	-	-	-	-
NB Direct Access On-Ramp from Canyon Park	*129*	127	3	-	30	-	-	-	-	-
SB Direct Access Off-Ramp to Canyon Park	-	-	-	-	-	*204*	200	4	-	30
SB Direct Access On-Ramp from Canyon Park	-	-	-	-	-	*445*	436	9	-	30
LOCAL ROADS										
SR 527 from 220th to 214th	*2,615*	2,589	13	13	45	*1,810*	1,792	9	9	45
SR 527 from NB Ramps to 220th	*1,955*	1,916	20	20	45	*2,585*	2,559	13	13	45
SR 527 from SB Ramps to NB Ramps	*1,680*	1,663	8	8	45	*2,570*	2,544	13	13	45
SR 527 from 228th to SB Ramps	*1,895*	1,857	19	19	45	*2,635*	2,609	13	13	45
17th from Business Driveways to 220th	*1,250*	1,250	-	-	30	*865*	865	-	-	30
17th Park and Ride to Business Driveways	*975*	975	-	-	30	*660*	660	-	-	30
17th Park and Ride Lane	*25*	25	-	-	30	-	-	-	-	30
17th from Park and Ride to DA Ramps	*780*	764	16	0	30	*595*	583	12	0	30
220th from SR 527 to 17th	*920*	874	23	23	25	*1,790*	1,772	9	9	25

Exhibit B-4. Modeled Hourly Traffic Volumes for Build Alternative

Roadway Segment	Modeled Traffic									
	NB/EB					SB/WB				
	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)	Total	Automobile	Medium Truck	Heavy Truck	Speed (mph)
SE 27th Ave from SE 35th Ave to 228th	*625*	619	3	3	30	*490*	480	5	5	30
NE 195th from NB Ramps to North Creek Pkwy	*930*	921	5	5	30	*1,595*	1,579	8	8	30
NE 195th from SB Ramps to NB Ramps	*740*	725	7	7	30	*1,305*	1,292	7	7	30
NE 195th from 112th Ave to SB Ramps	*750*	728	11	11	30	*875*	858	9	9	30
NE 160th from NB Ramps to 116th Ave	*1,305*	1,279	13	13	35	*1,585*	1,522	32	32	35
NE 160th from SB Ramps to NB Ramps	*1,475*	1,431	22	22	35	*1,130*	1,096	17	17	35
NE 160th from Driveways to SB Ramps	*1,160*	1,125	17	17	35	*1,315*	1,302	7	7	35
228th Street	*1,494*	1,480	7	7	35	*1,710*	1,676	17	17	35

EB = eastbound; NB = northbound, SB = southbound, WB = westbound

ATTACHMENT C RESIDENTIAL EQUIVALENCY

WSDOT calculates reasonableness based on the number of residences that benefit from a noise wall. For noise-sensitive uses other than residences, a residential equivalency (RE) of the users is calculated, based on the usage factor and number of users (WSDOT 2011). Residences may be in use at all times, but many other facilities such as schools have specific hours of operation. The usage factor accounts for the times of operation. Exhibit C-1 shows typical usage factors. In Washington, the average household has 2.55 members, so for sites use other than residential, the usage factor is multiplied by the number of users and then divided by 2.55 to convert to an equivalent number of households (Census 2017). Exhibit C-2 presents the residential equivalencies calculated for this report.

Exhibit C-1. WSDOT Established Usage Factors

Site	Hours/Day	Days/Week	Months/Year	Usage Factor
Homes	24	7	12	1
Apartments	24	7	12	1
Hospitals	24	7	12	1
Churches	6	3	12	0.11
Schools	10	5	9	0.22
Parks	10	5	5	0.17
Trails	9	7	12	0.375

Exhibit C-2. Residential Equivalency

Modeled Noise Receivers	Activity Description	Number of Users	Usage Factor	Users to Households Factor	Residential Equivalency
R59	High Woodlands - Private Playground	25	0.17	2.55	2
R60	High Woodlands - Private Tennis Court	8	0.25	2.55	1
R61	High Woodlands - Private Pool	25	0.15	2.55	1
R115-118	Tolt Pipeline Trail	30	0.38	2.55	4
R210	Cedar Park Christian School - Chapel Garden	10	0.22	2.55	1
R211	Cedar Park Christian - School Playground	25	0.22	2.55	2
R325-R341	Sammamish River Trail	110	0.38	2.55	16
R342-R343, R352, R354-R355, R359, R361, R388, R393, R395-R396, R398, R400, R403, R405, R407, R409, R413, R417, R419, R421, R459, R463, R469, R480, R486, R492	North Creek Trail	27	0.38	2.55	4
R348	Office Building - Outdoor Seating Area	40	0.15	2.55	2
R349	Office Area - Bike Path	10	0.38	2.55	1
R350	Country Inn & Suites - Courtyard Pool/Outdoor Sitting Area	5	0.67	2.55	1
R351	The Center for Bird & Exotic Animal Clinic - Outdoor Seating Area	4	0.29	2.55	1
R353	Menchie's Frozen Yogurt - Outdoor seating	6	0.38	2.55	1
R362	Baseball Field	20	0.25	2.55	2
R363	Bright Horizons Daycare - Playground	25	0.22	2.55	2
R365	North Creek Heights - Private Tennis Court/Pool	25	0.25	2.55	2
R390	Islamic Center of Bothell - Private Playground	25	0.11	2.55	1

Exhibit C-2. Residential Equivalency

Modeled Noise Receivers	Activity Description	Number of Users	Usage Factor	Users to Households Factor	Residential Equivalency
R411	Canyon Park Middle School - Athletic Track	30	0.22	2.55	3
R560	Playground	25	0.25	2.55	2
R572-R573	Kiddie Academy - Playgrounds	25	0.36	2.55	4
R651	Salted Grape Café - Outdoor Seating Area	10	0.24	2.55	1
R653	Extended Stay America - Courtyard Pool/Outdoor Sitting Area	5	0.67	2.55	1
R654	McDonalds - Outdoor Seating Area	16	0.83	2.55	5
R655	Starbucks - Outdoor Seating Area	16	0.63	2.55	4
R656	Rama House - Outdoor Seating Area	16	0.42	2.55	3
R657	Canyon Hills Community Church - Outdoor Seating Area	100	0.11	2.55	4
R658	Office Park - Tennis Court/Outdoor Seating Area	36	0.18	2.55	3
R662	Providence Apartments - Private Pool	25	0.17	2.55	2
R663	Qdoba - Outdoor Seating Area	16	0.46	2.55	3
R665	Hilton Garden Inn - Courtyard	5	0.67	2.55	1

ATTACHMENT D FIELD DATA SHEETS

Field data sheets for the noise analysis are available upon request.