Noise Discipline Report – Final

US 395 North Spokane Corridor Project

WSDOT—Environmental Services—Air, Noise, Energy

September 16, 2019

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Washington State Department of Transportation

US 395 North Spokane Corridor Project

I-90 to US 395 MP 158.51

I-90 MP 282.37 to 285.59

Noise Discipline Report – Final

September 16, 2019

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Project Objectives

The segment of US 395 North Spokane Corridor (NSC) will consist of constructing a new interchange on I-90, a four-lane divided highway to a new US 395 NSC interchange at SR 290 (Trent Avenue) vicinity in Spokane (I-90 to US 395 MP 158.51 and I-90 MP 282.37 to 285.59, Exhibit 1). The interchange on I-90 includes I-90 mainline braided ramps from the N. Nevada Street/N. Hamilton Street Interchange to the Sprague Avenue Interchange, city street improvements, utility relocates, drainage, bike path improvements, and traffic control systems. The four-lane divided highway between I-90 and SR 290 will be an elevated structure. The NSC/SR 290 partial interchange will consist of a southbound off-ramp and a northbound on-ramp. Additional work at this interchange includes city street improvements, utility relocations, retaining walls, drainage, paving, and sidewalks. The NSC will continue as an elevated four-lane divided highway to E. Mission Avenue vicinity, which is the limit for this noise study.

Improvements associated with this project will improve mobility by allowing motorists and freight to move north and south through metropolitan Spokane from I-90 to US 395. The Washington State Department of Transportation (WSDOT) has identified that once complete, the proposed NSC will decrease travel time, fuel usage, and congestion, while improving safety by reducing collisions on local arterials.

The NSC is considered a multi-modal corridor. As a freeway it maximizes vehicle capacity and contributes to freight hauling competitiveness by moving vehicles and freight traffic away from local arterials and onto a free-flowing freeway. The proposed project supports alternative transportation choices by providing: for future park-and-ride lots and vanpooling operations. It reserves enough right-of-way for high-capacity transit and provides a pedestrian/bicycle trail along its full length.

The proposed scope of the project includes the following:

- Shifts the current US 395 freeway alignment slightly to the east within the same Final Environmental Impact Statement (FEIS) footprint.
- Constructs sign structures, illumination, intelligent transportation systems (ITS) and other supporting project features, as required.
- Interchange improvements at I-90 and at SR 290 (Trent Avenue).
- Construct four-lane divided highway from I-90 to Mission Avenue.

The US 395 North Spokane Corridor Project (the project) is located within the city limits of Spokane and Spokane Valley, in Spokane County, Washington. The project will extend the future US 395 alignment to reach I-90 to the south and add connections to US 395 and I-90 onto vacant and vacated land to supporting project features as required. The shift of the existing highway alignment and capacity improvements included in the project are defined as Type I activities for noise analysis purposes as defined by the Federal Highway Administration (FHWA) and WSDOT.

Current Noise Environment

- The project area is located within current and planned future WSDOT right-of-way with single- and multi-family residential, mobile home communities, commercial, and light industrial development in the noise study area. Other land uses located within the noise study area include Liberty Park, Sheridan Elementary School, Libby Center School, Journey Church, Mt. Zion Holiness Church, St. Ann's Catholic Church, Mt. Olive Baptist Church, Korean Presbyterian Church of Spokane, Our Lady of Kazan Russian Orthodox Church, Liberty Park Community Development Center, Ben Burr Trail, Liberty Park Trail, trail and rest area west of the I-90/SR 290 Interchange, and new trail connections to a regional trail network. Surrounding land use includes areas of undeveloped land with predominately residential and vacant land located throughout the area. No existing noise walls are located within the noise study area.
- The primary noise source along the I-90 portion of the noise study area is vehicle traffic noise on I-90. Local road noise, noise from commercial and light industrial businesses, and noise from nearby railyards are often the primary noise sources in the areas located along the US 395 portion of the noise study area. Short-term noise events from the nearby Burlington Northern Railroad tracks and railyard, aircraft flying to and from Spokane International Airport located several miles to the southwest, commercial businesses, and traffic on side streets all contribute to the noise levels in the study area.

Noise Impacts Considering the New Alignment

- Existing condition (2018) noise abatement criteria impacts—161 residences, Liberty Park Trail, an unnamed trail and rest area west of the I-90/SR 290 Interchange, a new trail north of I-90 east of S. Freya St., and two outdoor areas at the Trailer Inns RV Park, represented by 159 modeling sites would approach or exceed the NAC.
- No Build (2040) noise abatement criteria impacts—198 residences and the same outdoor use areas as described for impacts under existing conditions represented by 176 modeling sites (includes all 159 modeling locations with NAC impacts under existing condition) would approach or exceed the NAC.
- Build (2040) noise abatement criteria impacts—81 residences and the same outdoor use locations as described for impacts under existing conditions represented by 76 modeling sites which includes 64 of the same modeling sites with NAC impacts under existing condition and 67 of the same modeling sites with NAC impacts under No Build 2040. The reduction in the number of impacted receivers with the future project alignment is primarily due to planned acquisition of additional parcels in-close-proximity to project improvements.
- Build (2040) – substantial increase impacts (of 10 dBA or greater over existing noise levels) would occur at 15 residences represented by 15 modeling sites. Noise abatement criteria impacts are not predicted at any of the 15 sites with substantial increase impacts.
- With noise abatement criteria impacts not predicted at any of the 15 sites with substantial increase impacts, the total 2040 Build combined impacts at discrete locations is 91 receivers representing 96 residences and the four outdoor use areas.

Abatement Recommended

Noise abatement was considered at nine locations where traffic noise impacts were predicted. Noise barriers were evaluated to reduce noise levels at all nine locations (15 noise barrier alignments) where future noise levels would approach or exceed the NAC and/or result in substantial increase impacts of noise level increases of 10 dBA or more over existing noise levels. Five locations (seven noise barrier alignments) where noise barriers were evaluated would meet WSDOT Criteria for the placement of a feasible noise barrier. However, none of the five locations that met WSDOT Criteria of a feasible noise barrier met WSDOT Reasonableness Criteria, therefore no abatement is recommended.

Project Construction and Future Planning

During project construction, areas adjacent to the project would be exposed to construction noise in addition to traffic-related noise. Impacts during construction are of short duration, and standard specifications for noise control would minimize or eliminate impacts during construction.

A copy of this final report will be made available to local jurisdictions by WSDOT. This report will serve to inform the local planning departments of the effects of the highway and highway-construction-related noise in the area studied. The information contained within this report can assist local officials in their planning process.

At the time of this report, several undeveloped or vacant lots were located near the proposed project improvements. Per the WSDOT Traffic Noise Policy, if building permits have been submitted for undeveloped properties, the proposed development needs to be included in the noise study. A review of the Cities of Spokane and Spokane Valley and Spokane County's land use and building permits was conducted in July 2019. The review identified four active permits or approvals on file with City of Spokane for areas within 1,000 feet of the project. One of four of the permits identified includes a noise sensitive land use within the noise study area. One future development that includes one noise-regulated land uses (a single-family residence) has been considered in this noise study. More information on related research conducted at the time of this report is presented in Appendix B of this report.

Based on the modeling results and future traffic volumes and speeds included in this report, areas within 300 to 400 feet of the proposed project improvements may experience noise levels that exceed the WSDOT residential noise abatement criteria of 66 dBA. The range of distances presented accounts for the varying terrain and shielding, which result in higher traffic noise levels farther from US 395 and I-90 in areas located higher than the roadways with direct line-of-sight to traffic. Commercial areas located within 100 to 150 feet of US 395 and I-90 may exceed the commercial abatement criteria of 71 dBA. Undeveloped lands located closer to US 395 and I-90 would likely experience higher noise levels due to the higher future traffic volumes on US 395, I-90, and local roadways. It is recommended that local officials use this information as a guide when developing future land use plans, zoning, or building code requirements. The use of this information may assist local government with future development plans and thereby result in development that is consistent with the noise environment.

Introduction

Project Description and Purpose

The segment of US 395 North Spokane Corridor (NSC) will consist of constructing a new interchange on I-90, a four-lane divided highway to a new US 395 NSC interchange at SR 290 (Trent Avenue) vicinity in Spokane (I-90 to US 395 MP 158.51 and I-90 MP 282.37 to 285.59, Exhibit 1). The interchange on I-90 includes I-90 mainline braided ramps from the N. Nevada Street/N. Hamilton Street Interchange to the Sprague Avenue Interchange, city street improvements, utility relocates, drainage, bike path improvements, and traffic control systems. The four-lane divided highway between I-90 and SR 290 will be an elevated structure. The NSC/SR 290 partial interchange will consist of a southbound off-ramp and a northbound on-ramp. Additional work at this interchange includes city street improvements, utility relocations, retaining walls, drainage, paving, and sidewalks. The NSC will continue as an elevated four-lane divided highway to E. Mission Avenue vicinity, which is the limit for this noise study.

Improvements associated with this project will improve mobility by allowing motorists and freight to move north and south through metropolitan Spokane from I-90 to US 395. The Washington State Department of Transportation (WSDOT) has identified that once complete, the proposed NSC will decrease travel time, fuel usage, and congestion, while improving safety by reducing collisions on local arterials.

The shift of the existing highway alignment and capacity improvements included in the project are defined as Type I activities for noise analysis purposes as defined by the Federal Highway Administration (FHWA) and WSDOT.

Type 1 Trigger for Noise Analysis

A traffic noise analysis is required by law[1] for federally funded projects and required by state policy[2] for other funded projects that:

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

The Type 1 Trigger included in this project is the construction of additional through traffic lanes on US 395 and a significant change in the horizontal and vertical alignments of US 395 and I-90. Therefore, a traffic noise analysis is required for the project. A summary of the noise analysis and abatement process is included in Appendix A.

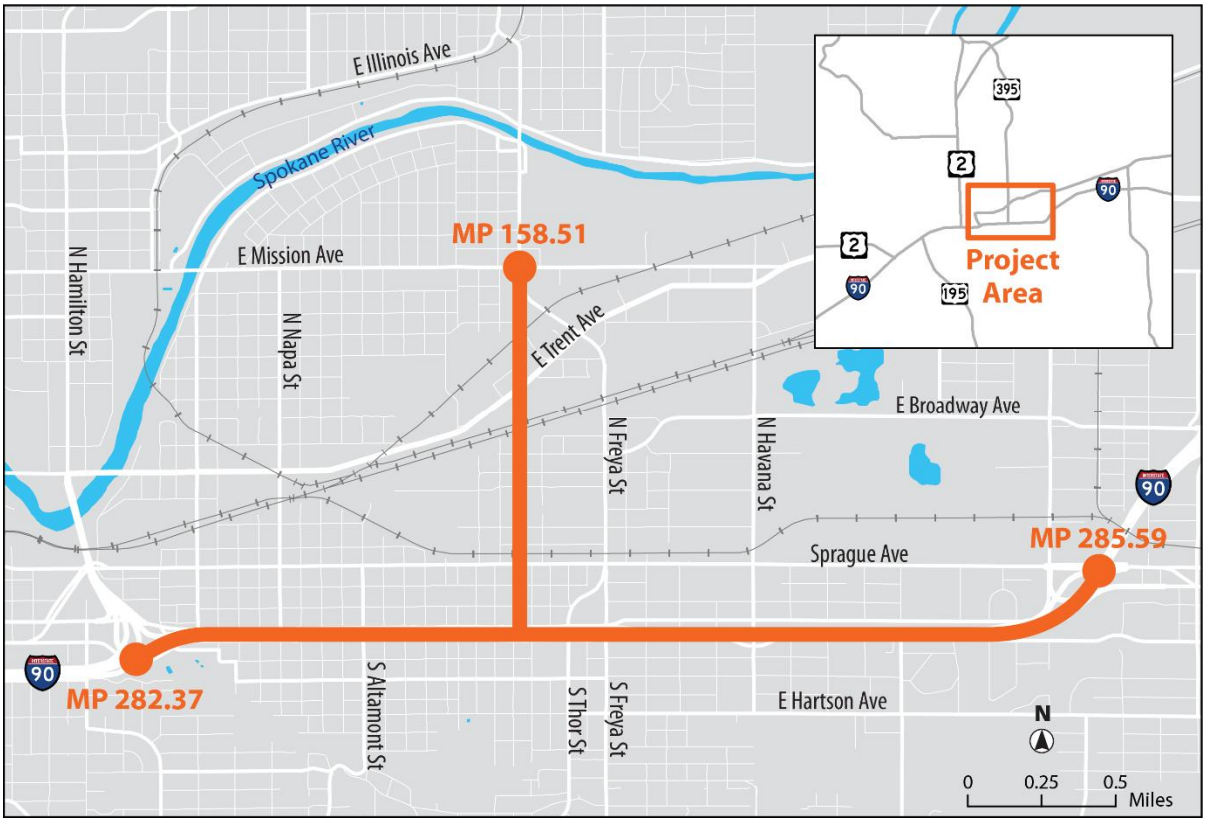
[1] 23 CFR 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise"
[2] 2011 WSDOT Traffic Noise Policy and Procedures

Noise Relevant Project Information

The following is a list of items relevant to the traffic noise analysis for the existing, No-Build, and Build conditions, including:

- The project includes an additional through lane capacity improvements in both directions of US 395.
- The project extends US 395 alignment from E. Mission Avenue to I-90.
- New on- and off-ramps are included in the proposed US 395 and I-90 alignments.
- Noise-sensitive land uses are located north and south of I-90 and a small residential community is located west of US 395 near the noise study limit. Noise-sensitive land uses located along I-90 include large residential communities with single- and multi-family residences and mobile home communities, Sheridan Elementary School, Libby Center School, several churches and parks, and recreational trails. Several structures including homes have been removed from the areas near the future I-90 alignment in recent years. The proposed US 395 NSC project alignment shifts traffic closer to noise-sensitive land uses located to the north and south of the existing I-90 alignment.
- Topography generally slopes towards the center of the project area from the north, west, and east. Existing topography includes large rock outcrops south of I-90 near the western and eastern ends of the project area. At the time of field reconnaissance for the noise study several vacant blocks north of I-90 and west of S. Altamont Street were being used to store stockpiled soils for a separate City of Spokane street project.
- No existing noise barriers are located along US 395, I-90 or along local roadways in the noise study area.
- Traffic noise from I-90 are the primary sources of noise in the study area with contributions from local roadways, rail lines, commercial businesses, and aircraft.
- Near the northern project terminus, the project would increase travel speeds of 35 miles per hour (posted) on N. Market Street and N. Greene Street to 60 miles per hour (posted) on the proposed US 395 alignment.
- The Year for Existing is 2018 and the Future Year for Build and No-Build conditions is 2040.

Exhibit 1: Project Vicinity Map



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Source: WSP USA, 2019

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Characteristics of Sound and Noise

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 varies between people.

Sound is measured using the logarithmic decibel scale, so doubling the number of noise sources, such as the number of cars on a roadway, increases noise levels by 3 dBA. Therefore, when you combine two noise sources emitting 60 dBA, the combined noise level is 63 dBA, not 120 dBA. The human ear can barely perceive a 3 dBA increase, while a 5 dBA increase is about one and one-half times as loud. A 10 dBA increase appears to be a doubling in noise level to most listeners. A tenfold increase in the number of noise sources will add 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 Hz, with less efficiency outside this range. Environmental noise is composed of many frequencies. A-weighting (dBA) of sound levels is applied electronically by a sound level meter and combines the many frequencies into one sound level that simulates how an average person hears sounds of low to moderate magnitude.

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. Magnitudes of typical noise levels are presented in Exhibit 2.

Traffic Noise Sources

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

Exhibit 2: Typical Noise Levels

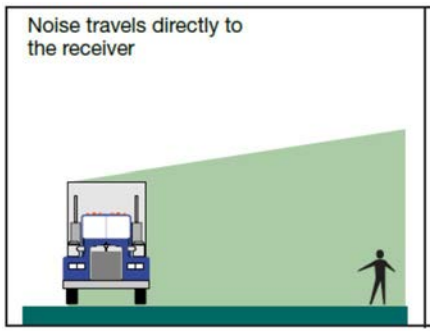
NOISE SOURCE OR ACTIVITY		SUBJECTIVE IMPRESSION	RELATIVE LOUDNESS (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
50-horsepower siren (100 feet)	130		32 times as loud
Loud rock concert near stage Jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 feet)	110		8 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 feet)*	90		2 times as loud
Garbage disposal (2 feet) **Pneumatic drill (50 feet)**	80	**Moderately loud**	**Reference loudness**
Vacuum cleaner (10 feet) Passenger car at 65 mph (25 feet)*	70		1/2 as loud
Typical office environment	60		1/4 as loud
Light auto traffic (100 feet)*	50	Quiet	1/8 as loud
Bedroom or quiet living room Bird calls	40		1/16 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	
High quality recording studio	20		
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	

Sources: Beranek (1988) and U.S. EPA (1974)

Sound Propagation

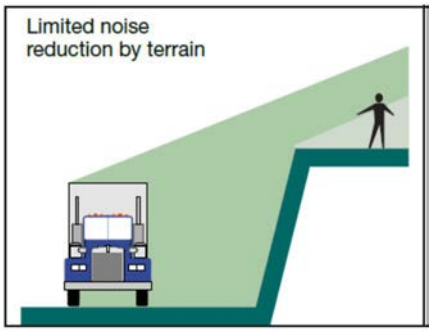
Sound propagation, or how far the sound travels, is affected by the terrain and the elevation of the receiver relative to the noise source. Noise levels can be reduced by breaking the line of sight between the receiver and the noise source.

- Level ground: noise travels in a straight path between the source and receiver.



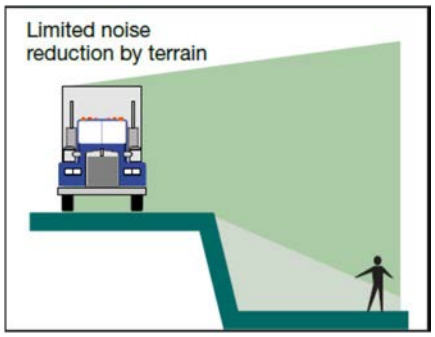
Level Ground

- Depressed source/elevated receiver: terrain may act like 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 acts as a partial noise barrier. Even a short barrier, like a concrete safety barrier, can reduce noise levels.



Elevated source/depressed receiver

Line and Point Sources

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

Effects of Noise

The Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) are based on speech interference, which is a well-documented effect 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 the Environmental Protection Agency (EPA) has established a protective level of 70 dBA $L_{eq}(24)$[3] for hearing loss. Noise also can affect some types of wildlife during certain activities.

Noise Level Descriptors

The equivalent sound level (L_{eq}) is a measure of the average noise level during a specified period of time. A one-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

[3] U.S. EPA, 1974

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 (SEL) is a measure of total sound energy from an event, and is used to calculate 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.

With L_n, "n" is the percent of time that a sound level is exceeded and is used to describe the range and pattern of sound levels experienced during the measurement period. 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 if both environments have the same L_{eq}.

Noise Regulations and Impact Criteria

Traffic noise impacts occur when predicted $L_{eq}(h)$ noise levels approach or exceed the NAC established by the FHWA, or substantially exceed existing noise levels[4]. WSDOT considers a noise impact to occur if predicted $L_{eq}(h)$ noise levels approach within 1 dBA of the NAC. The FHWA NAC specify exterior $L_{eq}(h)$ noise levels for various land activity categories as described in Exhibit 3. WSDOT also considers an increase of 10 dBA or more to be a substantial increase and a traffic noise impact.

Along with the federal noise impact criteria, most cities in Washington, including those in the project area, rely, at least in part, on the Washington State Noise Control Ordinance (WAC 173-60). The WAC 173-60 establishes residential, commercial, and industrial noise limits, along with construction noise limits. Traffic noise from public roadways is exempt from the WAC 173-60. Project construction would need to adhere to the ordinances applicable in the individual jurisdictions, which are based on the WAC noise control ordinance. Local noise ordinances can include different provisions from the state law.

The City of Spokane, City of Spokane Valley and Spokane County code similarly limit sounds that create a disturbance. Sounds resulting from public works projects operating between 10:00 p.m. and 7:00 a.m. are generally exempt from the noise provisions in the local codes. If construction noise results in complaints from the community or when construction activities occur closer than 1,000 feet from occupied residences, construction timing may be subject to restrictions.

[4] U.S. Department of Transportation, 1982, Noise Abatement Council

Exhibit 3: FHWA Noise Abatement Criteria by Land Use

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

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Traffic Noise Analysis Methodology

Determination of the Traffic Noise Study Area

The noise study area was determined using 23 CFR 772 (federal traffic noise policy) requiring identification of all existing land uses, and undeveloped lands permitted for development that may include noise-sensitive land uses. A 500-foot limit from project improvements was used as the noise study boundary and was confirmed as a sufficient study distance during field reconnaissance and field measurements. The noise study limits extend along the proposed US 395 alignment from E. Mission Avenue to I-90 and on I-90 from SR 290 to N. Fancher Road and include interchange improvements at the future US 395/I-90 interchange, as shown on Exhibits 15 through 22.

The project area is located within current and planned future WSDOT right-of-way with single- and multi-family residential, mobile home communities, commercial, and light industrial development in the noise study area. Other land uses located within the noise study area include Liberty Park, Sheridan Elementary School, Libby Center School, Journey Church, Mt. Zion Holiness Church, St. Ann's Catholic Church, Mt. Olive Baptist Church, Korean Presbyterian Church of Spokane, Our Lady of Kazan Russian Orthodox Church, Liberty Park Community Development Center, Ben Burr Trail, a trail and rest area west of the I-90/SR 290 Interchange, and new trail connections to a regional trail network. Surrounding land use includes areas of undeveloped land with predominately residential and vacant land located throughout the area. Existing land use is shown in Exhibit 4. No existing noise walls are located within the noise study area.

The primary noise source along the I-90 portion of the noise study area is vehicle traffic noise on I-90. Local road noise, noise from commercial and light industrial businesses, and noise from nearby railyards are often the primary noise sources in the areas located along the US 395 portion of the noise study area. Short-term noise events from the nearby Burlington Northern Railroad tracks and railyard, aircraft flying to and from Spokane International Airport located several miles to the southwest, commercial businesses, and traffic on side streets all contribute to the noise levels in the study area.

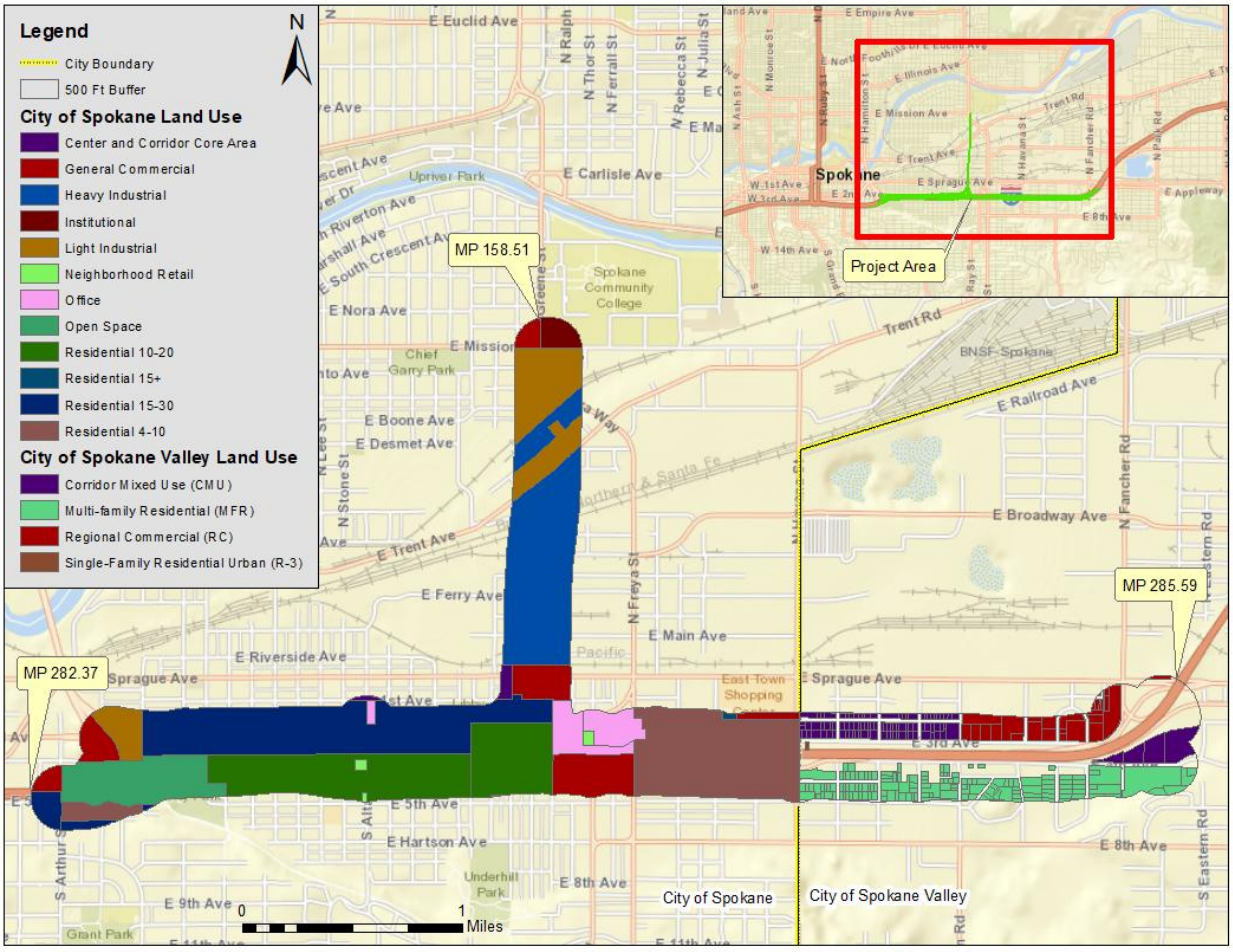
Topography generally slopes towards the center of the project area from the north, west, and east. Existing topography includes large rock outcrops south of I-90 near the western and eastern ends of the project area. At the time of field reconnaissance for the noise study several vacant blocks north of I-90 and west of S. Altamont Street were being used to store stockpiled soils for a separate City of Spokane street project.

A review of the Cities of Spokane and Spokane Valley and Spokane County's land use and building permits was conducted in July 2019. The review identified four active permits or approvals on file with City of Spokane for areas within 1,000 feet of the project. One of four of the permits identified includes a noise sensitive land use within the noise study area. One future developments that includes one noise-regulated land uses (a single-family residence) has been considered in this noise study. More information on related research conducted at the time of this report is presented in Appendix B of this report.

Traffic Noise Measurement

15-minute L_{eq} measurements were collected at seventeen locations representative of sound level environments within the study area during free-flowing traffic conditions. FHWA allows 15-minute L_{eq} measurements to represent the $L_{eq}(h)$. These traffic noise measurements are not a representation of "average" existing noise levels and are not used to determine whether noise abatement measures are warranted. The traffic noise measurements are made to complete the traffic noise model validation process, which is described in the next section.

Exhibit 4: Existing Land Use in Project Vicinity



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Measurements were conducted on March 28 and 29, 2019, with a calibrated Larson Davis Model 820 (Type 1) noise meter, which complies with ANSI S1.4 for a Type I instrument accuracy. The sound level meter was calibrated before and after each measurement and the noise meter is calibrated annually by the manufacturer, Larson Davis.

Traffic counts and meteorological conditions were also recorded during field measurements for model validation. Noise measurement data and observed traffic and meteorological conditions during measurements are provided in the field data sheets in Appendix G.

Short-term existing traffic noise levels were monitored at seventeen locations. The noise measurement locations and results are described in Exhibit 5. Noise levels at the seventeen short-term measurement sites ranged from 63 dBA L_{eq} to 75 dBA L_{eq}, depending on the proximity and direction to I-90 and US 395, and local roadways in the area. All noise measurements were performed during satisfactory weather conditions for performing noise measurements.

Traffic Noise Model Validation

FHWA's Traffic Noise Model (TNM) Version 2.5 (FHWA, 2004) was used for validation and to predict future L_{eq}(h) traffic noise levels. TNM Version 2.5 is the most current version of the noise model. TNM calculates precise estimates of noise levels at discrete points. 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. Noise from sources other than traffic is not included, so when non-traffic noise is present, such as aircraft noise, TNM will under predict the total noise level. To create the model, design files outlining major roadways, topographical features, and sensitive receptors were imported into the TNM model as background features and the corresponding values were entered manually. Aerial photographs and site visits were used to verify site conditions.

WSDOT provided all base maps and project design maps for use in the noise study. As standard practice, base maps were exported as DXF files and imported into the TNM package. In addition, ArcGIS was used to develop the TNM model. Major roadways, topographical features, and sensitive receptors were digitized into the model. The United States Geological Survey (USGS) 7.5-minute Digital Elevation Model was also used (USGS 2018).

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

Exhibit 5 describes the validation locations and the comparison of measured to modeled values. Traffic counted during the measurements is included in Appendix C. Exhibits 6 through 13 show the measured and modeled receiver locations. Traffic volumes, vehicle mix, and speed data collected during each validation measurement is included in Appendix C. Each of the seventeen short-term measured sites was found to model within ±2 dBA of the measured levels (Exhibit 5). Because a 2- to 3-dBA change in noise levels is barely perceptible to the average human ear, an agreement of ±2 dBA is acceptable for noise model validation purposes.

Exhibit 5: Existing Noise Measurement Data and Noise Model Validation Results

Site #/Location	Date	Start Time	Measured L_{eq} (dBA)	Modeled L_{eq} (dBA)	Difference (dBA)
Site 1—Liberty Park	3/28/19	10:03	66.0	66.9	0.9
Site 2—Ruins/Path at E 3rd Ave/S Arthur St.	3/28/19	10:49	68.3	66.9	-1.4
Site 3—Residence at 1024 5th St.	3/28/19	11:25	71.6	71.6	0.0
Site 4—Trail at SW Edge of Liberty Park	3/28/19	11:25	68.4	66.4	-2.0
Site 5—Vacant at S Pittsburgh St./E 2nd Ave.	3/28/19	12:30	68.6	66.8	-1.8
Site 6—Vacant at S Perry St./E 2nd Ave.	3/28/19	1:53	63.5	63.9	0.4
Site 7—Near Residence at 217 S Fiske St.	3/28/19	2:40	71.4	70.0	-1.4
Site 8—Vacant at S Cook St./E 2nd Ave.	3/28/19	3:08	70.1	69.2	-0.9
Site 9—Vacant at S Lee St./E 3rd Ave.	3/29/19	9:33	69.5	69.0	-0.5
Site 10—S Haven St/E 3rd Ave.	3/29/19	10:06	66.7	67.7	1.0
Site 11—E 4th Ave./S Dearborn St.	3/29/19	11:10	71.8	70.2	-1.6
Site 12—402 S Eastern Rd.	3/29/19	11:42	65.7	63.7	-2.0
Site 13—4903 E 3rd Ave.	3/29/19	12:05	65.9	65.8	-0.1
Site 14—S Florida St./E 2nd Ave.	3/29/19	12:40	67.1	67.9	0.8
Site 15—S Ralph St./E 2nd Ave.	3/29/19	1:14	63.1	64.6	1.5
Site 16—E 4th Ave./S Carnahan St.	3/29/19	3:14	74.6	72.7	-1.9
Site 17—S Howe Rd./E 3rd Ave.	3/29/19	3:14	64.1	63.8	-0.3

Notes:
Short term measured noise levels were used for model validation near existing roadways.

The modeled receiver locations are shown in Exhibits 6 through 13. Many validation sites were not taken at the optimal modeling location that represent the most frequent human outdoor use area and therefore are not used for peak-hour traffic noise predictions. Five-hundred and thirty-three sites were modeled to represent 671 outdoor use areas for all noise-sensitive locations within the study area.

Exhibit 6: Traffic Noise Measurement and Modeling Locations – Project Area West Terminus at I-90/SR 290

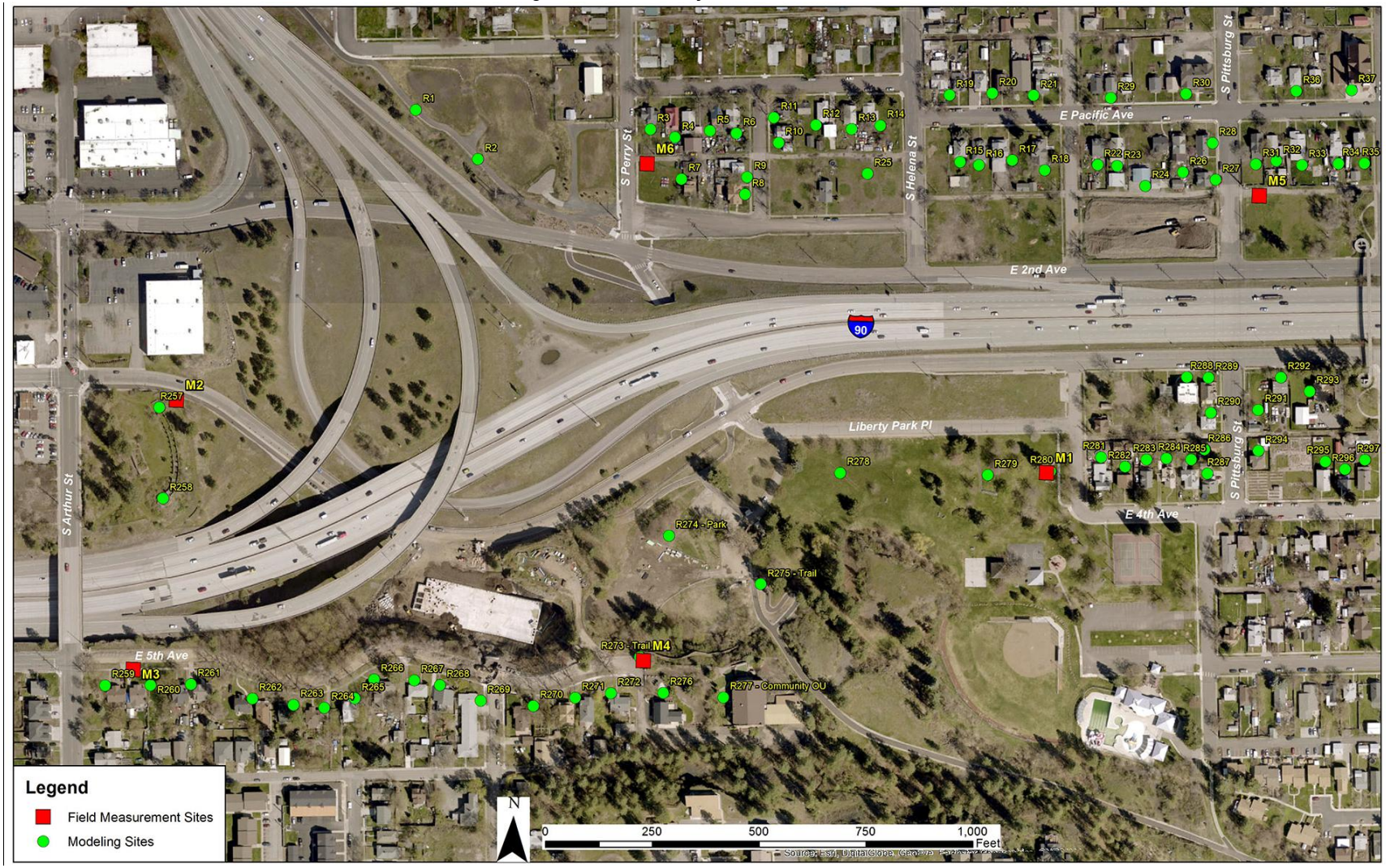

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Exhibit 7: Traffic Noise Measurement and Modeling Locations – Project Area West

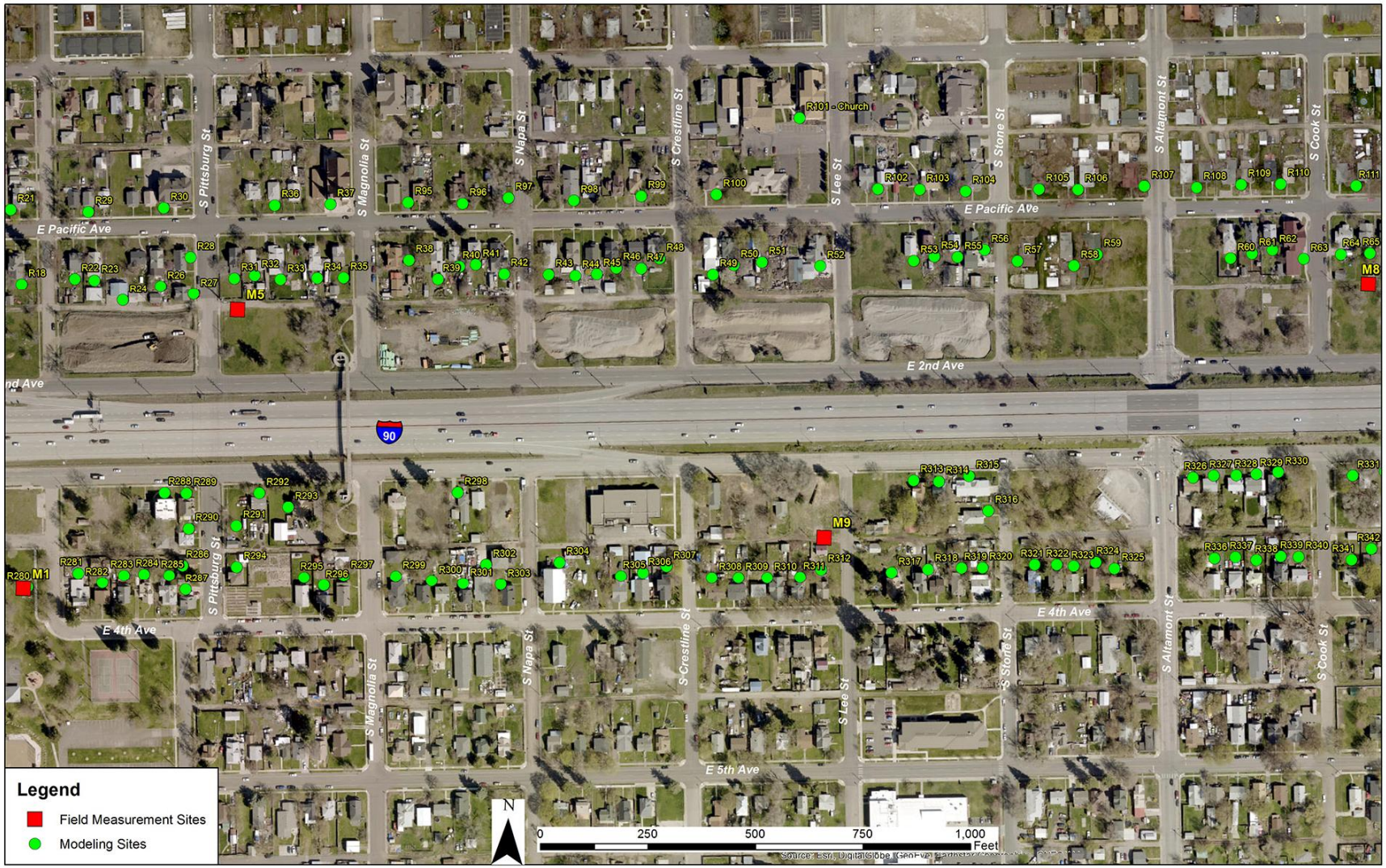

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Exhibit 8: Traffic Noise Measurement and Modeling Locations – Project Area West-Central

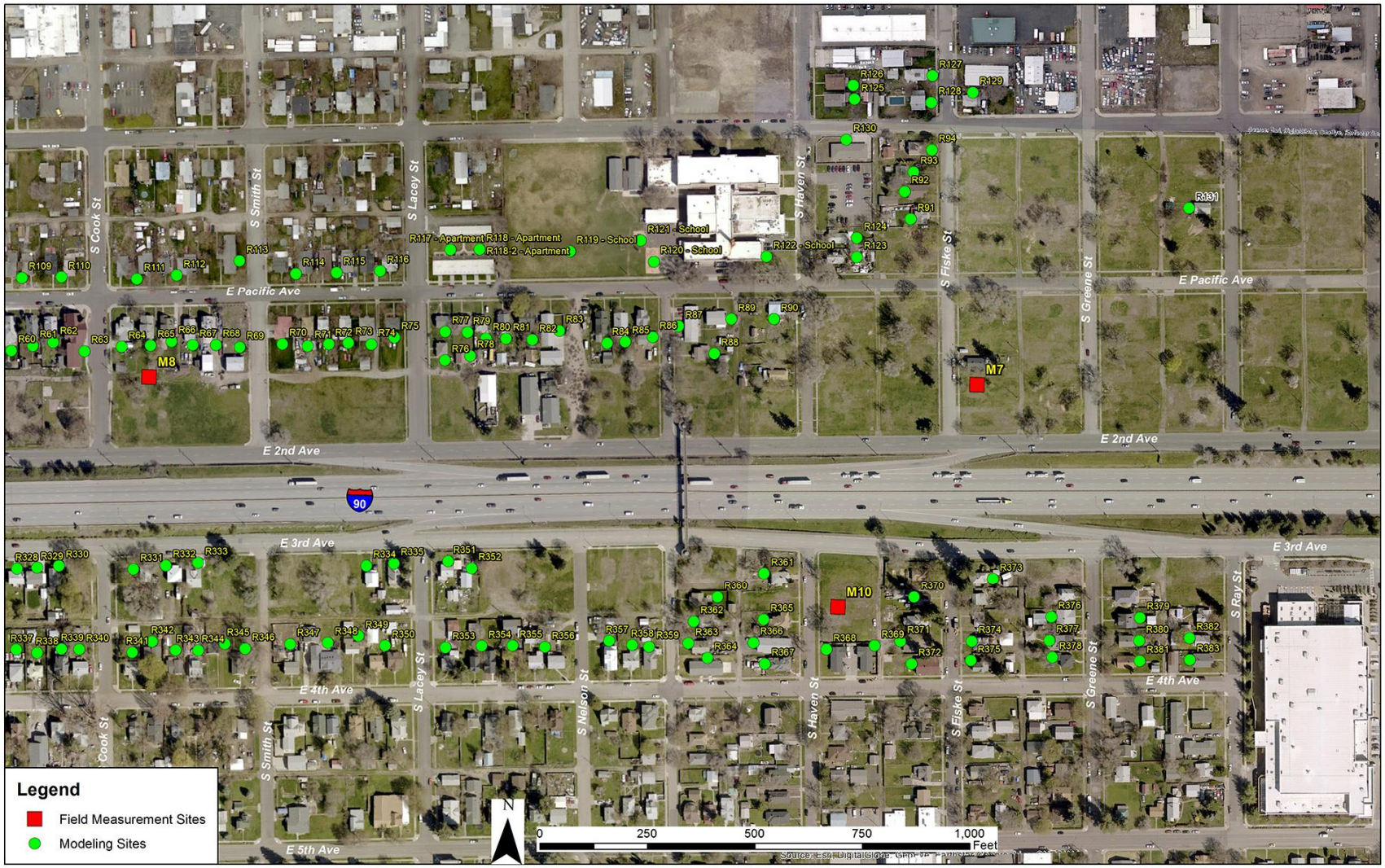

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Exhibit 9: Traffic Noise Measurement and Modeling Locations – Project Area Central

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Exhibit 10: Traffic Noise Measurement and Modeling Locations – Project Area Central-East

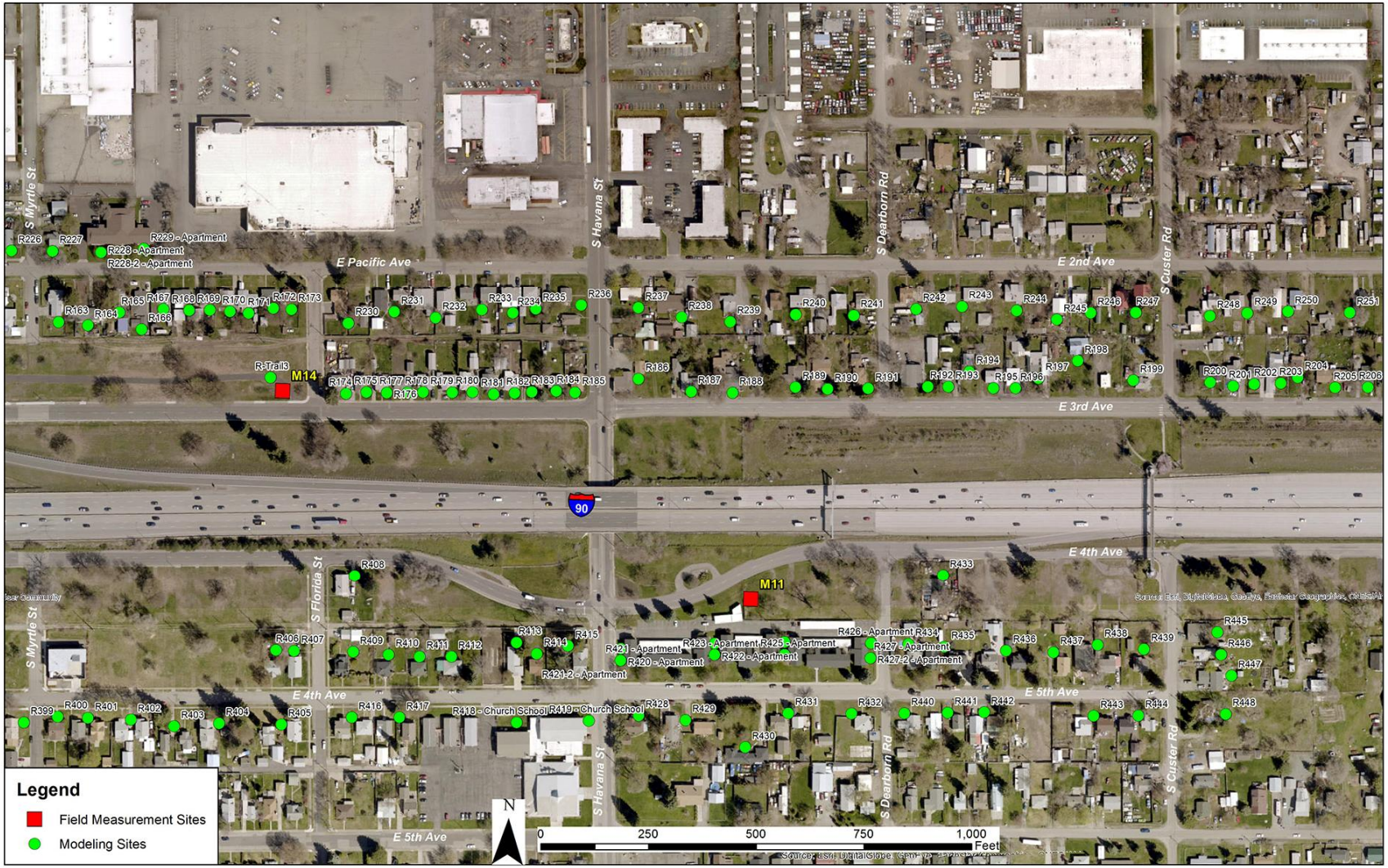

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Exhibit 11: Traffic Noise Measurement and Modeling Locations – Project Area East

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Exhibit 12: Traffic Noise Measurement and Modeling Locations – Project Area East Terminus at I-90/Sprague Avenue

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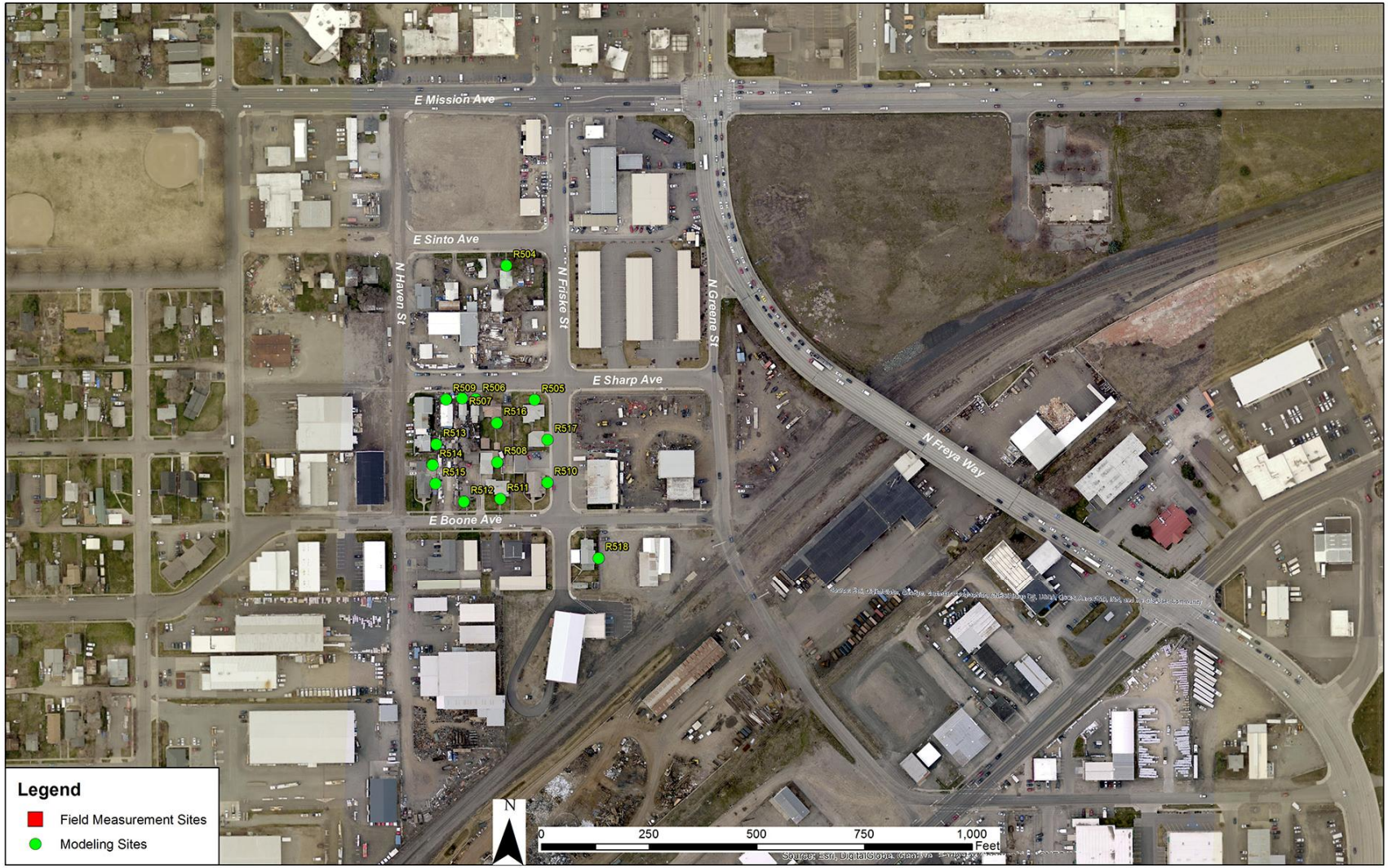
Exhibit 13: Traffic Noise Measurement and Modeling Locations – Project Area North Terminus at Future US 395/E. Mission Avenue



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Traffic Noise Levels

Description of Study Area

The study area and all modeled noise sensitive receivers are shown in Exhibits 6 through 13.

Operational Traffic Noise

Existing (2018), No Build (2040), and Build (2040) noise levels were modeled at the 533 modeling locations to represent 671 properties that could be affected by noise from the project. The modeling locations represent outdoor areas of frequent human use, such as common, ground-floor use areas, or benches or play areas.

Predicted noise levels were based on PM peak-hour traffic volumes to estimate Existing Conditions 2018 and future year 2040 noise levels with (Build) and without the project (No Build). A comparison of modeled noise levels resulting from PM peak traffic volumes and AM peak traffic volumes was conducted that confirmed the use of PM peak-hour traffic as the worst-case traffic volumes resulting in the highest noise levels. Traffic information including speed, volume, and vehicle mix data for existing and future traffic conditions with and without the project is included in Appendix C. A summary of impacts by condition is presented here:

- Existing condition (2018) noise abatement criteria impacts—161 residences, Liberty Park Trail, an unnamed trail and rest area west of the I-90/SR 290 Interchange, a new trail north of I-90 east of S. Freya St., and two outdoor areas at the Trailer Inns RV Park, represented by 159 modeling sites would approach or exceed the NAC.
- No Build (2040) noise abatement criteria impacts—198 residences and the same outdoor use areas as described for impacts under existing conditions represented by 176 modeling sites (includes all 159 modeling locations with NAC impacts under existing condition) would approach or exceed the NAC.
- Build (2040) noise abatement criteria impacts—81 residences and the same outdoor use locations as described for impacts under existing conditions represented by 76 modeling sites which includes 64 of the same modeling sites with NAC impacts under existing condition and 67 of the same modeling sites with NAC impacts under No Build 2040. The reduction in the number of impacted receivers with the future project alignment is primarily due to planned acquisition of additional parcels in-close-proximity to project improvements.
- Build (2040) – substantial increase impacts (of 10 dBA or greater over existing noise levels) would occur at 15 residences represented by 15 modeling sites. Noise abatement criteria impacts are not predicted at any of the 15 sites with substantial increase impacts.

Existing (2018) Noise Levels

Existing modeled worst-hour traffic noise levels for residential areas range from 41 dBA to 75 dBA (Exhibit 14). The modeled noise levels at these receivers depend on the proximity of the receiver to the existing roadways, primarily I-90. Of the 533 total modeled receivers, 159 receivers currently

experience traffic noise levels that approach or exceed the NAC of 67 dBA. The 159 receivers represent 161 residences, Liberty Park Trail, an unnamed trail and rest area west of the I-90/SR 290 Interchange, a new trail north of I-90 east of S. Freya St., and two outdoor areas at the Trailer Inns RV Park. Existing traffic noise levels for all modeled receivers are shown in Exhibit 14.

Design Year (2040) Traffic Noise Levels—No Build

Future No Build modeled worst-hour traffic noise levels for residential areas range from 44 dBA to 76 dBA (Exhibit 14). The modeled noise levels at these receivers depend on the proximity of the receiver to the existing roadways, primarily I-90. Of the 533 total receivers, the same 159 receivers that currently experience traffic noise levels above the NAC of 66 dBA are predicted to continue to experience traffic noise levels that approach or exceed the NAC of 67 dBA along with 17 additional receivers totaling 176 receivers predicted to experience traffic noise levels approach or exceed the NAC without the project in 2040. The 176 receivers represent the same 161 residences and outdoor use areas as described for impacts under existing conditions in addition to 17 receivers that represent 37 additional residences, totaling 198 residences and four outdoor use areas. Roadway traffic noise levels under the No Build Alternative would not result in a large change in noise levels over time due to a steady increase in traffic volumes on the existing roadway network. No Build traffic noise levels in the year 2040 for all modeled receivers are within 3 dBA of existing noise levels with most within 1 dBA of existing noise levels and are shown in Exhibit 14. No substantial increase impacts are predicted under 2040 No Build conditions.

Design Year (2040) Traffic Noise Levels—Build (Pre-Noise Abatement)

Future Build traffic noise levels represent transportation improvements associated with the US 395 NSC Project prior to noise abatement evaluated in the Traffic Noise Abatement section of this report. Future Build modeled worst-hour traffic noise levels for residential areas range from 52 dBA to 75 dBA (Exhibit 14). The modeled noise levels at these receivers depend primarily on the proximity of the receiver to existing roadways, primarily I-90, and the proposed US 395 alignment. Of the 533 total receivers, 64 receivers that currently experience traffic noise levels above the NAC of 66 dBA are predicted to continue to experience traffic noise levels that approach or exceed the NAC of 67 dBA. The reduction in the number of impacted receivers with the future project alignment is primarily due to planned acquisition of additional parcels in-close-proximity to project improvements.

In total 76 receivers (representing 81 residences, Liberty Park Trail, an unnamed trail and rest area west of the I-90/SR 290 Interchange, and two outdoor locations at the Trailer Inns RV Park) are predicted to experience traffic noise levels above the NAC, and 15 receivers (representing 15 residences) are predicted to experience substantial increase impacts in 2040. With noise abatement criteria impacts not predicted at any of the 15 sites with substantial increase impacts, the total 2040 Build combined impacts at discrete locations is 91 receivers representing 96 residences and the four outdoor use areas.

Roadway traffic noise levels under the Build Alternative would result in a large change in noise levels to areas near the future US 395 alignment and the future US 395/I-90 Interchange. Build traffic noise levels in the year 2040 for modeled receivers range between 8 dBA lower and 18 dBA higher

than existing noise levels and between 8 dBA lower and 15 dBA higher than future No Build noise levels due to the proximity to future alignments of US 395 and the I-90/US 395 Interchange. WSDOT considers an increase of 15 dBA or more over existing noise levels a substantial increase. Future noise levels at all modeled locations are shown in Exhibit 14 with all model locations and noise abatement criteria and substantial increase impacts shown in Exhibits 15 through 22.

Exhibit 14: Modeled Noise Levels

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R1	Residential	B/66	1	60	60	60
R2	Residential	B/66	1	60	60	60
R3	Residential	B/66	1	62	63	61
R4	Residential	B/66	1	57	57	58
R5	Residential	B/66	2	61	62	61
R6	Residential	B/66	1	64	64	62
R7	Residential	B/66	1	63	64	61
R8	Residential	B/66	1	67	67	65
R9	Residential	B/66	1	66	66	64
R10	Residential	B/66	1	65	65	64
R11	Residential	B/66	1	61	61	60
R12	Residential	B/66	2	61	61	60
R13	Residential	B/66	1	66	66	65
R14	Residential	B/66	1	66	66	64
R15	Residential	B/66	1	68	68	66
R16	Residential	B/66	1	68	69	66
R17	Residential	B/66	1	64	64	63
R18	Residential	B/66	1	67	67	65
R19	Residential	B/66	2	62	63	62
R20	Residential	B/66	2	61	61	60
R21	Residential	B/66	2	61	61	59
R22	Residential	B/66	1	67	68	65
R23	Residential	B/66	1	62	62	62
R24	Residential	B/66	1	70	70	67
R25	Residential	B/66	1	68	69	67
R26	Residential	B/66	1	65	65	63
R27	Residential	B/66	1	66	67	64
R28	Residential	B/66	1	61	62	60
R29	Residential	B/66	3	59	59	59
R30	Residential	B/66	3	58	58	58

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R31	Residential	B/66	1	67	67	65
R32	Residential	B/66	1	66	67	65
R33	Residential	B/66	1	67	67	66
R34	Residential	B/66	1	66	67	66
R35	Residential	B/66	1	66	67	66
R36	Residential	B/66	2	58	58	59
R37	Residential	B/66	2	58	59	58
R38	Residential	B/66	1	62	62	60
R39	Residential	B/66	1	65	66	63
R40	Residential	B/66	1	64	65	62
R41	Residential	B/66	1	65	65	62
R42	Residential	B/66	1	66	66	63
R43	Residential	B/66	1	66	66	62
R44	Residential	B/66	1	66	66	62
R45	Residential	B/66	1	66	66	62
R46	Residential	B/66	1	65	65	62
R47	Residential	B/66	1	65	65	62
R48	Residential	B/66	1	64	64	61
R49	Residential	B/66	1	65	65	62
R50	Residential	B/66	1	64	64	62
R51	Residential	B/66	1	63	64	61
R52	Residential	B/66	1	61	61	60
R53	Residential	B/66	1	63	63	61
R54	Residential	B/66	1	63	63	61
R55	Residential	B/66	1	62	62	60
R56	Residential	B/66	1	61	61	59
R57	Residential	B/66	1	61	61	60
R58	Residential	B/66	1	64	65	62
R59	Residential	B/66	1	64	64	62
R60	Residential	B/66	1	65	65	63
R61	Residential	B/66	1	65	65	62
R62	Residential	B/66	1	64	64	61
R63	Residential	B/66	1	64	64	61
R64	Residential	B/66	1	67	67	64
R65	Residential	B/66	1	66	66	64
R66	Residential	B/66	1	66	66	64

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R67	Residential	B/66	1	65	66	63
R68	Residential	B/66	1	63	63	62
R69	Residential	B/66	1	62	63	62
R70	Residential	B/66	1	66	66	65
R71	Residential	B/66	1	66	66	65
R72	Residential	B/66	1	66	66	65
R73	Residential	B/66	1	66	66	65
R74	Residential	B/66	1	66	66	65
R75	Residential	B/66	1	65	65	64
R76	Residential	B/66	1	67	67	65
R77	Residential	B/66	1	62	62	61
R78	Residential	B/66	1	65	65	63
R79	Residential	B/66	1	62	63	62
R80	Residential	B/66	1	63	64	62
R81	Residential	B/66	1	62	63	62
R82	Residential	B/66	1	60	60	59
R83	Residential	B/66	1	61	61	60
R84	Residential	B/66	1	64	64	62
R85	Residential	B/66	1	64	65	62
R86	Residential	B/66	1	64	64	61
R87	Residential	B/66	1	62	63	60
R88	Residential	B/66	1	65	65	63
R89	Residential	B/66	1	63	63	61
R90	Residential	B/66	1	64	65	62
R91	Residential	B/66	1	61	61	58
R92	Residential	B/66	1	59	60	57
R93	Residential	B/66	1	56	56	57
R94	Residential	B/66	1	57	58	59
R95	Residential	B/66	2	58	59	58
R96	Residential	B/66	1	57	58	57
R97	Residential	B/66	1	59	60	57
R98	Residential	B/66	3	57	58	57
R99	Residential	B/66	3	58	59	57
R100	Residential	B/66	4	59	59	57
R101 - Church	Church	C/66	1	57	57	56
R102	Residential	B/66	2	59	59	57

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R103	Residential	B/66	2	59	60	57
R104	Residential	B/66	2	59	59	57
R105	Residential	B/66	2	60	60	58
R106	Residential	B/66	2	60	61	59
R107	Residential	B/66	1	60	61	59
R108	Residential	B/66	2	62	62	59
R109	Residential	B/66	2	61	61	60
R110	Residential	B/66	2	61	61	60
R111	Residential	B/66	2	59	59	59
R112	Residential	B/66	2	58	59	59
R113	Residential	B/66	1	58	59	59
R114	Residential	B/66	2	58	58	58
R115	Residential	B/66	2	57	58	58
R116	Residential	B/66	2	58	58	58
R117 - Apartment	Residential	B/66	5	55	55	56
R117-2 - Apartment	Residential	B/66	5	59	60	60
R118 - Apartment	Residential	B/66	5	54	55	56
R118-2 - Apartment	Residential	B/66	5	59	60	60
R119 - School	School	C/66	1	57	58	58
R120 - School	School	C/66	1	59	59	58
R121 - School	School	C/66	1	58	58	58
R122 - School	School	C/66	1	60	60	60
R123	Residential	B/66	1	62	63	60
R124	Residential	B/66	1	61	62	60
R125	Residential	B/66	1	57	57	59
R126	Residential	B/66	1	57	58	59
R127	Residential	B/66	1	57	57	60
R128	Residential	B/66	1	57	57	60
R129	Residential	B/66	1	57	58	N/A
R130	Residential	B/66	1	59	59	59
R131	Residential	B/66	1	60	61	N/A
R132	Residential	B/66	1	57	58	58
R133	Residential	B/66	1	57	58	58

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R134	Residential	B/66	1	57	58	59
R135	Residential	B/66	1	57	58	58
R136	Residential	B/66	1	57	58	58
R137	Residential	B/66	1	57	58	58
R138	Residential	B/66	1	58	59	58
R139	Residential	B/66	1	58	59	59
R140	Residential	B/66	1	59	60	59
R141	Residential	B/66	1	59	60	59
R142	Residential	B/66	1	59	61	60
R143	Residential	B/66	1	60	61	58
R144	Residential	B/66	1	58	58	54
R145	Residential	B/66	1	59	60	55
R146	Residential	B/66	1	59	60	56
R147	Residential	B/66	1	57	57	54
R148	Residential	B/66	1	60	60	55
R149	Residential	B/66	1	61	61	57
R150	Residential	B/66	1	59	59	55
R151	Residential	B/66	1	59	59	54
R152	Residential	B/66	1	57	58	55
R153	Residential	B/66	1	61	62	58
R154	Residential	B/66	1	57	58	57
R155	Residential	B/66	1	60	60	60
R156	Residential	B/66	1	61	62	61
R157	Residential	B/66	1	62	62	61
R158	Residential	B/66	1	61	61	60
R159	Residential	B/66	1	62	62	62
R160	Residential	B/66	1	62	62	63
R161	Residential	B/66	1	62	63	63
R162	Residential	B/66	2	61	62	62
R163	Residential	B/66	1	63	63	63
R164	Residential	B/66	1	63	64	63
R165	Residential	B/66	1	59	59	60
R166	Residential	B/66	1	64	64	63
R167	Residential	B/66	1	62	62	60
R168	Residential	B/66	1	59	60	58
R169	Residential	B/66	1	62	62	60

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R170	Residential	B/66	1	63	63	61
R171	Residential	B/66	1	63	63	61
R172	Residential	B/66	1	63	63	61
R173	Residential	B/66	1	62	63	61
R174	Residential	B/66	1	68	68	62
R175	Residential	B/66	1	68	68	62
R176	Residential	B/66	1	68	69	62
R177	Residential	B/66	1	68	69	62
R178	Residential	B/66	1	68	69	62
R179	Residential	B/66	1	68	69	62
R180	Residential	B/66	1	68	69	62
R181	Residential	B/66	1	69	69	63
R182	Residential	B/66	1	69	69	63
R183	Residential	B/66	1	69	69	63
R184	Residential	B/66	1	68	69	63
R185	Residential	B/66	1	69	69	62
R186	Residential	B/66	1	66	66	61
R187	Residential	B/66	1	70	71	66
R188	Residential	B/66	1	71	71	67
R189	Residential	B/66	1	70	71	66
R190	Residential	B/66	1	70	71	66
R191	Residential	B/66	1	70	70	66
R192	Residential	B/66	1	70	70	66
R193	Residential	B/66	1	70	70	66
R194	Residential	B/66	1	67	68	63
R195	Residential	B/66	1	70	70	67
R196	Residential	B/66	1	70	70	67
R197	Residential	B/66	1	69	69	66
R198	Residential	B/66	1	66	67	65
R199	Residential	B/66	1	68	68	66
R200	Residential	B/66	1	69	69	68
R201	Residential	B/66	1	69	70	69
R202	Residential	B/66	1	68	69	68
R203	Residential	B/66	1	64	65	68
R204	Residential	B/66	1	65	66	68
R205	Residential	B/66	1	67	68	70

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R206	Residential	B/66	1	67	68	70
R207	Residential	B/66	1	67	67	70
R208	Residential	B/66	1	66	67	70
R209	Utilities	F/--	0	66	67	70
R210	Residential	B/66	1	66	67	71
R211	Residential	B/66	1	67	68	71
R212	Residential	B/66	2	66	67	71
R213	Residential	B/66	2	69	70	70
R214	Residential	B/66	2	63	63	64
R215	Residential	B/66	2	59	61	61
R216	Residential	B/66	2	57	59	58
R217	Residential	B/66	2	56	57	56
R218	Residential	B/66	2	56	57	56
R219	Residential	B/66	2	56	57	56
R220	Residential	B/66	2	57	58	57
R221	Residential	B/66	2	56	57	56
R222	Residential	B/66	2	56	57	56
R223	Residential	B/66	1	56	57	57
R224	Residential	B/66	1	57	57	57
R225	Residential	B/66	2	57	57	58
R226	Residential	B/66	2	58	58	59
R227	Residential	B/66	2	58	58	58
R228 - Apartment	Residential	B/66	2	58	58	58
R228-2 - Apartment	Residential	B/66	2	63	63	63
R229 - Apartment	Residential	B/66	2	58	58	58
R229-2 - Apartment	Residential	B/66	2	63	63	62
R230	Residential	B/66	1	62	62	60
R231	Residential	B/66	1	60	60	59
R232	Residential	B/66	2	60	61	59
R233	Residential	B/66	2	59	59	59
R234	Residential	B/66	1	60	61	59
R235	Residential	B/66	1	60	60	59
R236	Residential	B/66	2	60	60	58

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R237	Residential	B/66	2	57	57	57
R238	Residential	B/66	1	55	56	56
R239	Residential	B/66	2	62	62	59
R240	Residential	B/66	1	60	61	58
R241	Residential	B/66	1	62	62	59
R242	Residential	B/66	2	61	61	59
R243	Residential	B/66	2	57	58	58
R244	Residential	B/66	2	60	60	60
R245	Residential	B/66	2	60	60	60
R246	Residential	B/66	2	59	60	60
R247	Residential	B/66	2	61	62	61
R248	Residential	B/66	1	58	58	58
R249	Residential	B/66	2	58	59	59
R250	Residential	B/66	1	57	58	59
R251	Residential	B/66	2	57	58	61
R252	Residential	B/66	1	58	59	63
R253	Residential	B/66	2	59	60	64
R254	Residential	B/66	1	59	60	63
R255	Residential	B/66	2	60	60	64
R256	Residential	B/66	1	62	62	65
R-Trail1	Trail	C/66	1	66	67	62
R-Trail2	Trail	C/66	1	65	65	65
R-Trail3	Trail	C/66	1	66	67	63
R257	Trail	C/66	1	68	68	68
R258	Rest Area	C/66	1	75	75	75
R259	Residential	B/66	1	69	70	68
R260	Residential	B/66	1	68	68	68
R261	Residential	B/66	1	68	69	70
R262	Residential	B/66	1	65	65	67
R263	Residential	B/66	1	66	66	67
R264	Residential	B/66	1	67	67	67
R265	Residential	B/66	1	67	68	68
R266	Residential	B/66	1	69	69	69
R267	Residential	B/66	1	69	69	69
R268	Residential	B/66	1	68	69	68
R269	Residential	B/66	1	65	65	65

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R270	Residential	B/66	1	66	66	66
R271	Residential	B/66	1	66	66	66
R272	Residential	B/66	1	66	66	66
R273 - Trail	Trail	C/66	1	67	67	67
R274 - Park	Park	C/66	1	63	63	63
R275 - Trail	Trail	C/66	1	62	63	63
R276	Residential	B/66	1	65	65	65
R277 - Community OU	Community Center	C/66	1	64	64	64
R278	Residential	B/66	1	65	65	63
R279	Residential	B/66	1	67	67	64
R280	Residential	B/66	1	67	67	65
R281	Residential	B/66	1	67	67	67
R282	Residential	B/66	1	66	66	66
R283	Residential	B/66	1	66	67	67
R284	Residential	B/66	1	66	66	67
R285	Residential	B/66	1	65	65	67
R286	Residential	B/66	1	63	64	65
R287	Residential	B/66	1	64	64	65
R288	Residential	B/66	1	75	75	N/A
R289	Residential	B/66	1	75	75	N/A
R290	Residential	B/66	1	67	67	N/A
R291	Residential	B/66	1	71	71	N/A
R292	Residential	B/66	1	75	75	N/A
R293	Residential	B/66	1	73	73	N/A
R294	Residential	B/66	1	67	68	69
R295	Residential	B/66	1	66	66	68
R296	Residential	B/66	1	65	66	67
R297	Residential	B/66	1	64	65	66
R298	Residential	B/66	1	74	74	N/A
R299	Residential	B/66	1	64	64	65
R300	Residential	B/66	1	65	66	67
R301	Residential	B/66	1	65	65	67
R302	Residential	B/66	1	66	66	67
R303	Residential	B/66	1	62	62	63
R304	Residential	B/66	1	67	67	68
R305	Residential	B/66	1	64	65	65

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R306	Residential	B/66	1	62	63	61
R307	Residential	B/66	1	64	64	61
R308	Residential	B/66	1	65	66	63
R309	Residential	B/66	1	66	66	63
R310	Residential	B/66	1	66	66	63
R311	Residential	B/66	1	66	66	62
R312	Residential	B/66	1	66	66	62
R313	Residential	B/66	1	74	75	N/A
R314	Residential	B/66	1	74	74	N/A
R315	Residential	B/66	1	75	75	N/A
R316	Residential	B/66	1	71	71	N/A
R317	Residential	B/66	1	67	67	61
R318	Residential	B/66	1	67	67	60
R319	Residential	B/66	1	67	67	60
R320	Residential	B/66	1	63	64	59
R321	Residential	B/66	1	67	67	60
R322	Residential	B/66	1	67	67	60
R323	Residential	B/66	1	67	67	60
R324	Residential	B/66	1	67	67	N/A
R325	Residential	B/66	1	66	66	N/A
R326	Residential	B/66	1	71	71	N/A
R327	Residential	B/66	1	70	71	N/A
R328	Residential	B/66	1	70	70	N/A
R329	Residential	B/66	1	70	70	N/A
R330	Residential	B/66	1	70	70	N/A
R331	Residential	B/66	1	70	70	N/A
R332	Residential	B/66	1	70	71	N/A
R333	Residential	B/66	1	72	72	N/A
R334	Residential	B/66	1	75	75	N/A
R335	Residential	B/66	1	75	76	N/A
R336	Residential	B/66	1	66	66	N/A
R337	Residential	B/66	1	65	65	N/A
R338	Residential	B/66	1	64	64	59
R339	Residential	B/66	1	63	63	59
R340	Residential	B/66	1	64	64	59
R341	Residential	B/66	1	64	64	59

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R342	Residential	B/66	1	65	66	60
R343	Residential	B/66	1	65	65	60
R344	Residential	B/66	1	64	65	58
R345	Residential	B/66	1	65	65	61
R346	Residential	B/66	1	65	66	62
R347	Residential	B/66	1	65	65	62
R348	Residential	B/66	1	64	65	62
R349	Residential	B/66	1	63	66	61
R350	Residential	B/66	1	62	62	61
R351	Residential	B/66	1	75	76	N/A
R352	Residential	B/66	1	74	74	N/A
R353	Residential	B/66	1	64	64	62
R354	Residential	B/66	1	64	66	62
R355	Residential	B/66	1	62	63	60
R356	Residential	B/66	1	65	65	65
R357	Residential	B/66	1	68	68	67
R358	Residential	B/66	1	66	67	66
R359	Residential	B/66	1	63	64	63
R360	Residential	B/66	1	70	71	N/A
R361	Residential	B/66	1	72	73	N/A
R362	Residential	B/66	1	68	68	68
R363	Residential	B/66	1	66	66	65
R364	Residential	B/66	1	61	61	60
R365	Residential	B/66	1	69	69	68
R366	Residential	B/66	1	66	66	65
R367	Residential	B/66	1	60	60	61
R368	Residential	B/66	1	66	66	65
R369	Residential	B/66	1	66	67	66
R370	Residential	B/66	1	70	70	N/A
R371	Residential	B/66	1	66	67	66
R372	Residential	B/66	1	62	62	61
R373	Residential	B/66	1	71	71	N/A
R374	Residential	B/66	1	65	66	66
R375	Residential	B/66	1	63	64	63
R376	Residential	B/66	1	66	66	N/A
R377	Residential	B/66	1	62	62	61

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R378	Residential	B/66	1	60	61	60
R379	Residential	B/66	1	66	66	N/A
R380	Residential	B/66	1	61	61	62
R381	Residential	B/66	1	59	59	61
R382	Residential	B/66	1	64	64	65
R383	Residential	B/66	1	60	60	61
R384	Residential	B/66	1	69	70	N/A
R385	Residential	B/66	1	66	67	N/A
R386	Residential	B/66	2	61	62	63
R387	Residential	B/66	1	62	63	65
R388	Residential	B/66	1	60	62	62
R389 - School	School	C/66	1	61	62	62
R390 - School	School	C/66	1	60	61	61
R391	Residential	B/66	1	65	66	N/A
R392	Residential	B/66	1	67	68	N/A
R393	Residential	B/66	1	67	68	N/A
R394	Residential	B/66	1	63	63	62
R395	Residential	B/66	2	63	63	62
R396	Residential	B/66	2	63	64	61
R397	Residential	B/66	2	63	64	61
R398	Residential	B/66	2	63	63	60
R399	Residential	B/66	1	62	63	59
R400	Residential	B/66	1	63	63	60
R401	Residential	B/66	2	63	63	60
R402	Residential	B/66	2	62	63	60
R403	Residential	B/66	2	62	62	60
R404	Residential	B/66	2	61	61	59
R405	Residential	B/66	2	60	61	60
R406	Residential	B/66	1	65	65	63
R407	Residential	B/66	1	65	65	63
R408	Residential	B/66	1	69	70	N/A
R409	Residential	B/66	1	61	62	62
R410	Residential	B/66	1	64	64	63
R411	Residential	B/66	1	63	64	63
R412	Residential	B/66	1	63	63	63
R413	Residential	B/66	2	64	65	63

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R414	Residential	B/66	1	63	64	63
R415	Residential	B/66	1	62	63	63
R416	Residential	B/66	2	61	61	61
R417	Residential	B/66	2	59	60	60
R418 - Church School	Church/ School	C/66	1	60	60	61
R419 - Church School	Church/ School	C/66	1	59	59	61
R420 - Apartment	Residential	B/66	2	61	62	61
R420-2 - Apartment	Residential	B/66	2	66	67	65
R421 - Apartment	Residential	B/66	2	60	61	60
R421-2 - Apartment	Residential	B/66	2	65	66	64
R422 - Apartment	Residential	B/66	2	63	63	60
R422-2 - Apartment	Residential	B/66	2	66	66	64
R423 - Apartment	Residential	B/66	2	60	60	58
R423-2 - Apartment	Residential	B/66	2	65	65	64
R424 - Apartment	Residential	B/66	2	61	62	60
R424-2 - Apartment	Residential	B/66	2	67	67	66
R425 - Apartment	Residential	B/66	2	58	58	58
R425-2 - Apartment	Residential	B/66	2	65	65	65
R426 - Apartment	Residential	B/66	2	64	64	60
R426-2 - Apartment	Residential	B/66	2	67	68	65
R427 - Apartment	Residential	B/66	2	61	62	59

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R427-2 - Apartment	Residential	B/66	2	65	66	64
R428	Residential	B/66	1	59	59	61
R429	Residential	B/66	2	58	58	60
R430	Residential	B/66	2	57	57	59
R431	Residential	B/66	2	57	58	60
R432	Residential	B/66	1	58	58	60
R433	Residential	B/66	1	72	73	N/A
R434	Residential	B/66	1	62	62	61
R435	Residential	B/66	2	65	65	61
R436	Residential	B/66	2	65	64	61
R437	Residential	B/66	2	64	64	60
R438	Residential	B/66	2	65	66	60
R439	Residential	B/66	1	64	65	59
R440	Residential	B/66	1	58	59	60
R441	Residential	B/66	2	58	58	59
R442	Residential	B/66	2	59	59	59
R443	Residential	B/66	2	57	58	58
R444	Residential	B/66	2	58	58	58
R445	Residential	B/66	1	66	66	58
R446	Residential	B/66	1	63	64	57
R447	Residential	B/66	1	62	62	57
R448	Residential	B/66	1	59	59	56
R449	Residential	B/66	1	64	64	57
R450	Residential	B/66	1	59	60	55
R451	Residential	B/66	1	56	56	52
R452	Residential	B/66	1	65	65	58
R453	Residential	B/66	1	60	61	57
R454	Residential	B/66	1	60	61	57
R455	Residential	B/66	1	59	59	57
R456	Residential	B/66	1	57	58	55
R457	Residential	B/66	1	63	64	61
R458	Residential	B/66	1	63	63	61
R459	Residential	B/66	1	66	66	65
R460	Residential	B/66	1	60	60	57
R461	Residential	B/66	1	59	60	58
R462	Residential	B/66	1	57	58	57

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R463	Residential	B/66	1	57	57	57
R464	Residential	B/66	1	63	64	62
R465	Residential	B/66	2	63	64	60
R466	Residential	B/66	2	63	63	61
R467	Residential	B/66	1	56	56	54
R468	Residential	B/66	1	57	58	56
R469	Residential	B/66	1	58	59	57
R470	Residential	B/66	1	58	59	57
R471	Residential	B/66	1	55	56	55
R472	Residential	B/66	1	57	58	56
R473	Residential	B/66	1	57	58	56
R474	Residential	B/66	1	59	60	57
R475	Residential	B/66	1	61	62	59
R476	Residential	B/66	1	64	65	61
R478	Residential	B/66	1	57	58	56
R477	Residential	B/66	1	63	64	61
R479	Residential	B/66	1	59	60	56
R480	Residential	B/66	1	64	65	61
R481	Residential	B/66	1	66	67	68
R482	Residential	B/66	1	61	62	63
R483	Residential	B/66	1	59	60	59
R484	Residential	B/66	1	58	59	58
R485	Residential	B/66	1	57	57	58
R486	Residential	B/66	1	62	63	66
R487	Residential	B/66	1	60	61	63
R488	Residential	B/66	1	58	59	61
R489	Residential	B/66	1	57	58	60
R490	Residential	B/66	1	63	64	67
R491	Residential	B/66	1	60	61	64
R492	Residential	B/66	1	59	60	62
R493	Residential	B/66	1	57	57	59
R494	Residential	B/66	1	68	69	N/A
R495 - Mobile Home	Residential	B/66	3	66	67	69
R496 - Mobile Home	Residential	B/66	4	65	66	68

Site ID	Land Use	Land Use Category/ NAC[1] (L_{eq}) (dBA)	Dwelling Units/ Residential Equivalency[2]	Existing 2018 (L_{eq}) (dBA)	No-Build 2040 (L_{eq}) (dBA)	Build without barriers 2040 (L_{eq}) (dBA)
R497 - Mobile Home	Residential	B/66	3	62	63	66
R498	Residential	B/66	1	63	64	67
R499 - Mobile Home	Residential	B/66	3	59	60	63
R500 - Mobile Home	Residential	B/66	4	57	58	59
R501 - Mobile Home	Residential	B/66	4	58	59	60
R502-2-PlayStructure	Recreation	C/66	1	66	67	68
R503-1-PicnicArea	Recreation	C/66	1	65	66	66
R504	Residential	B/66	1	46	48	60
R505	Residential	B/66	1	43	46	61
R506	Residential	B/66	1	41	44	59
R507	Residential	B/66	1	42	44	59
R508	Residential	B/66	1	42	45	54
R509	Residential	B/66	1	42	44	58
R510	Residential	B/66	1	45	47	61
R511	Residential	B/66	1	44	46	56
R512	Residential	B/66	1	44	46	55
R513	Residential	B/66	1	44	46	57
R514	Residential	B/66	1	43	45	57
R515	Residential	B/66	1	42	44	56
R516	Residential	B/66	1	43	46	57
R517	Residential	B/66	1	45	48	61
R518	Residential	B/66	1	45	47	61

Notes:
Noise Abatement Criteria Impacts are noted by bolded values.
Substantial Increase Impacts are noted by shaded values.
"N/A" represents modeled locations that are planned for acquisition prior to project completion. These locations are not included for consideration for impacts or mitigation.
See Exhibit 3 for definitions of Activity Categories.
[1] 66 dBA is the approach limit for the activity categories B and C NAC of 67 dBA (Exhibit 3)
[2] Appendix D provides Residential Equivalency Calculations for all Activity Category C Sites.

Exhibit 15: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area West Terminus at I-90/SR 290

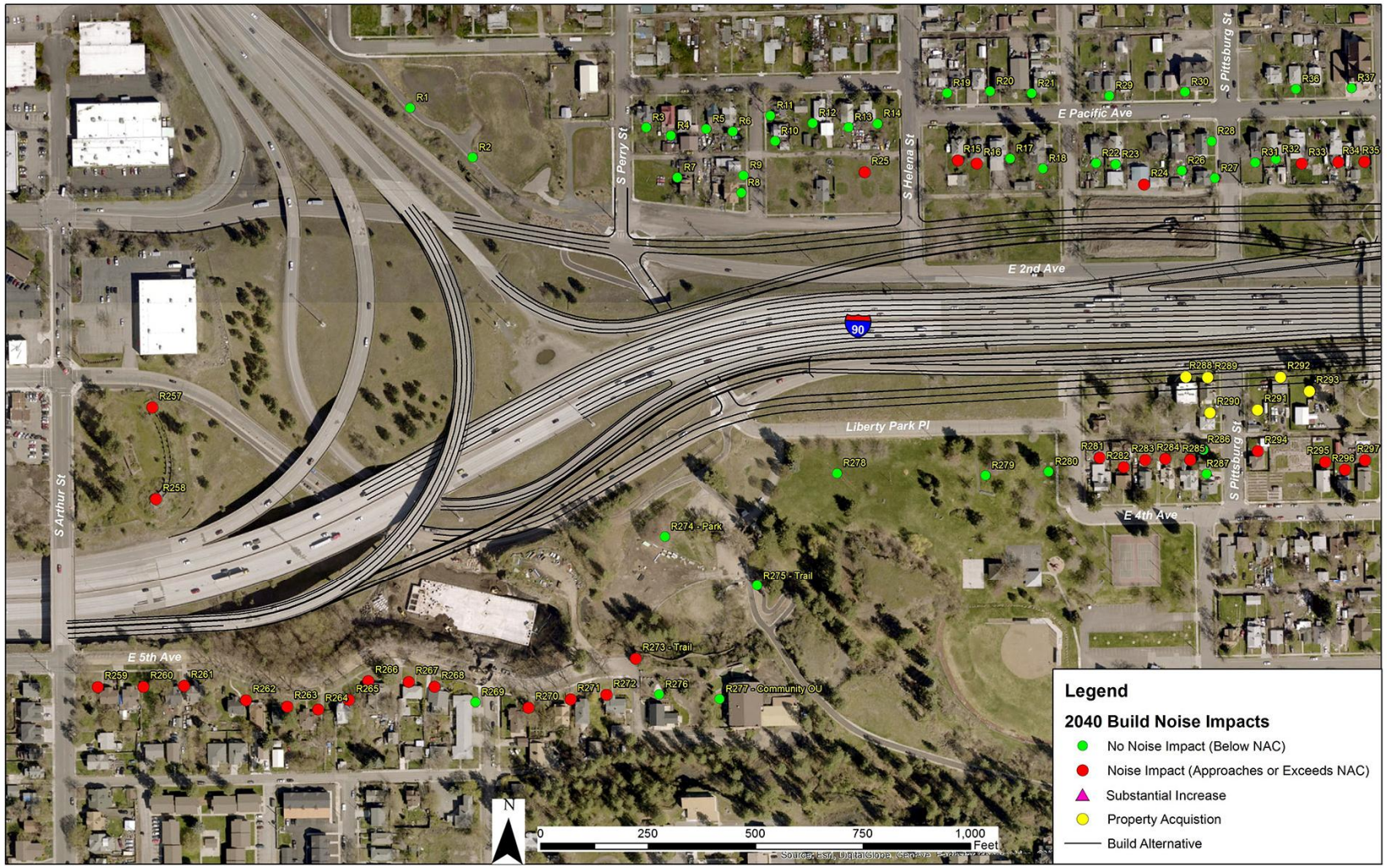

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Exhibit 16: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area West

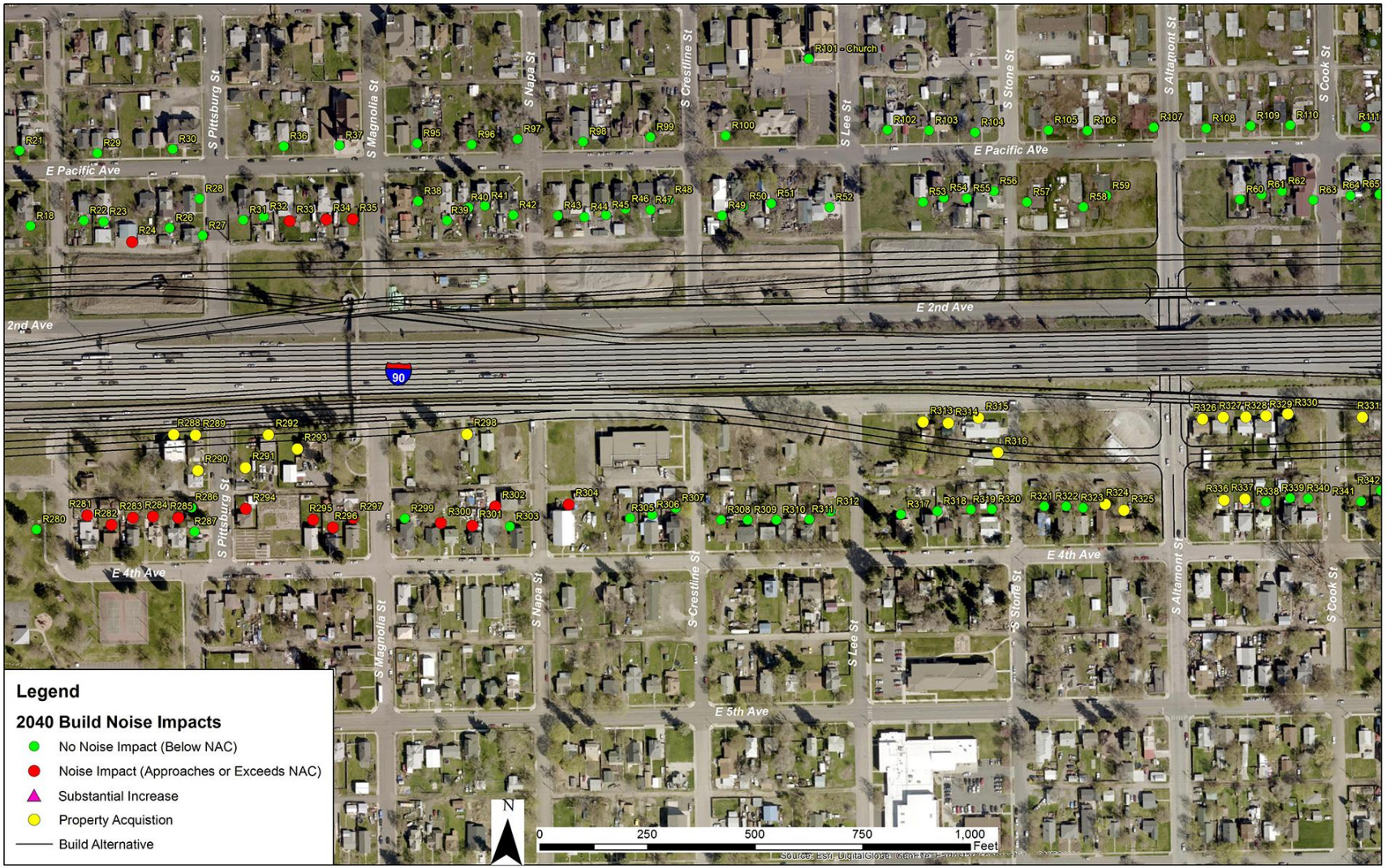

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Exhibit 17: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area West-Central

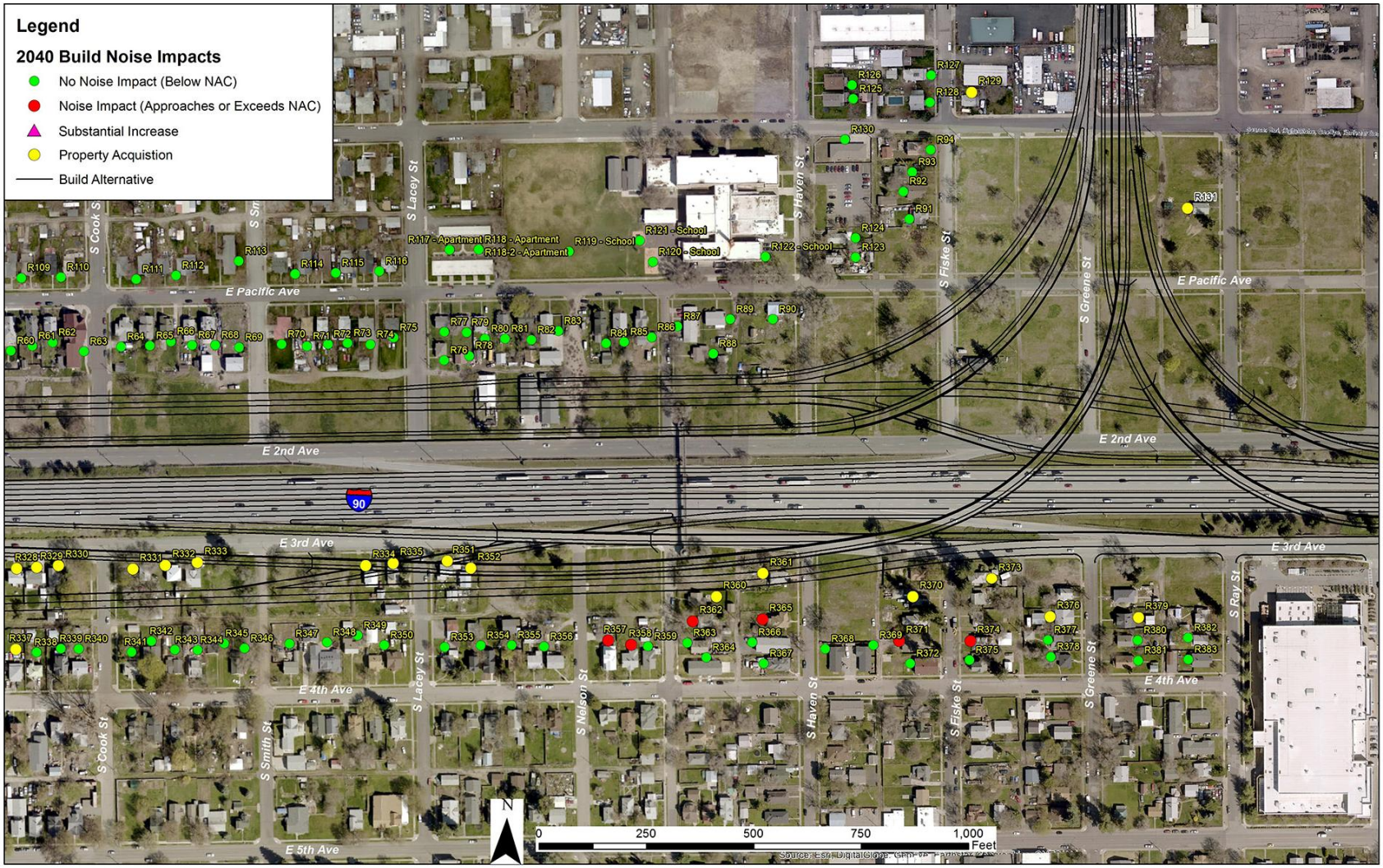

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Exhibit 18: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area Central

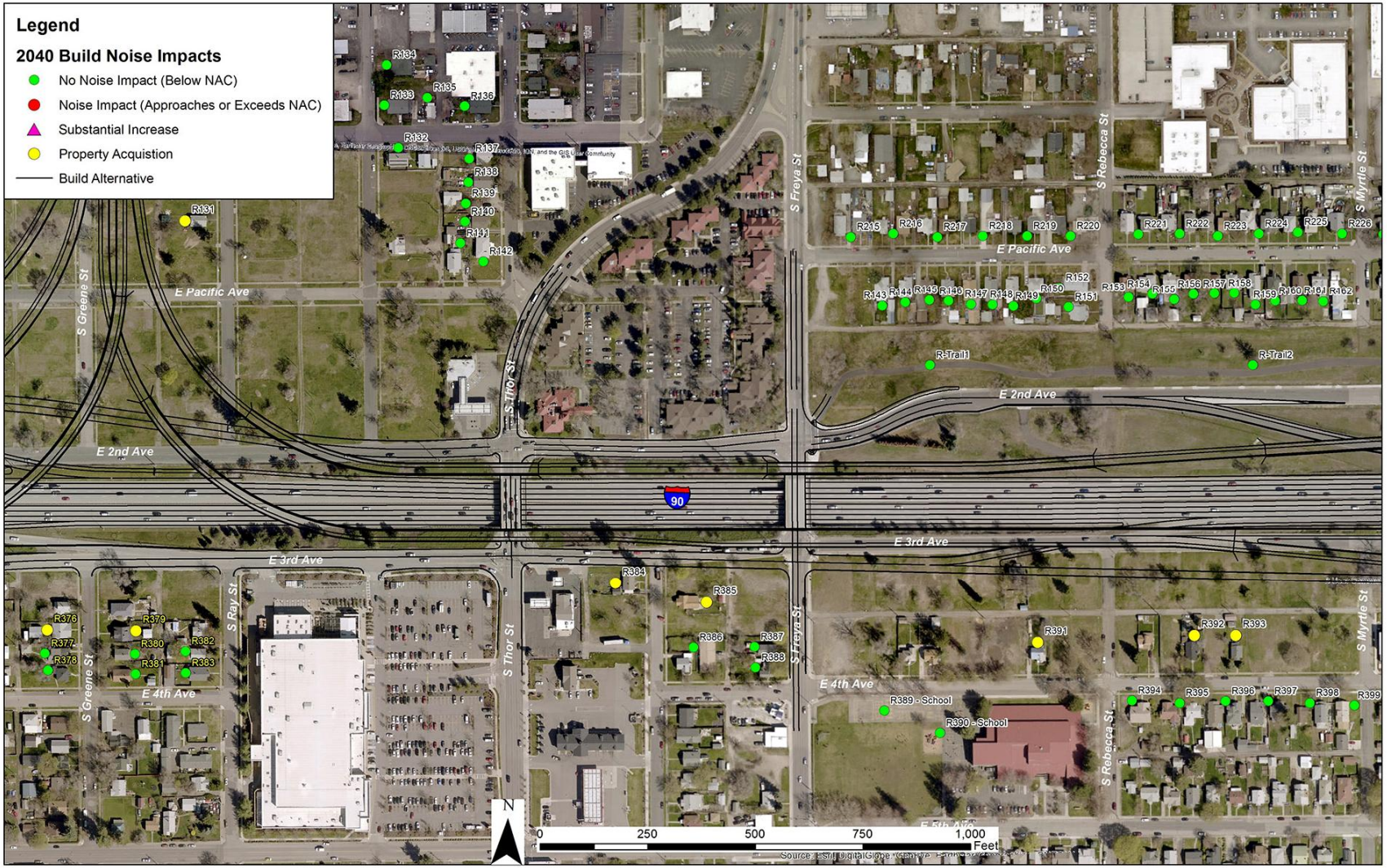

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Exhibit 19: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area Central-East

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Exhibit 20: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area East

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Exhibit 21: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area East Terminus at I-90/Sprague Avenue

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Exhibit 22: Modeled 2040 Build Noise Abatement Criteria Impacts – Project Area North Terminus at Future US 395/E. Mission Avenue

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Traffic Noise Abatement

Traffic Noise Abatement—Background

Noise abatement, including noise barrier evaluation, is necessary only where frequent human use occurs and where a lower noise level would provide benefits (FHWA, 1982). To be effective, the barrier must block the line-of-sight between the highest point of a noise source and the receptor. It must be long enough to prevent sounds from passing around the ends (flanking), have no openings (i.e., side streets), and be dense enough so that noise will not be transmitted through it. Intervening rows of buildings that are not noise sensitive could also be used as barriers (FHWA, 1973). Access limitations, location in relation to surrounding roadways, and the low number of noise-sensitive land uses at some impact locations prevent feasible and reasonable noise barrier placement to effectively reduce traffic noise levels predicted for the project as discussed below.

Abatement was considered for this project because traffic noise impacts are predicted at 91 modeled sites. The 91 modeled sites are grouped in nine discrete areas where noise barrier placement was considered. Areas where impacts are predicted were evaluated to determine if a feasible noise barrier could be constructed as described below.

Feasibility

Feasibility is a combination of acoustic and engineering considerations. All of the following must occur for abatement (e.g., noise barrier) to be considered feasible.

- Abatement must be physically constructible.
- The majority of first row receivers experiencing noise impacts must obtain a minimum 5 dBA of noise reduction as a result of abatement (insertion loss), assuring that every reasonable effort will be made to assess outdoor use areas as appropriate.

For this project, nine discrete areas of impacts were considered for noise abatement. Noise barriers were evaluated at all nine impact areas, and at multiple locations within impact areas to determine whether abatement could sufficiently reduce traffic noise levels. Fifteen noise barriers located within the nine impact areas were evaluated along the project corridor on both sides of I-90 and west of the proposed US 395 alignment. All noise barriers were evaluated within WSDOT right-of-way or near the edge of the roadway shoulder. Each evaluated noise barrier location is described below and includes consideration of multiple barrier heights and lengths in an attempt to achieve WSDOT criteria for feasibility and reasonableness.

Seven of the 15 evaluated barrier locations meet WSDOT Feasibility Criteria, as shown in Exhibit 23. Noise barrier locations are shown in Exhibits 24 through Exhibit 31.

Noise Barrier NW1-AB—Sites R15, R16, R24, R25, R33 through R35

Noise Barrier NW1-AB is a two-barrier system located on the edge of pavement on the frontage road north of I-90. Barrier Segment 1NW-A was evaluated between S. Perry Street and S. Helen Street; Barrier Segment 1NW-B was evaluated between S. Helen Street and S. Magnolia Street. The

location of the noise barriers is shown on Exhibits 24 and 25. Noise Barrier NW1-AB was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Perry Street and S. Magnolia Street, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 2,896 feet long in this location. A minimum feasible barrier height of 14 feet tall and 2,896 feet long would reduce traffic noise levels by at least 5 dBA at 5 of the 7 impacted first row homes in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier NW1-B—Sites R15, R16, R24, R33 through R35

Noise Barrier NW1-B is located on the edge of pavement on the frontage road north of I-90. Barrier Segment 1NW-B was evaluated between S. Helen Street and S. Magnolia Street. The location of the noise barrier is shown on Exhibits 24 and 25. Noise Barrier NW1-B was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Helen Street and S. Magnolia Street, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 1,094 feet long in this location. A minimum feasible barrier height of 14 feet tall and 1,094 feet long would reduce traffic noise levels by at least 5 dBA at 4 of the 6 impacted first row homes in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 2NE-Ramp—Sites R187 – R193, R195 – R197, and R199 -- R213

Noise Barrier 2NE-Ramp is located on the edge of pavement on the westbound I-90 on-ramp east of US 395. Barrier 2NE-Ramp was evaluated between S. Havana Street and S. Carnahan Road. The location of the noise barrier is shown on Exhibits 28 and 29. Noise Barrier 2NE-Ramp was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Havana Street and S. Carnahan Road, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 2,995 feet long in this location. A minimum feasible barrier height of 10 feet tall and 2,995 feet long would reduce traffic noise levels by at least 5 dBA at 14 of the 26 impacted first row homes in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 2NE-Mainline and Ramp—Sites R187 -- R193, R195 – R197, and R199 – R213

Noise Barrier 2NE-Mainline and Ramp is a two-barrier system located on the edge of pavement on the westbound I-90 mainline and westbound I-90 on-ramp east of US 395. Barrier 2NE-Mainline and Ramp was evaluated between S. Havana Street and S. Carnahan Road. The location of the two-barrier system is shown on Exhibits 28 and 29. Noise Barrier 2NE-Mainline and Ramp was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Havana Street and S. Carnahan Road, north of the proposed project alignment. The barrier system was evaluated at heights up to 20 feet tall and a combined 4,316 feet in length in this location. A minimum feasible barrier height of 10 feet tall and 4,316 feet combined length would reduce traffic noise levels by at least 5 dBA at 15 of the 26 impacted first row homes in this area. Since this barrier is feasible, the

next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 3SW-Trail—Sites R257 and R258

Noise Barrier 3SW-Trail is located on structure on the southbound SR 290 off-ramp to westbound I-90. Barrier 3SW-Trail was evaluated east of the I-90 overcrossing at S. Arthur Street. The location of the barrier is shown on Exhibit 24. Noise Barrier 3SW-Trail was evaluated to reduce noise levels at two outdoor recreation areas with noise criteria impacts located northwest of the I-90/SR 290 Interchange, northwest of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 957 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 3SW-Trail was not able to provide the necessary 5 dBA reduction at any of first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 3SW-Trail does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 3SW-Ramp—Sites R259 through R268 and R270 through R273-Trail

Noise Barrier 3SW-Ramp is located on structure on the eastbound I-90 off-ramp at S. Arthur Street. Barrier 3SW-Ramp was evaluated east of the I-90 overcrossing at S. Arthur Street. The location of the barrier is shown on Exhibit 24. Noise Barrier 3SW-Ramp was evaluated to reduce noise levels at 13 residences and one trail with noise criteria impacts located south of the I-90/SR 290 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,677 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 3SW-Ramp was not able to provide the necessary 5 dBA reduction at the majority of impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 3SW-Ramp does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 3SW-Frontage—Sites R259 through R268 and R270 through R273-Trail

Noise Barrier 3SW-Frontage is located on the edge of terrain line separating the community south of the I-90/SR 290 Interchange from I-90 and Liberty Park. Barrier 3SW-Frontage was evaluated east of the I-90 overcrossing at S. Arthur Street along E. 5th Avenue and along the highpoint of Liberty Trail overlooking Liberty Park and I-90. The location of the barrier is shown on Exhibit 24. Noise Barrier 3SW-Frontage was evaluated to reduce noise levels at 13 residences and one trail with noise criteria impacts located south of the I-90/SR 290 Interchange. The barrier was evaluated at heights up to 20 feet tall and 692 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 3SW-Frontage was not able to provide the necessary 5 dBA reduction at the majority of impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 3SW-Frontage does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 4SW—Sites R281 – R285, R294 – R297, R300 – R302, and R304

Noise Barrier 4SW is located on the edge of shoulder separating of the eastbound I-90 off-ramp from Liberty Park to S. Crestline Street southeast of the I-90/SR 290 Interchange. Barrier 4SW was evaluated along the eastbound I-90 off-ramp as this ramp is located at a topographic high point

between I-90 and the community to the south. The location of the barrier is shown on Exhibits 24 and 25. Noise Barrier 4SW was evaluated to reduce noise levels at 15 residences with noise criteria impacts located south of the I-90/SR 290 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,930 feet long in this location. A minimum feasible barrier height of 12 feet tall and 1,930 feet long would reduce traffic noise levels by at least 5 dBA at 11 of the 15 impacted first row homes in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 5SW-Frontage—Sites R357, R358, R362, R365, R369, R371, and R374

Noise Barrier 5SW-Frontage is located on structure of the eastbound I-90 off-ramp to northbound US 395. The location of the barrier is shown on Exhibit 26. Noise Barrier 5SW-Frontage was evaluated to reduce noise levels at 7 residences with noise criteria impacts located southwest of the future I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,332 feet long in this location. A minimum feasible barrier height of 12 feet tall and 1,332 feet long would reduce traffic noise levels by at least 5 dBA at 5 of the 7 impacted first row homes in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 5SW-Ramp—Sites R357, R358, R362, R365, R369, R371, and R374

Noise Barrier 5SW-Ramp is located on the edge of shoulder on the eastbound I-90 off-ramp to E. 3rd Avenue. The location of the barrier is shown on Exhibit 26. Noise Barrier 5SW-Ramp was evaluated to reduce noise levels at 7 residences with noise criteria impacts located southwest of the future I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,515 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 5SW-Ramp was not able to provide the necessary 5 dBA reduction at the majority of impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 5SW-Ramp does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 6SE-Apartments—Site R424-2

Noise Barrier 6SE-Apartments is located on the edge of shoulder on the eastbound Frontage Road running parallel to I-90 between S. Havana Street and S. Dearborn Road. The location of the barrier is shown on Exhibit 28. Noise Barrier 6SE-Apartments was evaluated to reduce noise levels at 2 apartment units with noise criteria impacts located at the Dearborn Apartment complex, southeast of the future I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,049 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 6SE-Apartments was not able to provide the necessary 5 dBA reduction at the majority of impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 6SE-Apartments does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 7SE-Frontage—Sites R481, R486, R490, and R495 through R498

Noise Barrier 7SE-Frontage is a three-barrier system located along the frontage road that parallels eastbound I-90 between S. McKinnon Road and S. Fancher Road. Noise Barrier 7SE-Front Segments

are located as follows: Segment A is located between S. McKinnon Road and S. Koren Road; Segment B is located between S. Koren Road and S. Howe Road; and Segment C is located between S. Howe Road and S. Fancher Road. The breaks between noise barrier segments are necessary to provide access to local roads. Segment C includes two openings at driveway entrances to maintain the only access to these properties. The location of the three-barrier system is shown on Exhibits 29 and 30. Noise Barrier 7SE-Frontage was evaluated to reduce noise levels at 14 residences with noise criteria impacts located south of the I-90 along E. 4th Avenue. The barrier was evaluated at heights up to 20 feet tall and a combined 1,443 feet in length in this location. At barrier heights up to 20 feet tall, Noise Barrier 7SE-Frontage was not able to provide the necessary 5 dBA reduction at the majority of impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 7SE-Frontage does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 8SE-Edge of Shoulder (EOS)—Sites R502 and R503

Noise Barrier 8SE-EOS is located along the edge-of-shoulder on eastbound I-90 off-ramp to I-90 Business Route/E. Appleway Blvd. The location of the barrier is shown on Exhibit 30. Noise Barrier 8SE-EOS was evaluated to reduce noise levels at two outdoor recreation areas at the Trailer Inns RV Park with noise criteria impacts located south of the eastbound I-90 off-ramp to I-90 Business Route/E. Appleway Blvd. The barrier was evaluated at heights up to 20 feet tall and 826 feet long in this location. A minimum feasible barrier height of 14 feet tall and 826 feet long would reduce traffic noise levels by at least 5 dBA at both impacted first row outdoor locations in this area. Since this barrier is feasible, the next step is to determine if there is a barrier configuration that is reasonable as well. Additional noise wall dimensions were evaluated as part of the reasonableness determination described later in this chapter.

Noise Barrier 9-Ramp—Sites R504 through R518

Noise Barrier 9-Ramp is located on structure on the southbound US 395 off-ramp to westbound I-90. The location of the barrier is shown on Exhibit 31. Noise Barrier 9-Ramp was evaluated to reduce noise levels at 15 residences with substantial increase impacts located northwest of the future I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,387 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 9-Ramp was not able to provide the necessary 5 dBA reduction at any of the impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 9-Ramp does not meet WSDOT Feasibility Criteria and is not recommended.

Noise Barrier 9-Mainline—Sites R504 through R518

Noise Barrier 9-Mainline is located on structure on southbound US 395 mainline north of I-90. The location of the barrier is shown on Exhibit 31. Noise Barrier 9-Mainline was evaluated to reduce noise levels at 15 residences with substantial increase impacts located northwest of the future I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,309 feet long in this location. At barrier heights up to 20 feet tall, Noise Barrier 9-Mainline was not able to provide the necessary 5 dBA reduction at any of the impacted first row sites. By not providing the necessary noise reduction at impacted sites located behind the barrier, Noise Barrier 9-Mainline does not meet WSDOT Feasibility Criteria and is not recommended.

Exhibit 23: Feasibility Analysis

Noise Barrier	1st Row Receptors			Min. Design Goal NW		- 10 dBA in 1st Row		Feasible? Yes/No
	Site & Land Use	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	
NW1-AB	R7 – R9, R15*, R16*, R17, R18, R22, R23, R24*, R25*, R26 – R28, R31, R32, R38 – R56, R33* – R35* (all Cat B)	66 - 70	66 - 67	5 - 7	71%	N/A	N/A	Yes
NW1-B	R15*, R16*, R17, R18, R22, R23, R26 – R28, R31, R32, R24*, R33* – R35*, R38 – R52 (all Cat B)	66 - 70	66 - 67	5 - 7	67%	N/A	N/A	Yes
NE2-Ramp	R187* – R193*, R195* – R197*, R199* – R211*, R212, R213 (all Cat B)	64 - 71	65 - 71	5 - 6	54%	N/A	N/A	Yes
NE2-Mainline /Ramp	R187* – R193*, R195* – R197*, R199* – R211*, R212, R213 (all Cat B)	64 - 71	65 - 71	5 - 6	58%	N/A	N/A	Yes
3SW-Trail	R25* and R258* (both Cat C)	68 - 75	68 - 75	3	0%	N/A	N/A	No
3SW-Ramp	R259* - R272*, R276* (all Cat B), R273* – R275* and R277 (Cat C)	62 - 69	63 - 70	0 - 5	7%	N/A	N/A	No
3SW-Frontage	R259* - R272*, R276* (all Cat B), R273* –	62 - 69	63 - 70	0 - 9	36%	N/A	N/A	No

Noise Barrier	1st Row Receptors			Min. Design Goal NW		- 10 dBA in 1st Row		Feasible? Yes/No
	Site & Land Use	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	
	R275* and R277 (Cat C)							
4SW	R281* – R285*, R294* - R297*, R300" – R302", R304* (all Cat B)	62 - 67	61 - 68	1 – 6	73%	N/A	N/A	Yes
5SW-Frontage	R353* - R359*, R362*, R363, R364, R365*, R366, R367, R368*, R369*, R371*, R372, R374*, R375, R377*, R378 (all Cat B)	60 - 69	60 - 68	1 - 6	71%	N/A	N/A	Yes
5SW-Ramp	R353* - R359*, R362*, R363, R364, R365*, R366, R367, R368*, R369*, R371*, R372, R374*, R375, R377*, R378 (all Cat B)	60 - 69	60 - 68	0 - 1	0%	N/A	N/A	No
6SE-Apartments	R413*-R415*, R420*-R427*, R428-R432, R434*-R439*, R440-R444, R420-2*-R427-2* (All Cat B), R418 (C), R419 (C)	57 - 67	57 - 66	0 - 5	17%	N/A	N/A	No
7SE-Frontage	R477-R479, R480*, R481*, R482-R485, R486*, R487-R489, R490*, R491-R493, R495*, R496*, R497,	57 - 66	56 - 69	0 - 9	36%	N/A	N/A	No

Noise Barrier	1st Row Receptors			Min. Design Goal NW		- 10 dBA in 1st Row		Feasible? Yes/No
	Site & Land Use	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	Insertion Loss (dBA)	% 1st Row ≥ 5 dBA	
	R498*, R499-R501 (All Cat B)							
8SE-EOS	R502* and R503* (both Cat C)	65 - 66	66 - 68	5 -6	100%	N/A	N/A	Yes
9-Ramp	R504, R505*, R506, R507, R508, R509, R510*, R511, R512, R513, R514, R515, R516, R517*, R518* (all Cat B)	41 - 46	54 - 61	0 - 1	0%	N/A	N/A	No
9-Mainline	R504, R505*, R506, R507, R508, R509, R510*, R511, R512, R513, R514, R515, R516, R517*, R518* (all Cat B)	41 - 46	54 - 61	1 - 4	0%	N/A	N/A	No

Notes:
"" denotes first row receiver*
See Exhibit 3 for definitions of Activity Categories.

Exhibit 24: 2040 Build Evaluated Noise Barriers — Project Area West Terminus at I-90/SR 290

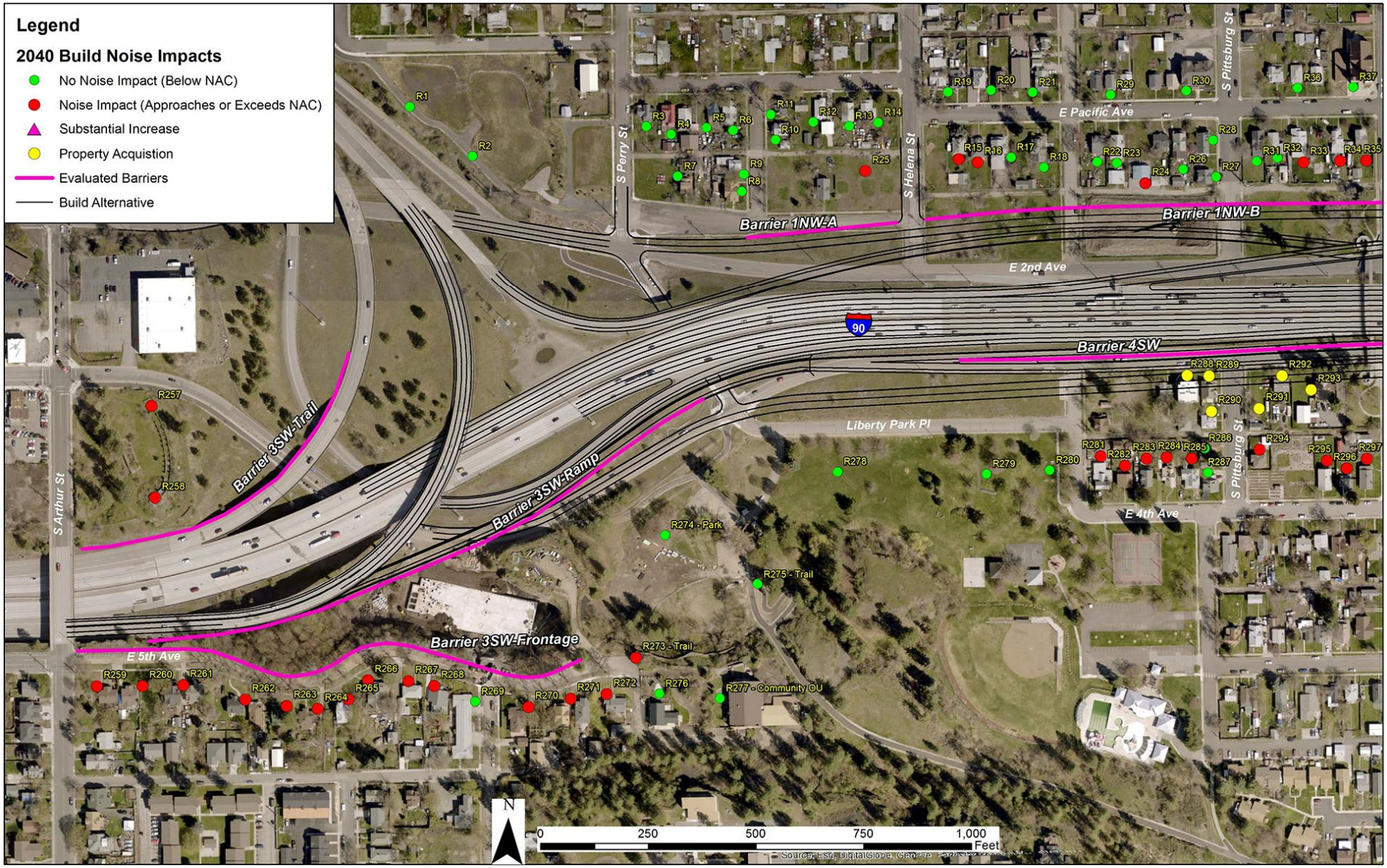

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Exhibit 25: 2040 Build Evaluated Noise Barriers — Project Area West

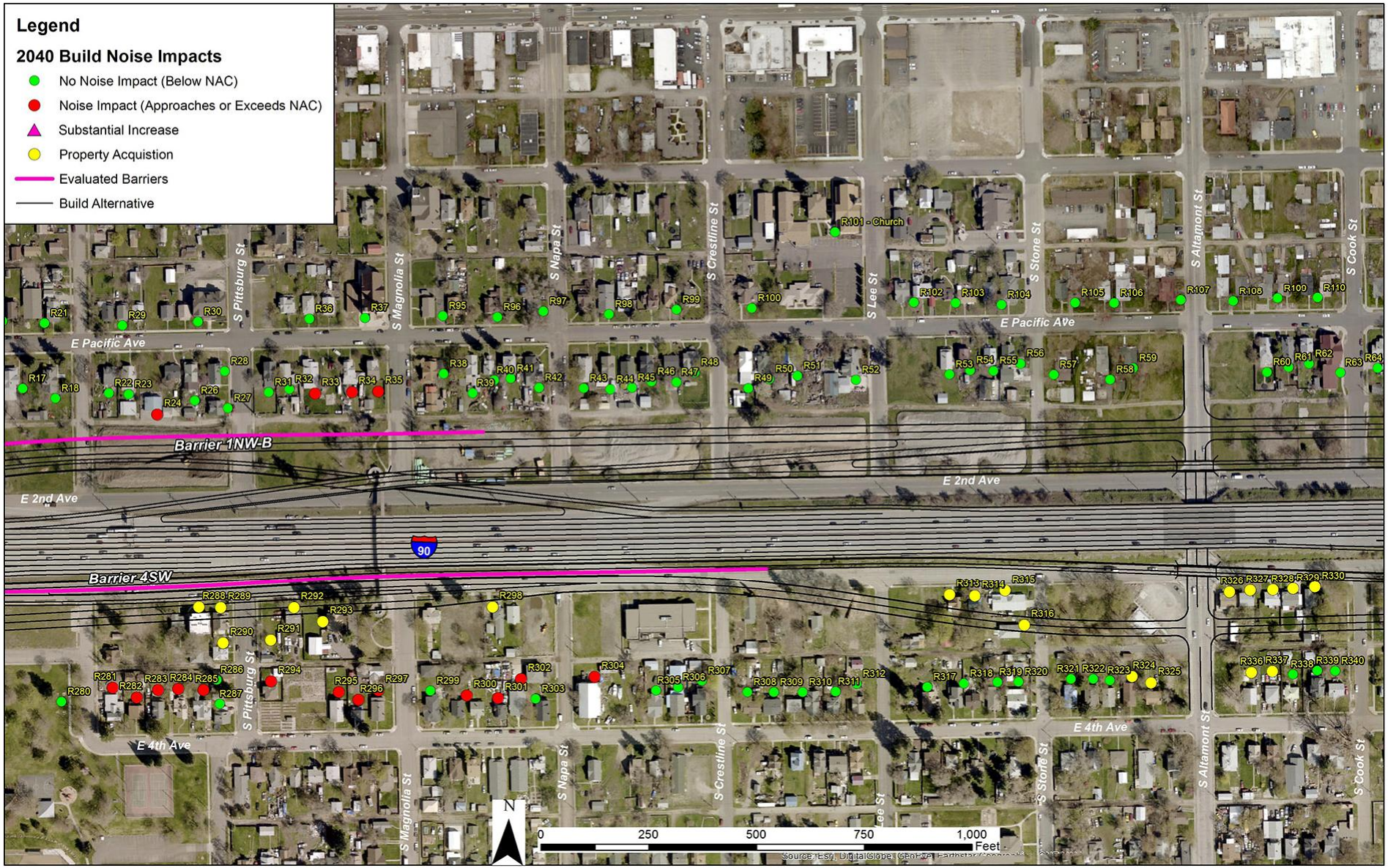

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Exhibit 26: 2040 Build Evaluated Noise Barriers — Project Area West-Central

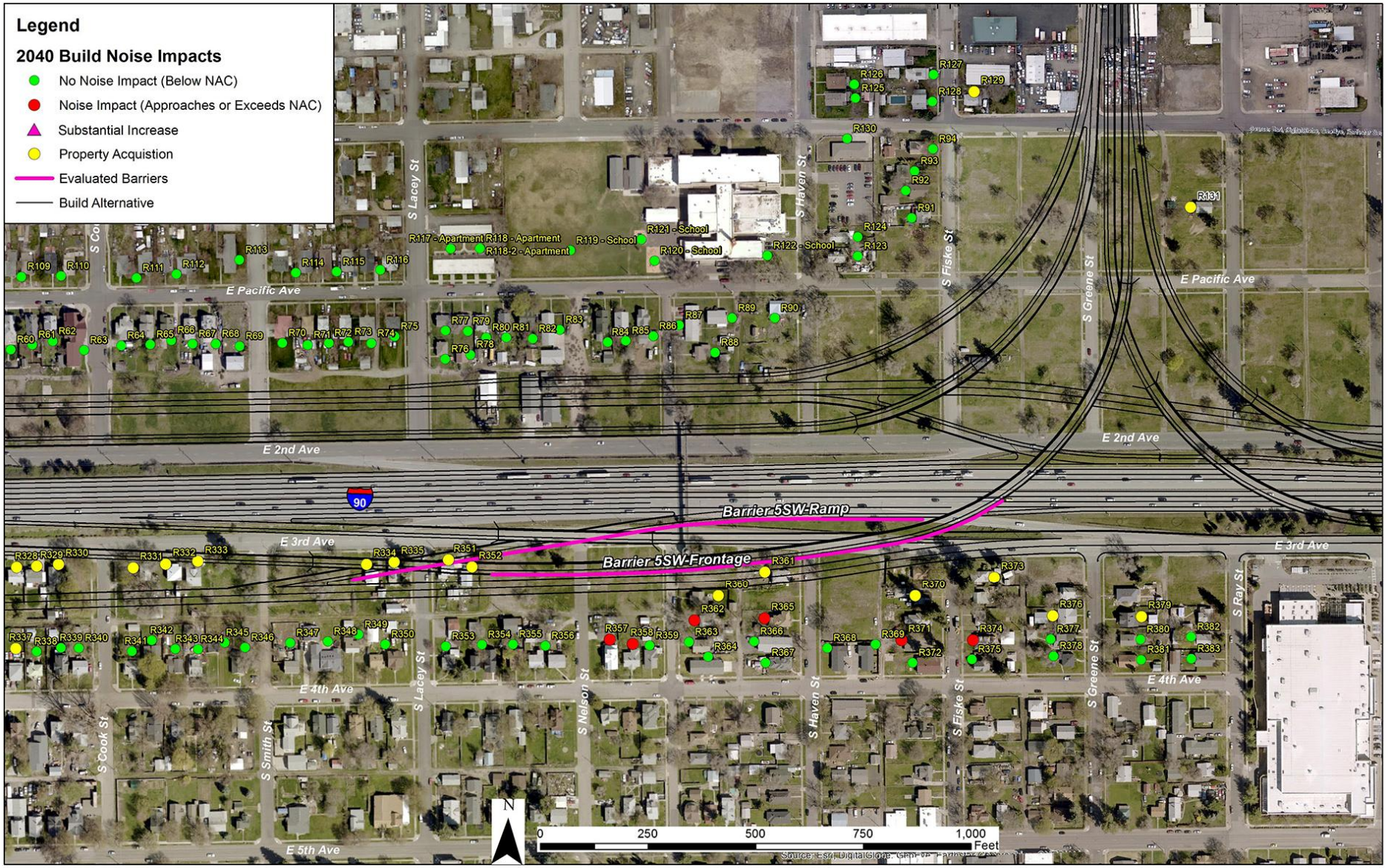

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Exhibit 27: 2040 Build Evaluated Noise Barriers — Project Area Central

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Exhibit 28: 2040 Build Evaluated Noise Barriers — Project Area Central-East

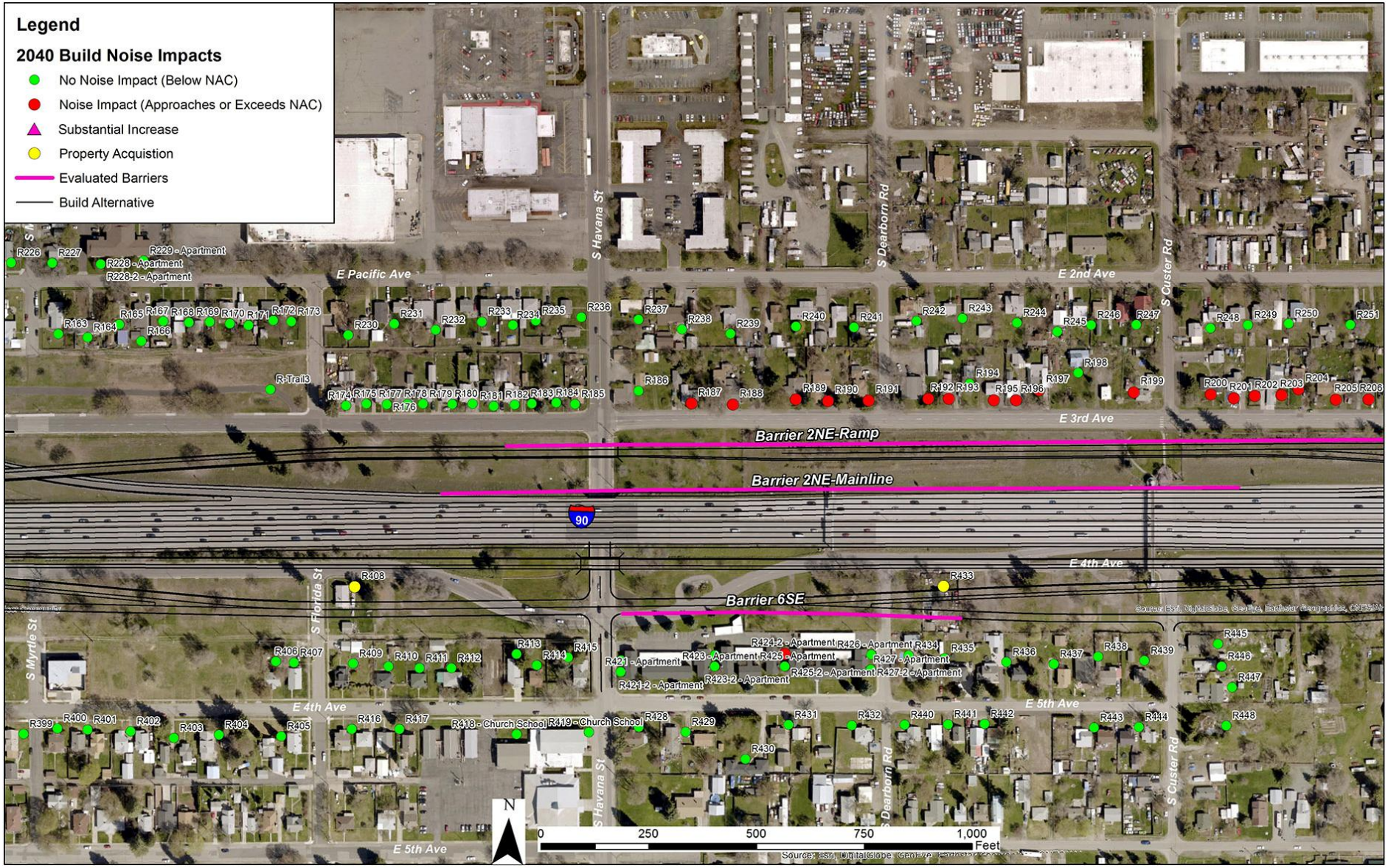

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Exhibit 29: 2040 Build Evaluated Noise Barriers — Project Area East

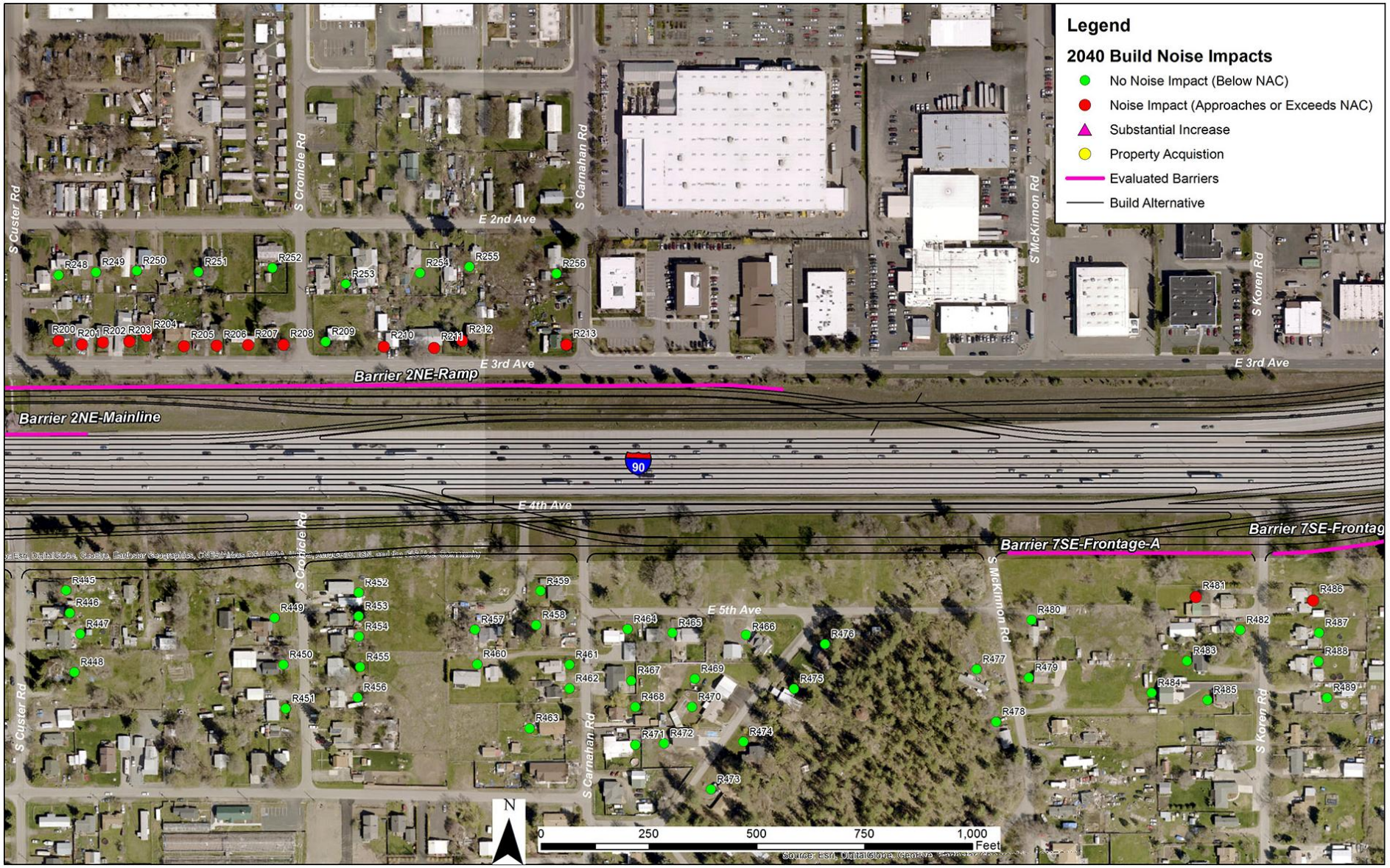

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Exhibit 30: 2040 Build Evaluated Noise Barriers — Project Area East Terminus at I-90/Sprague Avenue

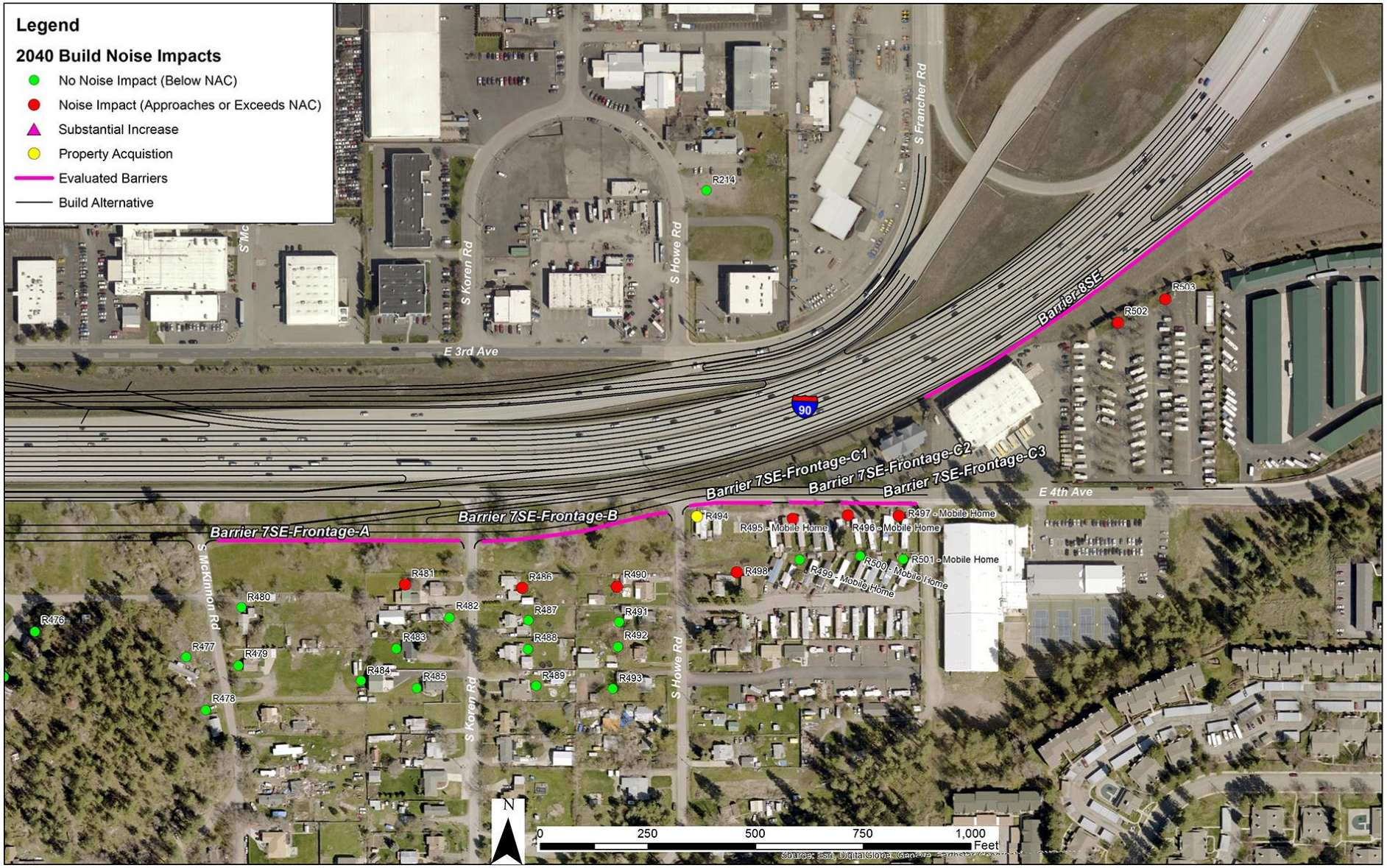

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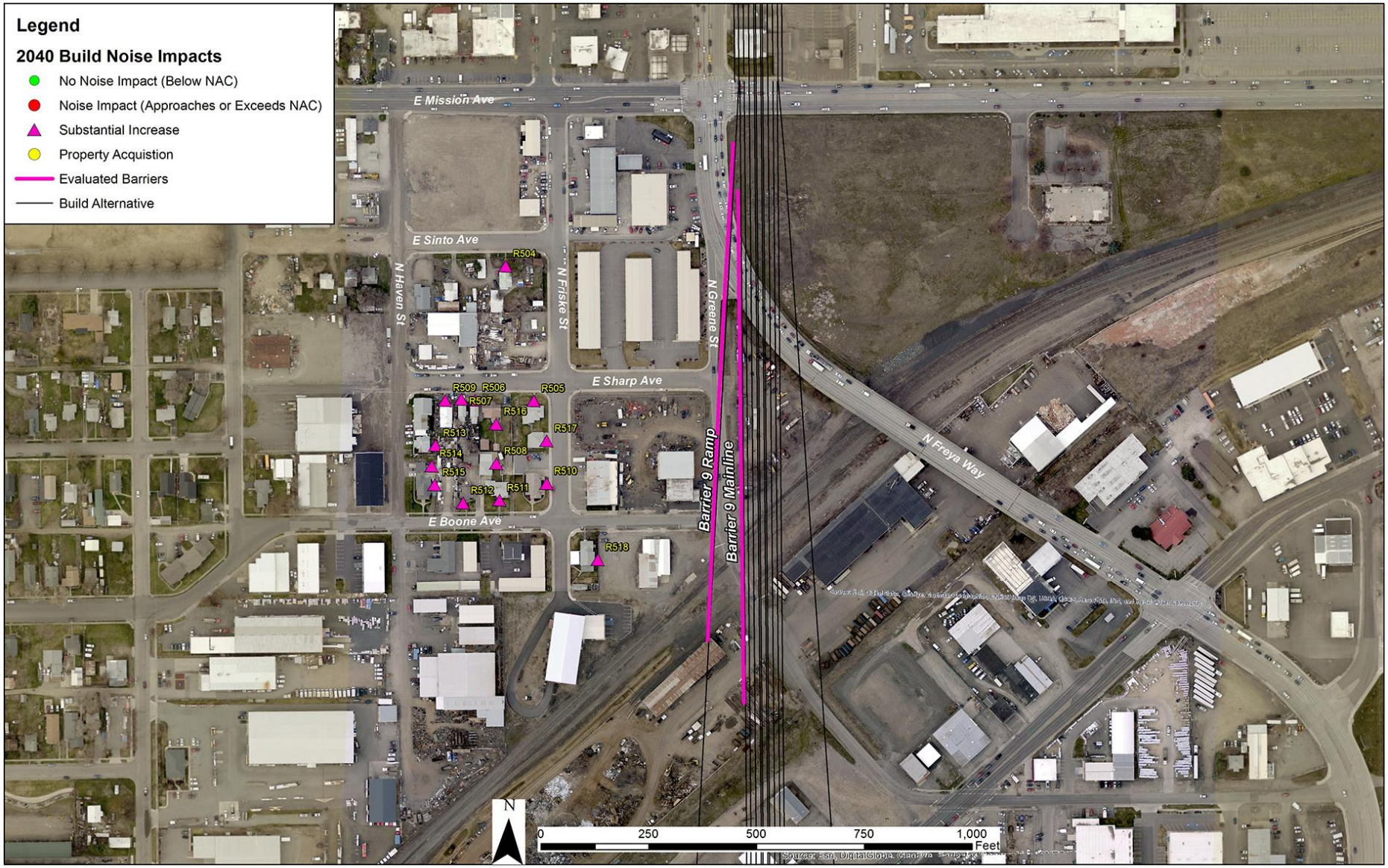
Exhibit 31: 2040 Build Evaluated Noise Barriers — Project Area North Terminus at Future US 395/E. Mission Avenue



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Noise Discipline Report

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Reasonableness of Noise Barriers

Since abatement is feasible at seven evaluated barriers within five impact areas [Noise Barriers NW1-AB, NW1-B, 2NE-Ramp, 2NE-Mainline/Ramp, 4SW, 5SW-Frontage, and 8SE-EOS], the reasonableness of abatement was evaluated for all seven barrier locations. Noise walls, or other types of abatement, will only be constructed by WSDOT if they have been determined to be reasonable by satisfying three criteria:

1. Cost Effectiveness

Noise abatement meets cost effectiveness criteria if the cost of minimum feasible noise abatement is equal to or less than the allowable cost of abatement for each noise wall location analyzed. Based on noise wall costs from 2007-2010, the current average cost for Washington State is $51.61 per square foot ($ft^2$) of wall area. The cost is applied to the allowed wall surface area (ft^2) to generate the allowable cost per qualified resident described in Exhibit 32. The allowable cost per receiver, based on Build condition traffic noise levels is described in Exhibit 32. The information provided in Exhibit 32 is included in the WSDOT Noise Policy (WSDOT, 2012).

Exhibit 32: Reasonableness Allowances

Column A Design Year Traffic Sound Decibel Level (dBA)	Column B Noise Level Increase as a Result of the Project (dBA)(2)	Column C Allowed Wall Surface Area Per Qualified Residence or Residential Equivalent	Column D Allowed Cost Per Qualified Residence or Residential Equivalent(1)
66		700 Square Feet	$36,127
67		768 Square Feet	$39,636
68		836 Square Feet	$43,146
69		904 Square Feet	$46,655
70		972 Square Feet	$50,165
71	10 (substantial, step 1) [3]	1,040 Square Feet	$53,674
72	11 (substantial, step 1)	1,108 Square Feet	$57,184
73	12 (substantial, step 1)	1,176 Square Feet	$60,693
74	13 (substantial, step 1)	1,244 Square Feet	$64,203
75	14 (substantial, step 1)	1,312 Square Feet	$67,712
76	15 (substantial, step 2)(4)	1,380 Square Feet	$71,222

Notes
(1) Current costs based on $51.61 per square foot constructed cost developed in 2011.
(2) If the noise level increases 10 dBA or more as the result of the project (Column B), regardless of Design Year traffic sound level, follow the allowed wall surface and cost for the level of increase in Column C 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 the project results in an increase of 15 or more decibels, continue increasing the allowance at the rate provided in the table unless circumstances determined on a case-by case basis require an alternative methodology for determining allowance.
(3) Step 1 is when the noise levels are 10 to 14 dBA over Existing condition traffic noise as a result of the transportation project.
(4) Step 2 is when the noise levels are 15 or more dBA over Existing condition traffic noise as a result 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.

The approximate costs reflected in the reasonableness evaluation are based on statewide average construction costs, and may not reflect site-specific complexities. Any additional costs of placing each noise barrier on property not owned by WSDOT or costs associated with noise barrier construction (conflicts from utilities, steep slopes, ground conditions, etc.) will be included in the final design state evaluation of this barrier to confirm whether or not the barrier meets the reasonableness criteria.

2. Design Goal Achievement

The minimum feasibility design goal for abatement on all projects is at least 5 dBA of noise reduction for the majority of front row receivers with noise impacts and, for reasonableness, at least 7 dBA of reduction for one or more receivers. 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 insertion loss (noise reduction) at the first row of receivers for all projects where abatement is recommended.

Exhibit 33 through Exhibit 39 describe the allowable cost per receiver and the cost of the minimum barrier size to achieve the design goal at all feasible noise barriers (Noise Barriers NW1-AB, NW1-B, 2NE-Ramp, 2NE-Mainline/Ramp, 4SW, 5SW-Frontage, 7SE-Frontage, and 8SE-EOS). No barriers were evaluated that would receive 10 dBA of reduction for the majority of first row receivers.

Noise Barrier NW1-AB—Sites R15, R16, R24, R25, R33 – R35

Noise Barrier NW1-AB is a two-barrier system located on the edge of pavement on the frontage road north of I-90. Barrier Segment 1NW-A was evaluated between S. Perry Street and S. Helen Street and Barrier Segment 1NW-B was evaluated S. Helen Street and S. Magnolia Street. The location of the noise barrier is shown on Exhibits 24 and 25. Noise Barrier NW1-AB was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Perry Street and S. Magnolia Street, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 2,896 feet long in this location. A minimum feasible barrier height of 14 feet tall and 2,896 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Site R24. At a height of 14 feet, the barrier would cost approximately $2,092,476. The barrier would benefit 12 receiver locations, which represent 12 residential equivalent units, resulting in a reasonable allowance of $473,160. Additional noise barrier heights and lengths were evaluated for Noise Barrier NW1-AB; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier NW1-AB being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier NW1-B—Sites R15, R16, R24, R33 – R35

Noise Barrier NW1-B is located on the edge of pavement on the frontage road north of I-90. Barrier Segment 1NW-B was evaluated between S. Helen Street and S. Magnolia Street. The location of the noise barrier is shown on Exhibits 24 and 25. Noise Barrier NB1-B was evaluated to reduce noise

levels at residences with noise criteria impacts located between S. Helen Street and S. Magnolia Street, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 1,094 feet long in this location. A minimum feasible barrier height of 14 feet tall and 1,094 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Site R24. At a height of 14 feet, the barrier would cost approximately $790,459. The barrier would benefit 11 receiver locations, which represent 11 residential equivalent units, resulting in a reasonable allowance of $476,669. Additional noise barrier heights and lengths were evaluated for Noise Barrier NW1-B; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier NW1-B being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier 2NE-Ramp—Sites R187 – R193, R195 – R197, and R199 – R213

Noise Barrier 2NE-Ramp is located on the edge of pavement on the westbound I-90 on-ramp east of US 395. Barrier 2NE-Ramp was evaluated between S. Havana Street and S. Carnahan Road. The location of the noise barrier is shown on Exhibits 28 and 29. Noise Barrier 2NE-Ramp was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Havana Street and S. Carnahan Road, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and 2,995 feet long in this location. A minimum feasible barrier height of 10 feet tall and 2,995 feet long would reduce traffic noise levels by at least 5 dBA at 14 of the 26 impacted first row homes in this area. A barrier height of 12 feet tall and 2,995 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Sites R204 and R212. At a height of 12 feet, the barrier would cost approximately $1,854,863. The barrier would benefit 15 receiver locations, which represent 17 residential equivalent units, resulting in a reasonable allowance of $807,179. Additional noise barrier heights and lengths were evaluated for Noise Barrier 2NE-Ramp; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier 2NE-Ramp being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier 2NE-Mainline and Ramp—Sites R187 – R193, R195 – R197, and R199 – R213

Noise Barrier 2NE-Mainline and Ramp is a two-barrier system located on the edge of pavement on the westbound I-90 mainline and westbound I-90 on-ramp east of US 395. Barrier 2NE-Mainline and Ramp was evaluated between S. Havana Street and S. Carnahan Road. The location of the two-barrier system is shown on Exhibits 28 and 29. Noise Barrier 2NE-Mainline and Ramp was evaluated to reduce noise levels at residences with noise criteria impacts located between S. Havana Street and S. Carnahan Road, north of the proposed project alignment. The barrier was evaluated at heights up to 20 feet tall and a combined 4,316 feet in length in this location. A minimum feasible barrier height of 10 feet tall and 4,316 feet combined length would reduce traffic noise levels by at least 5 dBA at 15 of the 26 impacted first row homes in this area. A barrier height of 12 feet tall and combined length of 4,316 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Sites R198, R204, and R212. At a height of 12 feet, the barrier would cost approximately

$2,672,985. The barrier would benefit 14 receiver locations, which represent 16 residential equivalent units, resulting in a reasonable allowance of $843,306. Additional noise barrier heights and lengths were evaluated for Noise Barrier 2NE-Mainline and Ramp; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier 2NE-Mainline and Ramp being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier 4SW—Sites R281 – R285, R294 – R297, R300 – R302, and R304

Noise Barrier 4SW is located on the edge of shoulder separating of the eastbound I-90 off-ramp from Liberty Park to S. Crestline Street southeast of the I-90/SR 290 Interchange. Barrier 4SW was evaluated along the eastbound I-90 off-ramp as this location is located at a topographic high point between I-90 and the community to the south. The location of the barrier is shown on Exhibits 24 and 25. Noise Barrier 4SW was evaluated to reduce noise levels at 15 residences with noise criteria impacts located south of the SR 290/I-90 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,930 feet long in this location. A minimum feasible barrier height of 12 feet tall and 1,930 feet long would reduce traffic noise levels by at least 5 dBA at 11 of the 15 impacted first row homes in this area. A barrier height of 14 feet tall and 1,930 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Sites R295, R296, and R301. At a height of 14 feet, the barrier would cost approximately $1,394,502. The barrier would benefit 18 receiver locations, which represent 20 residential equivalent units, resulting in a reasonable allowance of $782,196. Additional noise barrier heights and lengths were evaluated for Noise Barrier 4SW; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier 4SW being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier 5SW-Frontage—Sites R357, R358, R362, R365, R369, R371, and R374

Noise Barrier 5SW-Frontage is located on structure on the eastbound I-90 off-ramp to northbound US 395. The location of the barrier is shown on Exhibit 26. Noise Barrier 5SW-Frontage was evaluated to reduce noise levels at 7 residences with noise criteria impacts located southwest of the I-90/US 395 Interchange. The barrier was evaluated at heights up to 20 feet tall and 1,332 feet long in this location. A minimum feasible barrier height of 12 feet tall and 1,332 feet long would reduce traffic noise levels by at least 5 dBA at 5 of the 7 impacted first row homes in this area. A barrier height of 14 feet tall and 1,332 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Site R362. At a height of 14 feet, the barrier would cost approximately $962,423. The barrier would benefit 8 receiver locations, which represent 8 residential equivalent units, resulting in a reasonable allowance of $306,563. Additional noise barrier heights and lengths were evaluated for Noise Barrier 5SW-Frontage; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier 5SW-Frontage being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Noise Barrier 8SE-Edge of Shoulder (EOS)—Sites R502 and R503

Noise Barrier 8SE-EOS is a located along the edge-of-shoulder on eastbound I-90 off-ramp to I-90 Business Route/E. Appleway Blvd. The location of the barrier is shown on Exhibit 30. Noise Barrier 8SE-EOS was evaluated to reduce noise levels at two outdoor recreation areas at the Trailer Inns RV Park with noise criteria impacts located south of the eastbound I-90 off-ramp to I-90 Business Route/E. Appleway Blvd. The barrier was evaluated at heights up to 20 feet tall and 826 feet long in this location. A minimum feasible barrier height of 14 feet tall and 826 feet long would reduce traffic noise levels by at least 5 dBA at both impacted first row outdoor locations in this area. A barrier height of 16 feet tall and 826 feet long would achieve WSDOT's design goal of at least a 7-dBA noise reduction at Site R502. At a height of 16 feet, the barrier would cost approximately $682,078. The barrier would benefit 2 receiver locations, which represent 2 residential equivalent units, resulting in a reasonable allowance of $79,273. Additional noise barrier heights and lengths were evaluated for Noise Barrier 8SE-EOS; however, WSDOT Reasonableness Criteria were not met with all other barrier designs.

Due to the allowable cost of Noise Barrier 8SE-EOS being less than the construction cost of the barrier, the noise barrier does not meet the WSDOT Reasonableness Criteria and is not recommended.

Exhibit 33: Reasonableness Evaluation for Cost—Noise Barrier NW1-AB - 14 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R3	1	62	61	$0	$473,160	$2,092,476	0	N/A	N/A
R4	1	57	58	$0			0	N/A	N/A
R5	2	61	61	$0			1	N/A	N/A
R6	1	64	62	$0			1	N/A	N/A
R7	1	63	61	$0			0	N/A	N/A
R8	1	67	65	$36,127			5	N/A	N/A
R9	1	66	64	$0			4	N/A	N/A
R10	1	65	64	$0			2	N/A	N/A
R11	1	61	60	$0			0	N/A	N/A
R12	2	61	60	$0			2	N/A	N/A
R13	1	66	65	$0			3	N/A	N/A
R14	1	66	64	$0			2	N/A	N/A
R15*	1	68	66	$0			4	N/A	N/A
R16*	1	68	66	$36,127			5	N/A	N/A
R17	1	64	63	$36,127			5	N/A	N/A
R18	1	67	65	$36,127			5	N/A	N/A
R19	2	62	62	$0			2	N/A	N/A
R20	2	61	60	$0			1	N/A	N/A
R21	2	61	59	$0			0	N/A	N/A
R22	1	67	65	$36,127			5	N/A	N/A
R23	1	62	62	$0			4	N/A	N/A
R24*	1	70	67	$39,636			7	N/A	N/A
R25*	1	68	67	$0			4	N/A	N/A
R26	1	65	63	$36,127			5	N/A	N/A

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R27	1	66	64	$36,127			6	N/A	N/A
R28	1	61	60	$0			2	N/A	N/A
R29	3	59	59	$0			1	N/A	N/A
R30	3	58	58	$0			1	N/A	N/A
R31	1	67	65	$36,127			5	N/A	N/A
R32	1	66	65	$36,127			5	N/A	N/A
R33*	1	67	66	$36,127			5	N/A	N/A
R34*	1	66	66	$36,127			5	N/A	N/A
R35*	1	66	66	$36,127			5	N/A	N/A
R36	2	58	59	$0			2	N/A	N/A
R37	2	58	58	$0			1	N/A	N/A
R38	1	62	60	$0			2	N/A	N/A
R39	1	65	63	$0			3	N/A	N/A
R40	1	64	62	$0			2	N/A	N/A
R41	1	65	62	$0			2	N/A	N/A
R42	1	66	63	$0			3	N/A	N/A
R43	1	66	62	$0			1	N/A	N/A
R44	1	66	62	$0			2	N/A	N/A
R45	1	66	62	$0			2	N/A	N/A
R46	1	65	62	$0			2	N/A	N/A
R47	1	65	62	$0			2	N/A	N/A
R48	1	64	61	$0			1	N/A	N/A
R49	1	65	62	$0			2	N/A	N/A
R50	1	64	62	$0			2	N/A	N/A
R51	1	63	61	$0			2	N/A	N/A

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R52	1	61	60	$0			2	N/A	N/A
R53	1	63	61	$0			0	N/A	N/A
R54	1	63	61	$0			0	N/A	N/A
R55	1	62	60	$0			0	N/A	N/A
R56	1	61	59	$0			0	N/A	N/A
R95	1	58	58	$0			1	N/A	N/A
R96	1	57	57	$0			1	N/A	N/A
R97	2	59	57	$0			0	N/A	N/A
R98	1	57	57	$0			0	N/A	N/A
R99	2	58	57	$0			0	N/A	N/A
R100	1	59	57	$0			0	N/A	N/A
R101 - Church	1	57	56	$0			0	N/A	N/A
R102	1	59	57	$0			0	N/A	N/A
R103	1	59	57	$0			0	N/A	N/A
R104	1	59	57	$0			0	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes:
Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

Exhibit 34: Reasonableness Evaluation for Cost—Noise Barrier NW1-B - 14 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R15*	1	68	66	$0	$476,669	$790,459	3	N/A	N/A
R16*	1	68	66	$0			4	N/A	N/A
R17	1	64	63	$36,127			5	N/A	N/A
R18	1	67	65	$36,127			5	N/A	N/A
R19	2	62	62	$0			1	N/A	N/A
R20	2	61	60	$0			1	N/A	N/A
R21	2	61	59	$0			0	N/A	N/A
R22	1	67	65	$36,127			5	N/A	N/A
R23	1	62	62	$0			4	N/A	N/A
R24*	1	70	67	$39,636			7	N/A	N/A
R25*	1	68	67	$39,636			5	N/A	N/A
R26	1	65	63	$36,127			6	N/A	N/A
R27	1	66	64	$0			2	N/A	N/A
R28	1	61	60	$0			1	N/A	N/A
R29	3	59	59	$0			1	N/A	N/A
R30	3	58	58	$36,127			5	N/A	N/A
R31	1	67	65	$36,127			5	N/A	N/A
R32	1	66	65	$36,127			5	N/A	N/A
R33*	1	67	66	$36,127			5	N/A	N/A
R34*	1	66	66	$36,127			5	N/A	N/A
R35*	1	66	66	$0			2	N/A	N/A
R36	2	58	59	$0			1	N/A	N/A
R37	2	58	58	$0			2	N/A	N/A
R38	1	62	60	$0			3	N/A	N/A

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R39	1	65	63	$0			2	N/A	N/A
R40	1	64	62	$0			2	N/A	N/A
R41	1	65	62	$0			3	N/A	N/A
R42	1	66	63	$0			1	N/A	N/A
R43	1	66	62	$0			2	N/A	N/A
R44	1	66	62	$0			2	N/A	N/A
R45	1	66	62	$0			2	N/A	N/A
R46	1	65	62	$0			2	N/A	N/A
R47	1	65	62	$0			1	N/A	N/A
R48	1	64	61	$0			2	N/A	N/A
R49	1	65	62	$0			2	N/A	N/A
R50	1	64	62	$0			2	N/A	N/A
R51	1	63	61	$0			2	N/A	N/A
R52	1	61	60	$0			1	N/A	N/A
R95	1	58	58	$0			1	N/A	N/A
R96	1	57	57	$0			0	N/A	N/A
R97	2	59	57	$0			0	N/A	N/A
R98	1	57	57	$0			0	N/A	N/A
R99	2	58	57	$0			0	N/A	N/A
R100	1	59	57	$0			3	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes: Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

Exhibit 35: Reasonableness Evaluation for Cost—Noise Barrier 2NE-Ramp - 12 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R186*	1	66	61	$0	$807,179	$1,854,863	3	N/A	N/A
R187*	1	70	66	$0			1	N/A	N/A
R188*	1	71	67	$0			2	N/A	N/A
R189*	1	70	66	$0			2	N/A	N/A
R190*	1	70	66	$0			2	N/A	N/A
R191*	1	70	66	$0			2	N/A	N/A
R192*	1	70	66	$0			2	N/A	N/A
R193*	1	70	66	$0			2	N/A	N/A
R194*	1	67	63	$0			4	N/A	N/A
R195*	1	70	67	$0			3	N/A	N/A
R196*	1	70	67	$0			3	N/A	N/A
R197*	1	69	66	$0			4	N/A	N/A
R198*	1	66	65	$36,127			6	N/A	N/A
R199*	1	68	66	$36,127			6	N/A	N/A
R200*	1	69	68	$43,146			5	N/A	N/A
R201*	1	69	69	$46,655			5	N/A	N/A
R202*	1	68	68	$43,146			5	N/A	N/A
R203*	1	64	68	$43,146			6	N/A	N/A
R204*	1	65	68	$43,146			7	N/A	N/A
R205*	1	67	70	$50,165			6	N/A	N/A
R206*	1	67	70	$50,165			6	N/A	N/A
R207*	1	67	70	$50,165			6	N/A	N/A
R208*	1	66	70	$50,165			6	N/A	N/A

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R210*	1	66	71	$53,674			6	N/A	N/A
R211*	1	67	71	$53,674			6	N/A	N/A
R212	2	66	71	$53,674			7	N/A	N/A
R213	2	69	70	$50,165			5	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes:
Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

Exhibit 36: Reasonableness Evaluation for Cost—Noise Barrier 2NE-Mainline and Ramp - 12 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R186*	1	66	61	$0	$843,306	$2,672,985	4	N/A	N/A
R187*	1	70	66	$0			1	N/A	N/A
R188*	1	71	67	$0			2	N/A	N/A
R189*	1	70	66	$0			3	N/A	N/A
R190*	1	70	66	$0			2	N/A	N/A
R191*	1	70	66	$0			2	N/A	N/A
R192*	1	70	66	$0			3	N/A	N/A
R193*	1	70	66	$0			3	N/A	N/A
R194*	1	67	63	$0			4	N/A	N/A
R195*	1	70	67	$0			3	N/A	N/A
R196*	1	70	67	$0			3	N/A	N/A
R197*	1	69	66	$36,127			5	N/A	N/A
R198*	1	66	65	$36,127			7	N/A	N/A
R199*	1	68	66	$36,127			6	N/A	N/A
R200*	1	69	68	$43,146			5	N/A	N/A
R201*	1	69	69	$46,655			5	N/A	N/A
R202*	1	68	68	$43,146			5	N/A	N/A
R203*	1	64	68	$43,146			6	N/A	N/A
R204*	1	65	68	$43,146			7	N/A	N/A
R205*	1	67	70	$50,165			6	N/A	N/A
R206*	1	67	70	$50,165			6	N/A	N/A
R207*	1	67	70	$50,165			6	N/A	N/A
R208*	1	66	70	$50,165			6	N/A	N/A

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R210*	1	66	71	$53,674			6	N/A	N/A
R211*	1	67	71	$53,674			6	N/A	N/A
R212	2	66	71	$53,674			7	N/A	N/A
R213	2	69	70	$50,165			5	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes:
Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

Exhibit 37: Reasonableness Evaluation for Cost—Noise Barrier 4SW - 14 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R279*	1	67	64	$0	$782,196	$1,394,502	2	N/A	N/A
R280*	1	67	65	$0			3	N/A	N/A
R281*	1	67	67	$39,636			5	N/A	N/A
R282*	1	66	66	$36,127			5	N/A	N/A
R283*	1	66	67	$39,636			5	N/A	N/A
R284*	1	66	67	$39,636			5	N/A	N/A
R285*	1	65	67	$39,636			6	N/A	N/A
R286*	1	63	65	$36,127			5	N/A	N/A
R287*	1	64	65	$36,127			6	N/A	N/A
R294*	1	67	69	$46,655			6	N/A	N/A
R295*	1	66	68	$43,146			7	N/A	N/A
R296*	1	65	67	$39,636			7	N/A	N/A
R297*	1	64	66	$36,127			6	N/A	N/A
R299*	1	64	65	$36,127			5	N/A	N/A
R300	2	65	67	$39,636			6	N/A	N/A
R301*	1	65	67	$39,636			7	N/A	N/A
R302	2	66	67	$39,636			6	N/A	N/A
R303*	1	62	63	$36,127			5	N/A	N/A
R304*	1	67	68	$43,146			6	N/A	N/A
R305*	1	64	65	$36,127			5	N/A	N/A
R306*	1	62	61	$0			3	N/A	N/A
R307*	1	64	61	$0			2	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes: Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

Exhibit 38: Reasonableness Evaluation for Cost—Noise Barrier 5SW-Frontage - 14 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R353*	1	64	62	$0	$306,563	$962,423	1	N/A	N/A
R354*	1	64	62	$0			4	N/A	N/A
R355*	1	62	60	$0			3	N/A	N/A
R356*	1	65	65	$36,127			5	N/A	N/A
R357*	1	68	67	$39,636			5	N/A	N/A
R358*	1	66	66	$36,127			6	N/A	N/A
R359*	1	63	63	$0			4	N/A	N/A
R362*	1	68	68	$43,146			7	N/A	N/A
R363	1	66	65	$0			4	N/A	N/A
R364	1	61	60	$0			2	N/A	N/A
R365*	1	69	68	$43,146			5	N/A	N/A
R366	1	66	65	$36,127			5	N/A	N/A
R367	1	60	61	$0			3	N/A	N/A
R368*	1	66	65	$0			4	N/A	N/A
R369*	1	66	66	$0			4	N/A	N/A
R371*	1	66	66	$36,127			5	N/A	N/A
R372	1	62	61	$0			3	N/A	N/A
R374*	1	65	66	$36,127			5	N/A	N/A
R375	1	63	63	$0			4	N/A	N/A
R377*	1	62	61	$0			3	N/A	N/A
R378	1	60	60	$0			2	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes: Noise Abatement Criteria Impacts are noted by bolded values. "" denotes first row receiver Reasonableness cost based on $51.61/ft²*
N/A = Noise reduction not achieved by evaluated noise barrier; See Exhibit 3 for definitions of Activity Categories.

Exhibit 39: Reasonableness Evaluation for Cost—Noise Barrier 8SE-EOS - 16 Feet Tall

Site and Land Use Category	Dwelling Units/ Residential Equivalency	Existing (L_{eq}) (dBA)	Build (L_{eq}) (dBA)	Reasonableness Allowance		Minimum Design Goal Noise Wall		- 10 dBA in Majority of 1st Row	
				Per Modeled Receiver	Total Cost	Total Cost	Insertion Loss (dBA)	Total Cost	Insertion Loss (dBA)
R502	1	66	68	$43,146	$79,273	$682,078	7	N/A	N/A
R503	1	65	66	$36,127			6	N/A	N/A
					Design Goal Achieved?	Yes		No	
					Cost Effective?	No		No	

Notes:
Noise Abatement Criteria Impacts are noted by bolded values.
"" denotes first row receiver*
Reasonableness cost based on $51.61/ft²
N/A = Noise reduction not achieved by evaluated noise barrier
See Exhibit 3 for definitions of Activity Categories.

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3. Desire for Abatement from Public within the Noise Study Area

Public involvement must occur when traffic noise abatement is recommended for Type I projects, even when public involvement is not required as part of the National Environmental Policy Act or State Environmental Policy Act 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. The final determination whether to construct a noise wall or other abatement that is recommend in the traffic noise analysis cannot be made until public outreach has occurred.

Traffic Noise Abatement Summary

Noise abatement was considered at nine locations (15 noise barrier alignments) where traffic noise impacts were predicted. Noise barriers were evaluated to reduce noise levels at all nine locations where future noise levels would approach or exceed the NAC and/or result in substantial increase impacts of noise level increases of 10 dBA or more over existing noise levels. Five locations (seven noise barrier alignments) where noise barriers were evaluated would meet WSDOT Criteria for the placement of a feasible noise barrier. However, none of the six locations that met WSDOT Criteria of a feasible noise barrier met WSDOT Reasonableness Criteria, therefore no abatement is recommended.

Construction Noise

Construction Noise Background

Construction creates temporary noise. Construction is usually carried out in reasonably discrete steps, each with its own mix of equipment and noise characteristics. For example, construction of this project requires asphalt removal, grading, paving, restriping, foundations for signage and ITS facilities, retaining walls, noise barriers, and drainage systems to name a few.

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 operate at fairly constant sound levels. Trucks are present during most phases of construction and are not confined to the project site, so noise from trucks may affect more receivers than other construction noise. Other common noise sources include impact equipment, which could be pneumatic, hydraulic, or electric powered.

Noise levels during the construction period depend on the type, amount, and location of construction activities.

- The type of construction methods establish 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.

Areas where structural supports and concrete and asphalt are planned for removal will typically generate the highest noise levels during project construction. Noise generated by construction equipment likely used for this project include trucks, forklifts, asphalt grinding machines, dozers, excavators, cranes, concrete mixers, drill rigs, vibratory rollers, backhoes, excavators, loaders, paving machines, pile drivers, and generators which can reach levels from 73 dBA to 105 dBA at 50 feet. As a point source, construction noise decreases by 6 dBA per doubling of distance moving away from the equipment source. The various pieces of equipment are almost never operating simultaneously at full-power and some will be turned off, idling, or operating at less than full power at any time. Therefore, the average L_{eq} noise levels will be less than the aggregate of the maximum noise levels.

Construction Noise Level Limits

Traffic noise and construction noise are exempt from the property line noise limits during daytime hours, but noise limits still apply to construction noise at night. Noise levels in Exhibit 40 apply only to construction noise at residential properties during nighttime hours, between 10 p.m. and 7 a.m. At night, construction noise must meet Washington State Department of Ecology property line regulations[5] 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).

Exhibit 40: Maximum Permissible Environmental Noise Levels

EDNA of Noise Source	EDNA of Receiving Property (dBA)		
	Class A	Class B	Class C
Class A	55	57	60
Class B	57	60	65
Class C	60	65	70

Allowable nighttime (10:00 PM to 7:00 AM) noise levels at Class A receiving properties (residential) are reduced by 10 dBA.

Short-term exceedance of the sound levels in Exhibit 40 is allowed. During any one-hour period, the maximum level may be exceeded by:

- 5 dBA for a total of 15 minutes,
- 10 dBA for a total of 5 minutes, or
- 15 dBA for a total of 1.5 minutes[6].

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 40, 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.

An hourly L_{eq} that is approximately 2 dBA higher than the values in Exhibit 40 is an equivalent sound level to the permissible levels, including the short term exceedances. A $L_{eq}(h)$ of 59 dBA corresponds approximately to a noise level of 57 dBA for 45 minutes and 62 dBA for 15 minutes, which are the maximum permissible noise levels created by a commercial source (Class B) and received by a residential property (Class A).

[5] WAC Chapter 173-40
[6] WAC 173-60-040

Construction Noise Assessment

Construction noise was not assessed quantitatively because the project is exempt from Department of Ecology property line noise level limits during daytime hours. The following sections discuss noise variances that would be required for nighttime work, typical construction equipment noise levels, and abatement measures.

Construction Noise Variance for Night Work

Construction noise is exempt from local property line regulations during daytime hours. If nighttime construction is required for this project, WSDOT (or the Design-Builder, dependent on specific contract requirements) will apply for variances or exemptions from local noise ordinances for the night work. Noise variances or exemptions require construction noise abatement measures that vary by jurisdiction. If night work is necessary for this project, noise variances may be required from the City of Spokane or Spokane County for construction work occurring weekdays between 10:00 p.m. to 7:00 a.m. with additional restricted times on weekends and holidays.

Construction Noise Abatement

Construction noise can be reduced by using enclosures or walls to surround noisy equipment, installing mufflers on engines, substituting quieter equipment or construction methods, minimizing time of operation, and locating equipment farther away from noise sensitive receivers, e.g., homes. To reduce construction noise at nearby receptors, the following abatement measures can be incorporated into construction plans and contractor specifications:

- Limiting construction activities to between 7 a.m. and 10 p.m. would reduce construction noise levels during sensitive nighttime hours
- Using haul vehicles with rubber bed-liners would reduce noise from loading trucks
- Equipping trucks with ambient backup alarms would reduce the noise for equipment backing
- Equipping construction equipment engines with adequate mufflers, intake silencers, and engine enclosures would reduce their noise by 5 to 10 dBA (U.S. EPA, 1971)
- Constructing temporary noise barriers or curtains around stationary equipment that must be located close to residences would decrease noise levels at nearby sensitive receptors

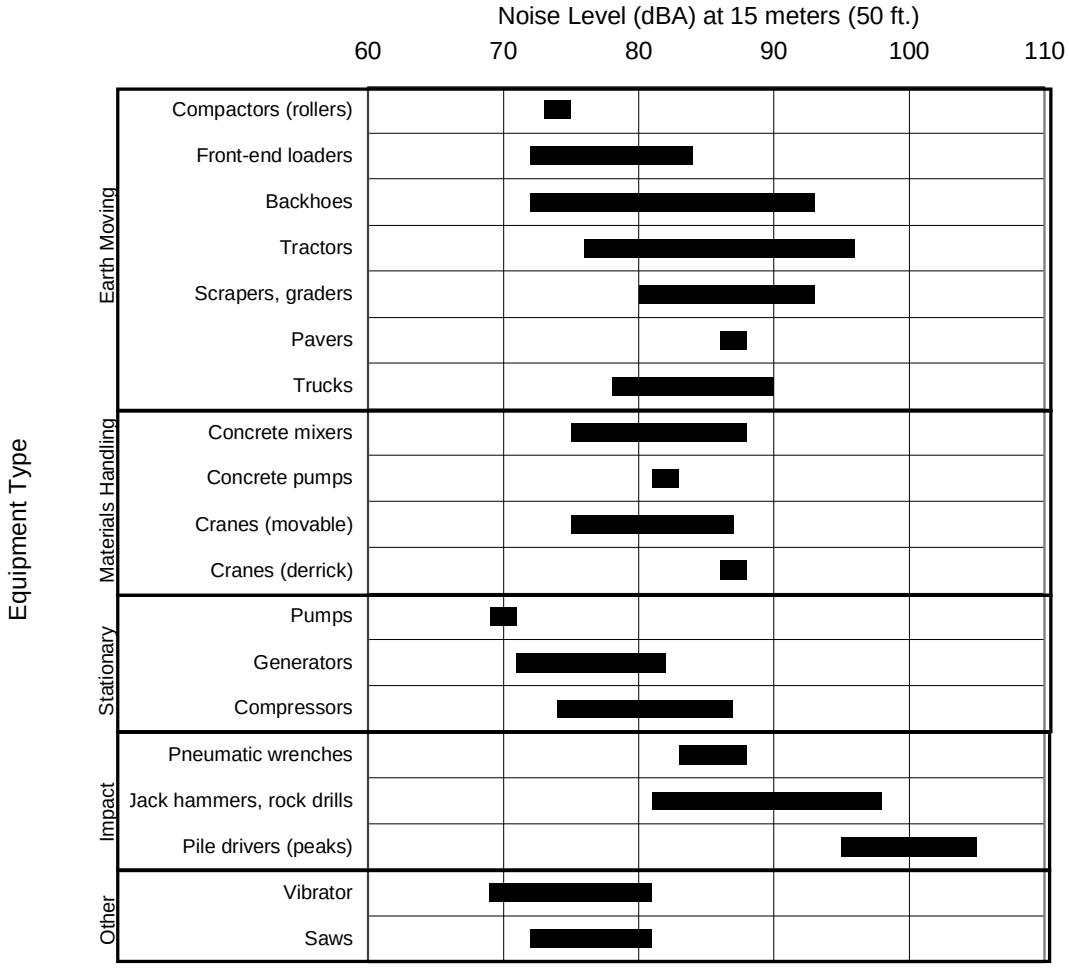
Noise generated by construction equipment likely used for this project include trucks, forklifts, asphalt grinding machines, dozers, excavators, cranes, concrete mixers, drill rigs, vibratory rollers, backhoes, excavators, loaders, paving machines, pile drivers, and generators which can reach levels from 73 dBA to 105 dBA at 50 feet as presented in Exhibit 41.

Additional methods for reducing construction noise levels that may be incorporated by the project engineering office or required by a jurisdiction include the following:

- Specifying the quietest equipment available would reduce noise by 5 to 10 dBA
- Turning off construction equipment during prolonged periods of non-use would eliminate noise from construction equipment during those periods

- Requiring contractors to maintain all equipment and train their equipment operators would reduce noise levels and increase efficiency of operation
- Locating stationary equipment away from receiving properties would decrease noise from that equipment in relation to the increased distance

Exhibit 41: Construction Equipment Noise Ranges



References

Beranek, L.L., 1988. *Noise and Vibration Control*. Institute of Noise Control Engineering. McGraw Hill.

City and County of Spokane Washington, Review of online Building Permits and Land Use Proposals in the US 395 NSC Noise Study on April and July, 2019 at http://maps.spokanecity.org/permit-alert/# and https://www.spokanecounty.org/3260/Notice-of-Application-and-Technical-Revi.

Spokane Municipal Code. SMC Chapter 10.080D Noise Control. Accessed and reviewed online in July 2019 at https://my.spokanecity.org/smc/?Chapter=10.08D.

U.S. Code of Federal Regulations (CFR) Part 772 (23 CFR Part 772), July 2010.

U.S. Department of Transportation, Federal Highway Administration (FHWA). 1996. *Measurement of Highway-Related Noise*. Washington, D.C.

U.S. Department of Transportation, Federal Highway Administration (FHWA). 1998. *FHWA Traffic Noise Model User's Guide*. Washington, D.C.

U.S. Department of Transportation, Federal Highway Administration (FHWA). 2010. *Highway Traffic Noise: Analysis and Abatement.* Revised December 2010.

U.S. Department of Transportation, Federal Highway Administration (FHWA). 2010. *Highway Traffic Noise: Analysis and Abatement Guidance.* Revised December 2010.

U.S. Department of Transportation, Federal Transit Administration (FTA). 1995. *Transit Noise and Vibration Impact Assessment*. Washington D.C.

U.S. Environmental Protection Agency (EPA). 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances.* Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* Report Number 550/9-74-004.

U.S. Geological Survey (USGS). https://viewer.nationalmap.gov/basic/ (last accessed November 2018).

Washington Administrative Code (WAC). 1989. Chapter 173-60*. Maximum Environmental Noise Levels*. Olympia, Washington.

Washington State Department of Transportation (WSDOT). 2012. *Traffic Noise Policy and Procedures.* Olympia, Washington.

Washington State Department of Transportation (WSDOT), 2018. US 395 North Spokane Corridor (NSC) Project. Traffic data for Existing and Future provided electronically by WSDOT US 395 NSC Project Team in March and April, 2019, Spokane, Washington.

Washington State Department of Transportation (WSDOT), 2018. US 395 North Spokane Corridor (NSC) Project. Design files for Existing and Future Design provided electronically by WSDOT US 395 NSC Project Team in May and June, 2019, Spokane, Washington.

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APPENDIX A—Traffic Noise Analysis and Abatement Process

When are noise reports and/or recommendations final?

The noise abatement process from the 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.

The traffic noise discipline report can be finalized.

Design Phase

Design Phase and Public Involvement steps (below) may be incorporated before the 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 at the time the discipline report was prepared.

If conflicts from utilities, steep slopes, etc. are present, the details and costs of the conflicts are provided to the noise analyst by the project team. 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 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 effects of the noise wall (or other abatement) on their community.

The final determination whether to construct a noise wall or other abatement that is recommend in the traffic noise analysis 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 office's discretion. 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.

Appendix B—Permitted Future Land Use

Appendix B presents the results of a review of available building permits from the City and County of Spokane and City of Spokane Valley.

The information was researched from available online files on City and County websites on July 1, 2019. The review identified four active permits or approvals on file with City of Spokane for areas within 1,000 feet of the project. One of four of the permits identified includes a noise sensitive land use within the noise study area. One permitted development includes one noise-regulated land uses a single-family residence located at 4207 E. 4th Avenue.

At the time of this report, several undeveloped or vacant lots were located near the proposed project improvements. Per the WSDOT Traffic Noise Policy, if building permits have been submitted for undeveloped properties, the proposed development needs to be included in the noise study. The permitted residence has been considered in this noise study as one of the two homes represented by modeled Site R413.

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Appendix C—Traffic Data

Appendix C provides traffic data collected during field measurements on March 28 and 29, 2019. The data includes traffic volumes, speeds, and vehicle mix by roadway for each noise measurement location. Worst-Hour Existing 2018, 2040 No Build, and 2040 Build traffic data were provided by WSDOT's US 395 North Spokane Corridor Project Team.

Exhibit C-1: Measured Traffic Volumes during Validation Measurement

New Name	Roadway	15-Minute Counts			
		Autos	MT	HT	Speed (mph)
M1	I-90 EB	878	22	48	60-65
	I-90 WB	914	16	62	60-65
	I-90 WB off-ramp	60	9	0	40
	3rd Ave EB	13	1	0	30
M2	I-90 EB	684	14	34	55-60
	I-90 WB	658	10	54	55-60
	I-90 EB off-ramp	74	0	6	40-45
	I-90 WB on-ramp	34	0	4	45-50
	3rd Ave	118	2	0	25-30
M3	I-90 EB	704	8	30	60-65
	I-90 WB	737	12	47	55-60
	I-90 WB on-ramp	72	0	5	45-50
	I-90 EB off-ramp	74	0	8	40-45
M4 & M5	I-90 EB	916	10	34	60-65
	I-90 WB	1020	5	30	60-65
	3rd Ave EB	81	1	0	25-30
	2nd Ave WB	86	0	0	25-30
M6	I-90 EB	768	27	57	60-65
	I-90 WB	753	18	48	60-65
	I-90 WB off-ramp	145	0	3	40-45
	I-90 WB on-ramp	66	6	9	40-45
	I-90 EB off-ramp	99	3	3	40-45
	Perry Street (total)	22	1	0	15-20
	2nd Ave WB	151	1	0	30-35
M7	I-90 EB	1326	16	34	60-65
	I-90 WB	1016	8	44	60-65
	2nd Ave beyond I-90 ramp	38	0	0	30
	2nd Ave to I-90 WB On	180	8	2	35-50
	S Fiske St	60	0	0	30
M8	I-90 EB	1281	12	24	60-65
	I-90 WB	1158	18	30	60-65
	Cook SB	11	0	0	25
	2nd Ave WB	106	0	0	30
M9	I-90 EB	840	12	44	60-65
	I-90 WB	1023	25	42	60-65
	I-90 WB on-ramp	25	3	4	45
	3rd Ave	85	3	3	30
M10	I-90 EB	915	11	43	60-65
	I-90 WB	860	12	26	60-65
	I-90 WB on-ramp	150	5	9	45
	3rd Ave	31	2	0	30
M11	I-90 EB	891	16	38	60-65
	I-90 WB	955	15	34	60-65
	I-90 EB on-ramp	215	3	9	35
M12	I-90 EB	855	6	39	60-65
	I-90 WB	804	6	24	60-65
	I-90 EB ramp	210	6	6	45-50
	4th Ave	30	0	0	30
M13	I-90 EB	1276	22	40	60-65
	I-90 WB	1060	20	16	60-65
	I-90 EB on-ramp	32	2	0	45
	3rd Ave WB	56	0	0	25
M14	I-90 EB	993	18	58	60-65
	I-90 WB	1266	12	15	60-65
	2nd Ave WB	63	0	1	30
M15	I-90 EB	964	14	48	60-65
	I-90 WB	970	4	16	60-65
	2nd Ave WB	227	5	4	30
M16 and M17	I-90 EB	1389	18	36	60-65
	I-90 WB	1358	7	30	60-65
	2nd Ave WB	42	5	0	35
	I-90 WB upper ramp	186	0	0	55
	I-90 EB lower ramp	120	0	0	40

Source: WSP, 2019.

Exhibit C-2: Modeled Hourly Traffic Volumes for 2018 Existing Conditions – PM Peak-Hour

EXISTING YEAR - PM PEAK HOUR VOLUMES (WEST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Mission Ave	EB	672	652	20	17	3	30
E Mission Ave	WB	788	764	24	20	4	30
E Trent Ave	EB	509	494	15	13	3	30
E Trent Ave	WB	309	300	9	8	2	30
E Sprague Ave	EB	653	633	20	16	3	30
E Sprague Ave	WB	435	422	13	11	2	30
E 2nd Ave	WB	463	449	14	12	2	30
I-90	EB	4621	4159	462	300	162	60
I-90	WB	4491	4042	449	292	157	60
I-90 from S Thor St WB On-Ramp	WB	690	669	21	17	3	40
I-90 to S Thor St EB Off-Ramp	EB	750	728	23	19	4	30
I-90 to S Altamont WB Off-Ramp	WB	140	136	4	4	1	30
I-90 from Altamont WB On-Ramp	WB	245	238	7	6	1	40
I-90 to S Altamont EB Off-Ramp	EB	395	383	12	10	2	30
I-90 from Altamont EB On-Ramp	EB	595	577	18	15	3	40
I-90 to 2nd Ave WB Off-Ramp (Exit 282B)	WB	210	204	6	5	1	30
WB I-90 to NB 290 Ramp	WB	565	509	57	37	20	40
EB I-90 to NB 290 Ramp	EB	550	495	55	36	19	40
SB 290 to EB I-90 Ramp	EB	895	806	90	58	31	40
E 3rd Ave	EB	754	731	23	19	4	30
N Freya Street	NB	364	353	11	9	2	35
N Freya Street	SB	306	297	9	8	2	35

EXISTING YEAR - PM PEAK HOUR VOLUMES (EAST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Trent Ave	EB	1085	1052	33	27	5	35
E Trent Ave	WB	909	882	27	23	5	35
E Sprague Ave	EB	892	865	27	22	4	35
E Sprague Ave	WB	936	908	28	23	5	35
E 3rd Ave (E 2nd Ave)	WB	231	224	7	6	1	30
I-90 to N Freya St WB Off-Ramp	WB	860	774	86	56	30	30
I-90 from N Freya St EB On-Ramp	EB	620	558	62	40	22	40
I-90	EB	4886	4397	489	318	171	60
I-90	WB	4867	4380	487	316	170	60
I-90 E Sprague Ave EB Off-Ramp	EB	892	803	89	58	31	30
I-90 Havana EB On-Ramp	EB	295	266	30	19	10	40
I-90 S Fancher Rd WB On-Ramp	WB	220	198	22	14	8	35
I-90 E Sprague Ave WB On-Ramp	WB	735	662	74	48	26	35
E 4th Street (Frontage Road)	EB	330	320	10	8	2	30

Arterial	Cars	97%
	Trucks	3%
Freeway	Cars	90%
	Trucks	10%
US395	91.20%	Cars
	3.10%	HT
	5.70%	MT
Ramps		No Info

Source: WSDOT, 2019.

Exhibit C-3: Modeled Hourly Traffic Volumes for 2040 No Build Conditions – PM Peak Hour

2040 NO BUILD - PM PEAK HOUR VOLUMES (WEST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Mission Ave	EB	915	888	27	23	5	30
E Mission Ave	WB	1121	1087	34	28	6	30
E Trent Ave	EB	891	864	27	22	4	30
E Trent Ave	WB	594	576	18	15	3	30
E Sprague Ave	EB	828	803	25	21	4	30
E Sprague Ave	WB	692	671	21	17	3	30
E 2nd Ave	WB	1050	1019	32	26	5	30
I-90	EB	4881	4393	488	317	171	60
I-90	WB	4751	4276	475	309	166	60
I-90 from S Thor St WB On-Ramp	WB	804	780	24	20	4	40
I-90 to S Thor St EB Off-Ramp	EB	801	777	24	20	4	30
I-90 to S Altamont WB Off-Ramp	WB	691	670	21	17	3	30
I-90 from Altamont WB On-Ramp	WB	388	376	12	10	2	40
I-90 to S Altamont EB Off-Ramp	EB	552	535	17	14	3	30
I-90 from Altamont EB On-Ramp	EB	865	839	26	22	4	40
I-90 to 2nd Ave WB Off-Ramp (Exit 282B)	WB	301	292	9	8	2	30
WB I-90 to NB 290 Ramp	WB	576	518	58	37	20	40
EB I-90 to NB 290 Ramp	EB	671	604	67	44	23	40
SB 290 to EB I-90 Ramp	EB	1040	936	104	68	36	40
E 3rd Ave	EB	1247	1210	37	31	6	30
N Freya Street	NB	1002	972	30	25	5	35
N Freya Street	SB	1310	1271	39	33	7	35

E2040 NO BUILD - PM PEAK HOUR VOLUMES (EAST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Trent Ave	EB	1361	1320	41	34	7	35
E Trent Ave	WB	1216	1180	36	30	6	35
E Sprague Ave	EB	1455	1411	44	36	7	35
E Sprague Ave	WB	1433	1390	43	36	7	35
E 3rd Ave (E 2nd Ave)	WB	561	544	17	14	3	30
I-90 to N Freya St WB Off-Ramp	WB	824	742	82	54	29	30
I-90 from N Freya St EB On-Ramp	EB	368	331	37	24	13	40
I-90	EB	5313	4782	531	345	186	60
I-90	WB	5462	4916	546	355	191	60
I-90 E Sprague Ave EB Off-Ramp	EB	1310	1179	131	85	46	30
I-90 Havana EB On-Ramp	EB	235	212	24	15	8	40
I-90 S Fancher Rd WB On-Ramp	WB	90	81	9	6	3	35
I-90 E Sprague Ave WB On-Ramp	WB	1344	1210	134	87	47	35
E 4th Street (Frontage Road)	EB	586	568	18	15	3	30

Arterial	Cars	97%
	Trucks	3%
Freeway	Cars	90%
	Trucks	10%
US395	91.20%	Cars
	3.10%	HT
	5.70%	MT
Ramps		No Info

Source: WSDOT, 2019.

Exhibit C-4: Modeled Hourly Traffic Volumes for 2040 Build Conditions – PM Peak Hour

2040 BUILD - PM PEAK HOUR VOLUMES (WEST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Mission Ave	EB	952	923	29	24	5	30
E Mission Ave	WB	927	899	28	23	5	30
E Trent Ave	EB	1023	992	31	26	5	30
E Trent Ave	WB	682	662	20	17	3	30
E Sprague Ave	EB	702	681	21	18	4	30
E Sprague Ave	WB	596	578	18	15	3	30
E 2nd Ave	WB	911	884	27	23	5	30
I-90	EB	5052	4547	505	328	177	60
I-90	WB	4107	3696	411	267	144	60
I-90 from S Thor St WB On-Ramp	WB	Roadway does not exist in 2040 Build Condition					40
I-90 to S Thor St EB Off-Ramp	WB						30
I-90 to S Altamont WB Off-Ramp	WB						30
I-90 from Altamont WB On-Ramp	WB						40
I-90 to S Altamont EB Off-Ramp	EB						30
I-90 from Altamont EB On-Ramp	EB						40
I-90 to 2nd Ave WB Off-Ramp (Exit 282B)	WB						30
WB I-90 to NB 290 Ramp	WB	811	730	81	53	28	40
EB I-90 to NB 290 Ramp	EB	1550	1395	155	101	54	40
SB 290 to EB I-90 Ramp	EB	1377	1239	138	90	48	40
SB 290 to WB I-90 Ramp	WB	491	442	49	32	17	41
E 3rd Ave	EB	1259	1221	38	31	6	30
I-90 Altamont WB OnRamp	WB	661	641	20	17	3	40
SR395/NSC SB to I-90 WB Ramp	WB	613	595	18	15	3	40
I-90 EB to SR395/NSC NB Ramp	EB	1259	1221	38	31	6	40
SR 395/NSC	SB	2584	2357	227	147	80	60
SR 395/NSC	NB	2702	2464	238	154	84	60
N Freya Street	NB	1128	1094	34	28	6	35
N Freya Street	SB	1363	1322	41	34	7	35

2040 BUILD - PM PEAK HOUR VOLUMES (EAST OF STUDY INTERCHAGE)							
Modeled Roadway	Direction	Total (vph)	Autos (vph)	Total Heavy Vehicles (vph)	Medium Trucks (vph)	Heavy Trucks (vph)	Posted Speed Limit
E Trent Ave	EB	1228	1191	37	31	6	35
E Trent Ave	WB	1194	1158	36	30	6	35
E Sprague Ave	EB	1244	1207	37	31	6	35
E Sprague Ave	WB	1331	1291	40	33	7	35
E 3rd Ave (E 2nd Ave)	WB	564	547	17	14	3	30
I-90 to N Freya St WB Off-Ramp	WB	Roadway does not exist in 2040 Build Condition					30
I-90 from N Freya St EB On-Ramp	EB						40
I-90 WB to SR395/NSC NB Ramp	WB	1395	1256	140	91	49	40
I-90	EB	5566	5009	557	362	195	60
I-90	WB	5248	4723	525	341	184	60
SR395/NSC SB to I-90 EB Ramp	EB	1113	1002	111	72	39	40
I-90 E 2nd Ave WB Off-Ramp	WB	Roadway does not exist in 2040 Build Condition					30
I-90 Havana EB On-Ramp	EB	297	267	30	19	10	40
I-90 S Fancher Rd WB On-Ramp	WB	Roadway does not exist in 2040 Build Condition					35
I-90 E Sprague Ave WB On-Ramp	WB						35
E 4th Street (Frontage Road)	EB	504	489	15	13	3	30

Arterial	Cars	97%
	Trucks	3%
Freeway	Cars	90%
	Trucks	10%
US395	91.20%	Cars
	3.10%	HT
	5.70%	MT
Ramps		No Info

Source: WSDOT, 2019.

Appendix D—Modeling Site Descriptions

Appendix D provides additional information on modeling site locations and residential equivalency calculations.

Exhibit D-1: Modeled Site Descriptions and Residential Equivalency Calculations

Site ID	Land Use / Site Description	Usage Factor Calculation (Hours/Day, Days/Week, Months/Year)[7]	Average Users at Site	Average Number of People Per Household[8]	Dwelling Units Residential Equivalency[9]
R1	Bicycle/Walking Trail	(16/24)*(7/7)*(12/12) = 0.67	3[10]	2.53	1
R2	Bicycle/Walking Trail	(16/24)*(7/7)*(12/12) = 0.67	3[11]	2.53	1
R119 School	Libby Center – Playfield	(8/24)*(5/7)*(8/12) = 0.16	20[12]	2.53	1
R120 School	Libby Center – Play Area	(8/24)*(5/7)*(8/12) = 0.16	10[13]	2.53	1
R121 School	Libby Center – Play Area	(8/24)*(5/7)*(8/12) = 0.16	4[14]	2.53	1
R257	I-90/SR 290 Trail (former structures)	(10/24)*(7/7)*(5/12) = 0.17	2[15]	2.53	1
R258	I-90/SR 290 Rest Area (former structures)	(10/24)*(7/7)*(5/12) = 0.17	2[16]	2.53	1
R-Trail1	New Bicycle/Walking Trail (I-90/S. Freya St.)	(16/24)*(7/7)*(12/12) = 0.67	3[17]	2.53	1
R-Trail2	New Bicycle/Walking Trail (I-90/S. Freya St.)	(16/24)*(7/7)*(12/12) = 0.67	3[18]	2.53	1
R-Trail3	New Bicycle/Walking Trail (I-90/S. Freya St.)	(16/24)*(7/7)*(12/12) = 0.67	3[19]	2.53	1
R273	Liberty Park Trail	(16/24)*(7/7)*(12/12) = 0.67	2[20]	2.53	1
R274	Liberty Park Rest Area	(10/24)*(7/7)*(5/12) = 0.17	4[21]	2.53	1

[7] Calculated using WSDOT's Residential Equivalency Calculations, unless noted
[8] Average number of people per household in Washington State 2.53 (WSDOT, 2012)
[9] Dwelling Units Residential Equivalency = Usage Factor x Average Users at site ÷ Average Number of People per Household
[10] Based on observed bicycle and pedestrian counts
[11] Based on observed bicycle and pedestrian counts
[12] Based on size and capacity of play area
[13] Based on size and capacity of play area
[14] Based on size and capacity of play area
[15] Estimated based on size of park and site observations
[16] Estimated based on size of park and site observations
[17] Based on observed bicycle and pedestrian counts
[18] Based on observed bicycle and pedestrian counts
[19] Based on observed bicycle and pedestrian counts
[20] Estimated based on size of trail and site observations
[21] Estimated based on size of park and site observations

Site ID	Land Use / Site Description	Usage Factor Calculation (Hours/Day, Days/Week, Months/Year)[7]	Average Users at Site	Average Number of People Per Household[8]	Dwelling Units Residential Equivalency[9]
R275	Ben Burr Trail	(16/24)*(7/7)*(12/12) = 0.67	5[22]	2.53	1
R278	Liberty Park Rest Area	(10/24)*(7/7)*(5/12) = 0.17	4[23]	2.53	1
R279	Liberty Park Rest Area	(10/24)*(7/7)*(5/12) = 0.17	4[24]	2.53	1
R280	Liberty Park – Horseshoes	(10/24)*(7/7)*(5/12) = 0.17	4[25]	2.53	1
R389 - School	Sheridan Elementary – Play Area	(8/24)*(5/7)*(8/12) = 0.16	10[26]	2.53	1
R390 - School	Sheridan Elementary – Play Area	(8/24)*(5/7)*(8/12) = 0.16	4[27]	2.53	1
R418	Church/School – Play Area	(8/24)*(5/7)*(8/12) = 0.16	4[28]	2.53	1
R419	Church/School – Play Area	(8/24)*(5/7)*(8/12) = 0.16	4[29]	2.53	1
R502	RV Park – Play Structure	(10/24)*(7/7)*(9/12) = 0.31	6[30]	2.53	1
R503	RV Park – Picnic Area	(10/24)*(7/7)*(5/12) = 0.17	12[31]	2.53	1

Source: WSP USA, 2019

Notes: Sites R495 to R497 and R 499 to R501 represent full time residences at Mobile Home Park and not included in Residential Equivalency calculation.

[22] Estimated based on size of trail and site observations
[23] Estimated based on size of park and site observations
[24] Estimated based on size of park and site observations
[25] Estimated based on size of park and site observations
[26] Based on size and capacity of play area
[27] Based on size and capacity of play area
[28] Based on size and capacity of play area
[29] Based on size and capacity of play area
[30] Estimated based on capacity and site observations
[31] Estimated based on capacity and site observations

APPENDIX E—TNM Barrier Graphics

Appendix E contains TNM noise barrier graphics for the seven locations evaluated for noise barrier placement that met WSDOT criteria for a feasible noise barrier.

Exhibit E-1: TNM Noise Barrier Graphic—Noise Barrier 1NW-AB

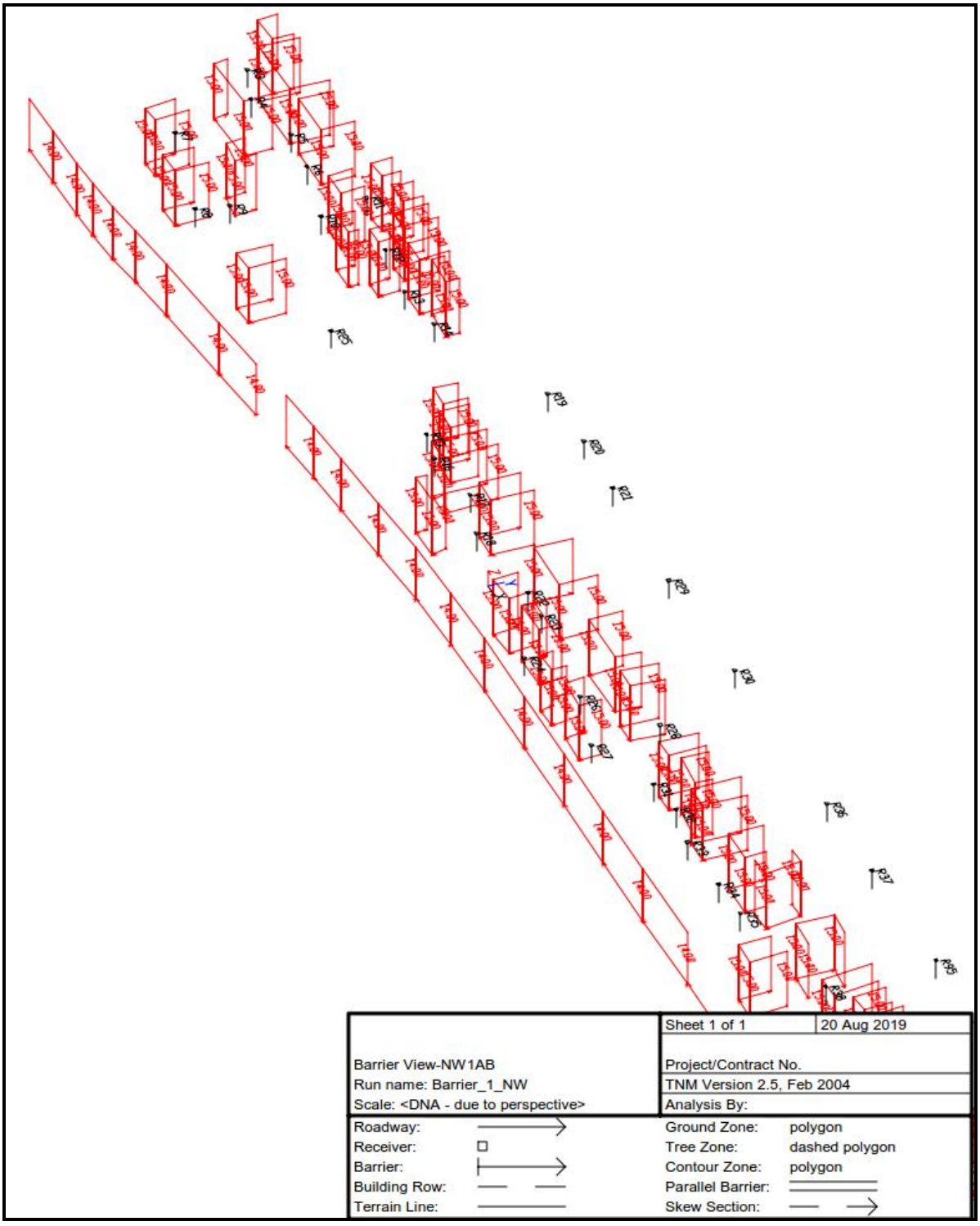


Exhibit E-2: TNM Noise Barrier Graphic—Noise Barrier 1NW-B

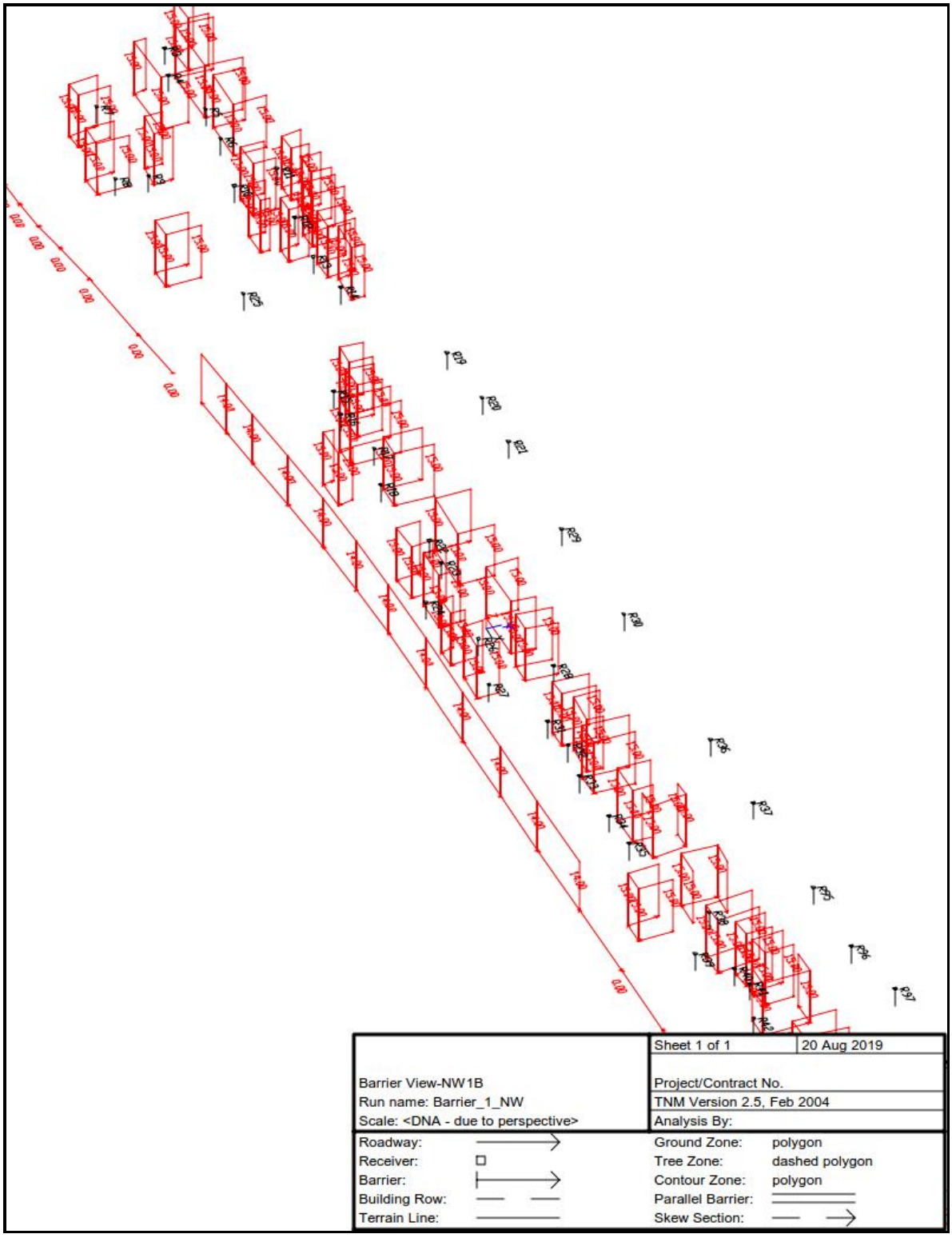


Exhibit E-3: TNM Noise Barrier Graphic—Noise Barrier 2NE-Ramp

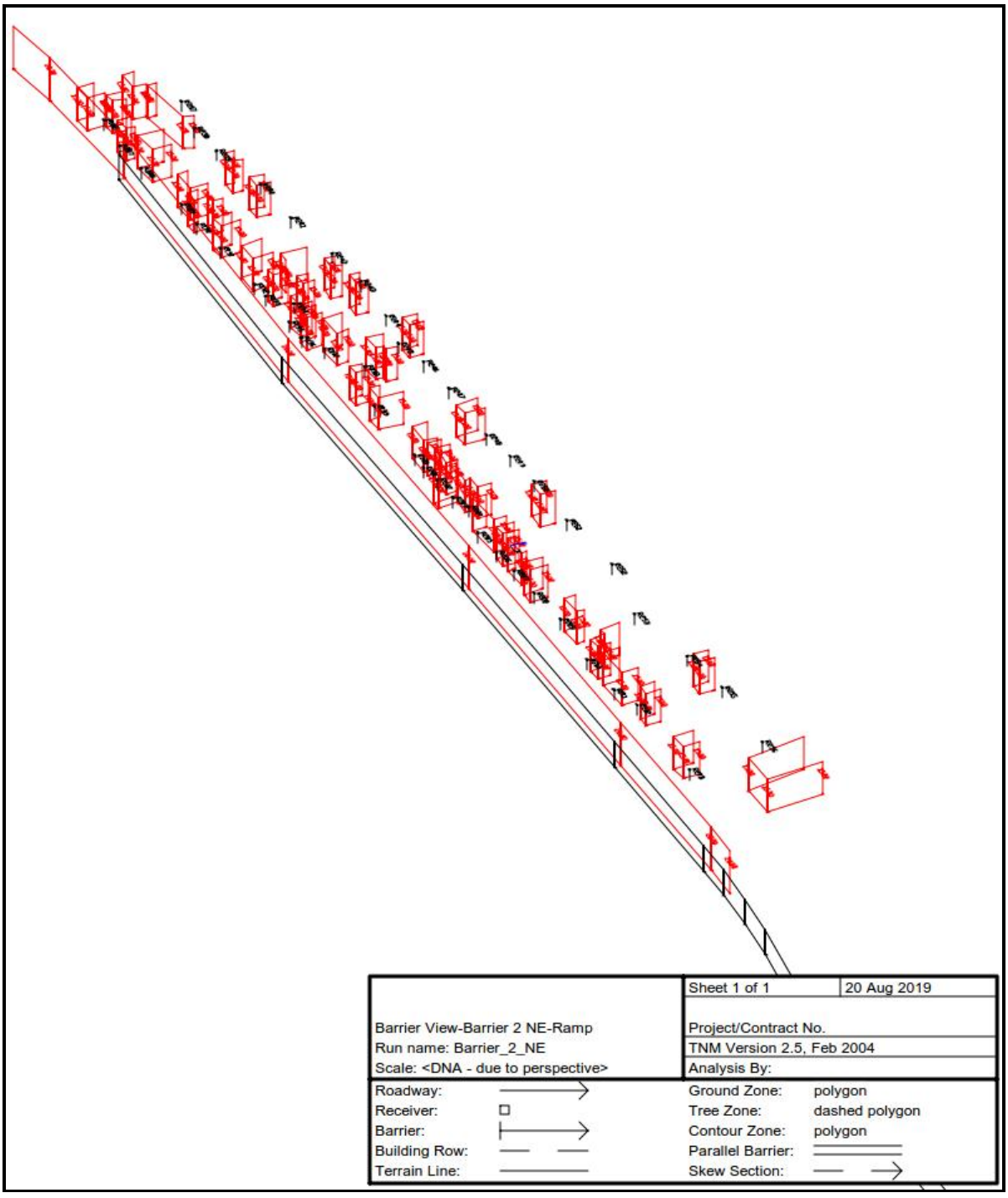


Exhibit E-4: TNM Noise Barrier Graphic—Noise Barrier 2NE-Mainline/Ramp

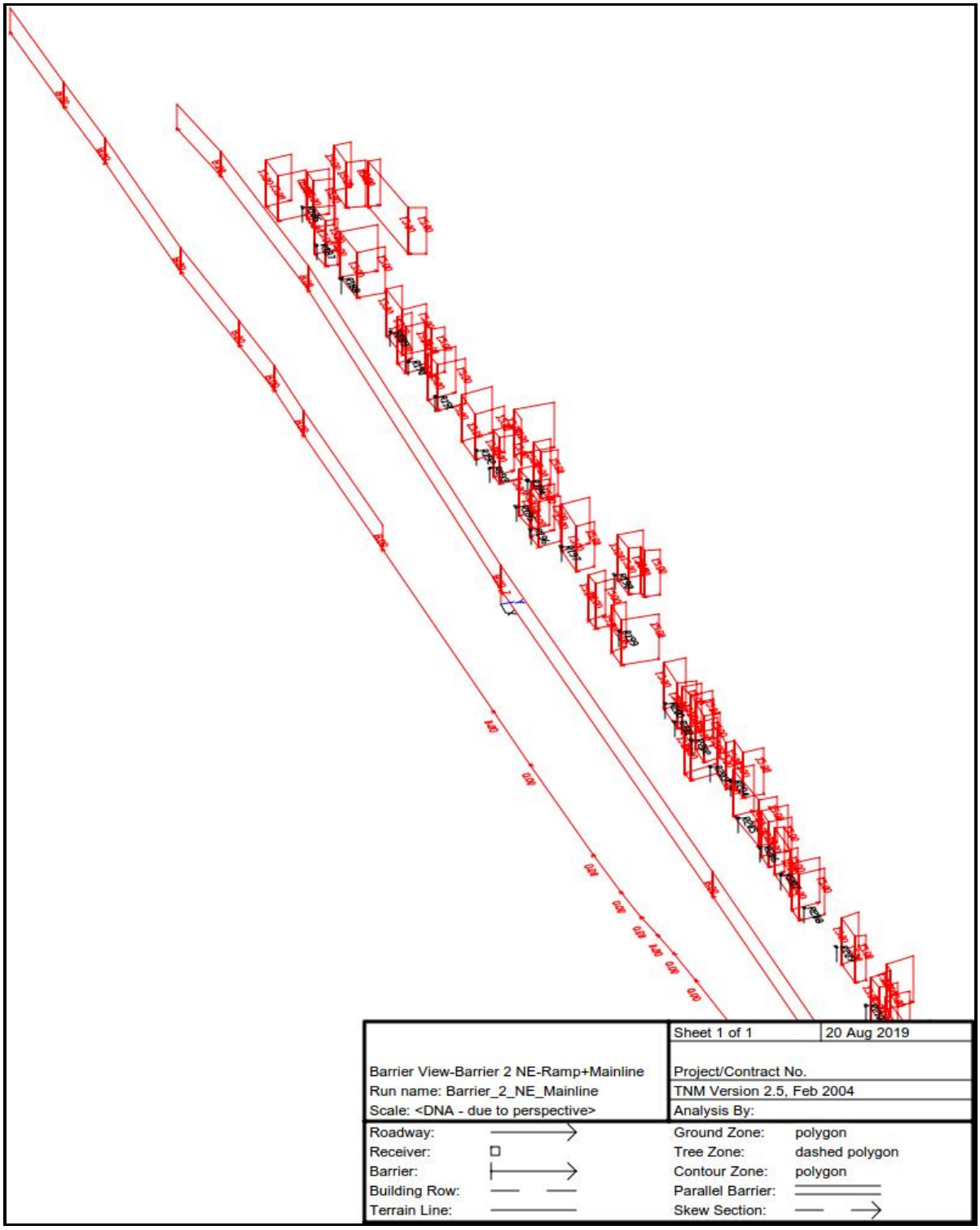


Exhibit E-5: TNM Noise Barrier Graphic—Noise Barrier 4SW

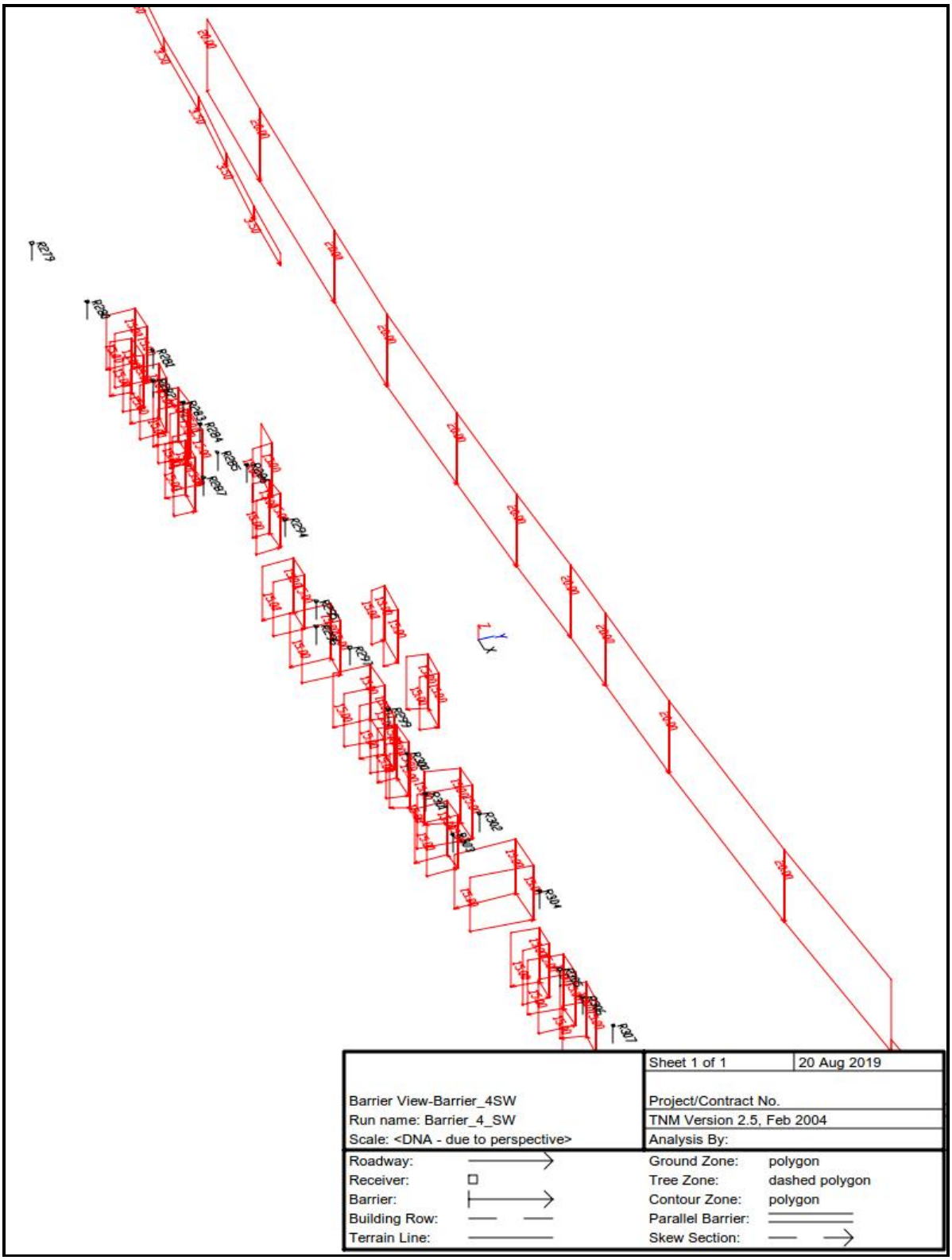


Exhibit E-6: TNM Noise Barrier Graphic—Noise Barrier 5SW-Frontage

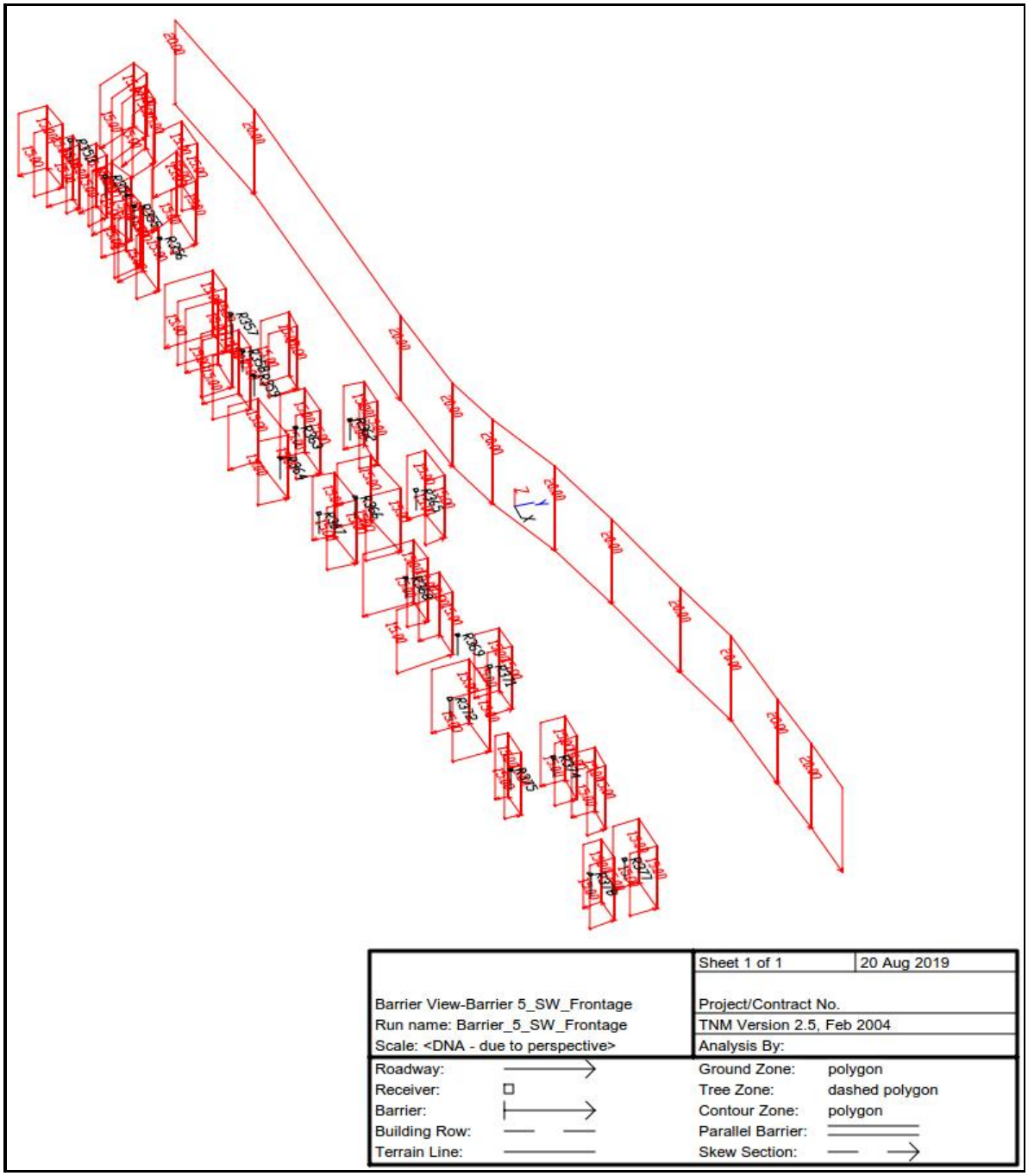
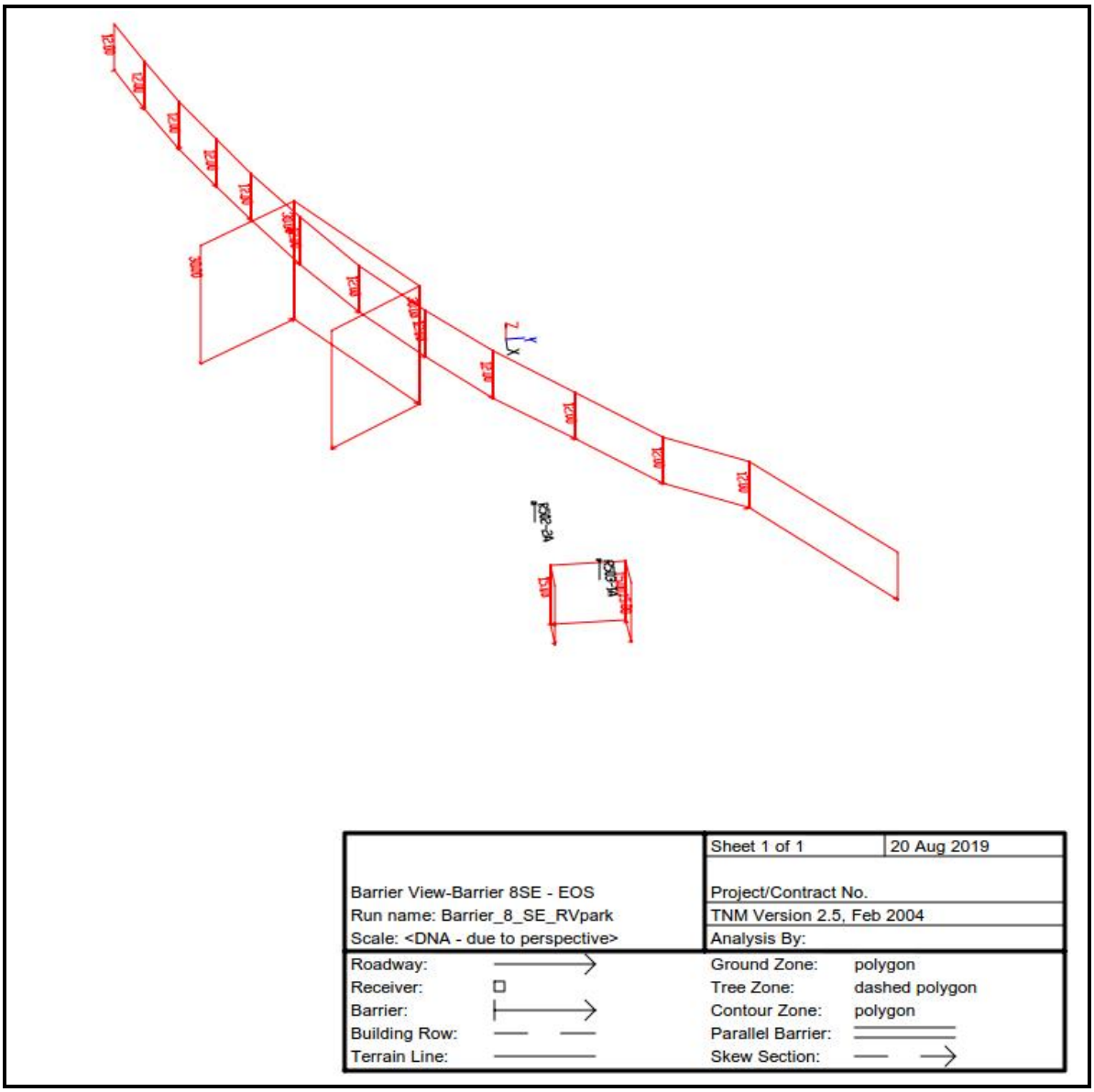


Exhibit E-8: TNM Noise Barrier Graphic—Noise Barrier 8SE-Edge of Shoulder



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APPENDIX F—TNM Data

TNM v2.5 files of all noise modeling files are provided electronically with the Final Noise Discipline Report. Modeling files developed for this report are as follows:

Validation Models:

- US395_Validation_M1
- US395_Validation_M2
- US395_Validation_M3
- US395_Validation_M4
- US395_Validation_M5
- US395_Validation_M6
- US395_Validation_M7
- US395_Validation_M8
- US395_Validation_M9
- US395_Validation_M10
- US395_Validation_M11
- US395_Validation_M12
- US395_Validation_M13
- US395_Validation_M14
- US395_Validation_M15
- US395_Validation_M16
- US395_Validation_M17

Existing Conditions Models (PM Peak):

- US395_EX_395_NE
- US395_EX_395_NW
- US395_EX_395_SE
- US395_EX_395_SW

No Build Models (PM Peak):

- US395_NB_395_NE
- US395_NB_395_NW
- US395_NB_395_SE
- US395_NB_395_SW

Build Models (PM Peak):

- US395_Build_N_Mission
- US395_Build_NE
- US395_Build_NE_Trail
- US395_Build_NW
- US395_Build_SE

- US395_Build_SE_RVpark
- US395_Build_SW

Mitigation Models (PM Peak):

- US395_Barrier_1_NW
- US395_Barrier_2_NE
- US395_Barrier_2_NE_Mainline
- US395_Barrier_3_SW
- US395_Barrier_4_SW
- US395_Barrier_5_SW
- US395_Barrier_6_SE_Apartment
- US395_Barrier_7_SE
- US395_Barrier_8_SE_RVpark
- US395_Barrier_9_NorthMission

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APPENDIX G—Field Data Sheets

Appendix G contains data sheets from the field that describe the locations where noise measurements were taken on March 28 and 29, 2019.

Exhibit G-1: 15-Minute Validation Measurement Site 1—Liberty Park—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC Job # 160331S-AE

ID

SITE IDENTIFICATION: M1 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3/28/19 10:03 Am END DATE & TIME: 3/28/19 10:18 Am
ADDRESS: Liberty Park

Weather

TEMP: 45 °F HUMIDITY: 80 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 03 MPH DIR: N NE (E) SE S SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: ____

Rec #	Start Time / End Time							
M1	10:03 / 10:18	L_{eq} 66.0	L_{max} 70.5	L_{min} 63.1	L_{90} 64.4	L_{50} 65.1	L_{10} 67.4	
____	____ / ____	L_{eq} ____	L_{max} ____	L_{min} ____	L_{90} ____	L_{50} ____	L_{10} ____	

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90 MAIN) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

COUNT #1 DURATION: 15 -MINUTE	NB/(EB) / SB/(WB)	SPEED (mph) NB/(EB) / SB/(WB)	COUNT #2: I-90 WB OFF / 3RD AVE 15 -MINUTE	NB/(EB) / SB/(WB)	SPEED (mph) NB/(EB) / SB/(WB)
AUTOS:	878 / 914	60-65 60-65		13 / 60	30 / 40
MED. TRUCKS:	22 / 16	↓ / ↓		1 / 9	↓ / ↓
HVY TRUCKS:	48 / 62	↓ / ↓		0 / 0	↓ / ↓
BUSES:	____ / ____	____ / ____		____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____		____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: (distant AIRCRAFT) overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: ____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Park facing I-90
SITE SKETCH / PHOTOGRAPHS: Distant

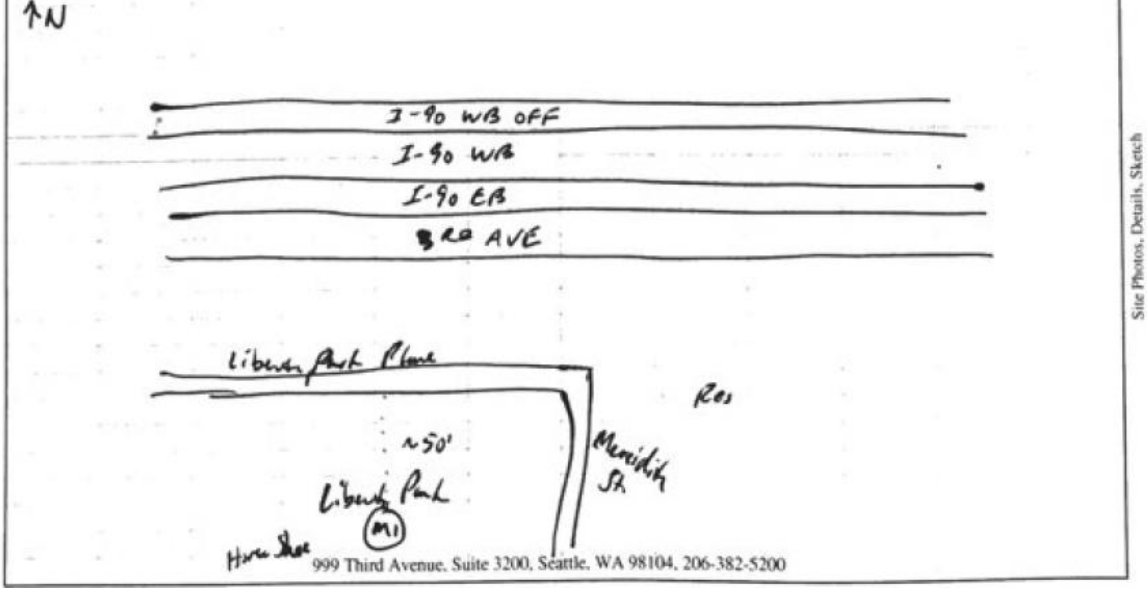

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Exhibit G-2: 15-Minute Validation Measurement Site 2—3rd Ave/S. Arthur St—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC Job # 160331S-AE

ID

SITE IDENTIFICATION: M2 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3/28/19 10:49 END DATE & TIME: 11:04 3-28-19
ADDRESS: Ruins / Trail at 3RD / S. Arthur St.

Weather

TEMP: 45 °F HUMIDITY: 80 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: N NE (E) SE S SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}
192	10:49	11:04	68.3	74.2	62.3	65.2	67.8	70.6
____	____	____	____	____	____	____	____	____

COMMENTS:

Source Info and Traffic Counts

I-90 EB off, WB-ON, 3RD Ave

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

	COUNT #1 DURATION: 15 -MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB	COUNT #2: 15 -MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB
AUTOS:	684 / 658	____ / ____	74 / 34	40-45 / 45-50
MED. TRUCKS:	14 / 10	____ / ____	0 / 0	2 / ____
HVY TRUCKS:	34 / 54	____ / ____	6 / 4	0 / ____
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / DRIVING (OBSERVER)

OTHER NOISE SOURCES: (distant AIRCRAFT overhead) RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / (distant TRAINS) / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Trail above I-90 / US 290 Int / Cheye
SITE SKETCH / PHOTOGRAPHS: Dig. Pad

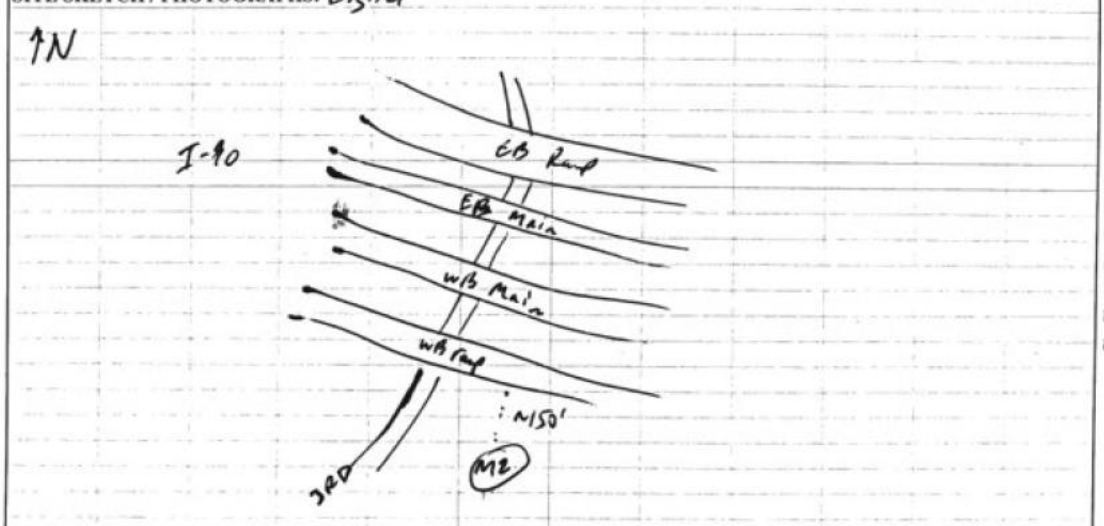

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Exhibit G-3: 15-Minute Validation Measurement Sites 3 and 4—1025 5th St. & Liberty Park—Field Data Sheet

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 1603315-AE

ID

SITE IDENTIFICATION: M3 & M4 OBSERVER(s): Romero Papas
START DATE & TIME: 3/28/19 11:25 Am END DATE & TIME: 3/28/19 11:40 Am
ADDRESS: Res @ 1024 5th St. / Liberty Park

Weather

TEMP: 47 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-4 MPH DIR: N NE E SE S (SW) W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD B20 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M3	11:25 / 11:40 :	L_{eq} 71.6,	L_{max} 74.7,	L_{min} 67.8,	L_{90} 69.8,	L_{50} 71.4,	L_{10} 72.8,	_____
M4	" / " :	L_{eq} 68.4,	L_{max} 70.7,	L_{min} 64.2,	L_{90} 67.1,	L_{50} 69.4,	L_{10} 69.4,	_____

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90 Main) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: I-90 EB off / WB on

	COUNT #1 DURATION: 15 -MINUTE		SPEED (mph)		COUNT #2: 15 -MINUTE		SPEED (mph)	
	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)
AUTOS:	704	737	60-65	55-60	74	72	40-45	45-50
MED. TRUCKS:	8	12	↓	↓	0	0	↓	↓
HVY TRUCKS:	30	47	↓	↓	8	5	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Res & Park above I-90 / 290 I/C
SITE SKETCH / PHOTOGRAPHS: Digital

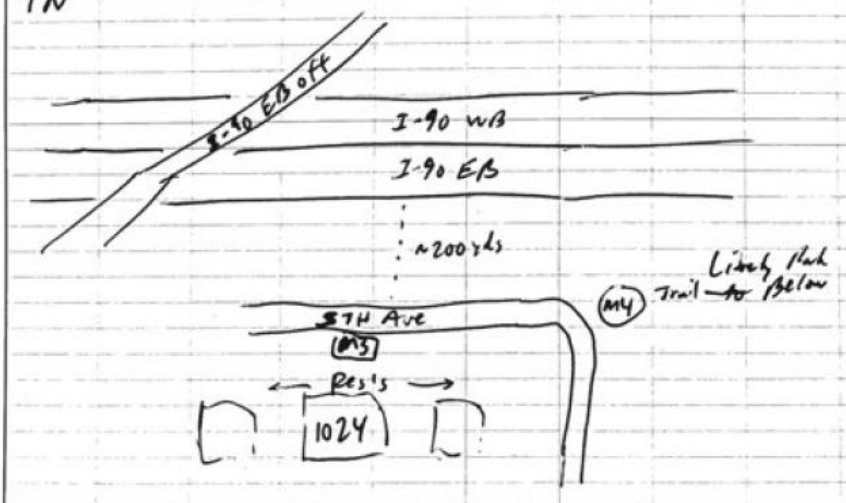

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Exhibit G-4: 15-Minute Validation Measurement Site 5—Pittsburgh St./2nd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 160315-AE

ID

SITE IDENTIFICATION: M5 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-28-19 12:30 pm END DATE & TIME: 3-28-19 12:45 pm
ADDRESS: Former Res Pittsburgh / 2nd Ave

Weather

TEMP: 51 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE S (SW) W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time	End Time								
M5	12:30	12:45	L_{eq} 68.6	L_{max} 74.4	L_{min} 64.7	L_{90} 67.1	L_{50} 68.3	L_{10} 69.8		
____	____	____	L_{eq} ____	L_{max} ____	L_{min} ____	L_{90} ____	L_{50} ____	L_{10} ____		

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: 3RD 2ND

	COUNT #1 DURATION: 15-MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB	COUNT #2: 15-MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB
AUTOS:	916 / 1020	60-65 / 60-65	81 / 86	25-30 / 25-30
MED. TRUCKS:	10 / 5	↓ / ↓	1 / 0	↓ / ↓
HVY TRUCKS:	34 / 30	↓ / ↓	0 / 0	↓ / ↓
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant land next to I-90
SITE SKETCH / PHOTOGRAPHS:

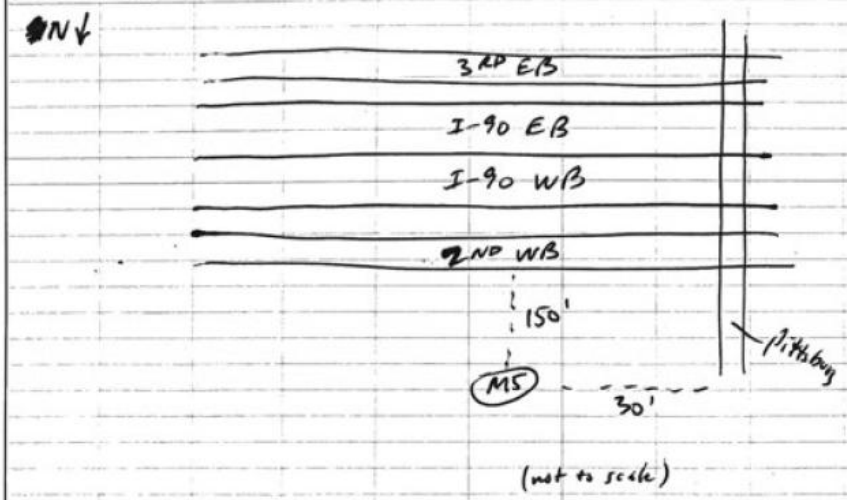

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Exhibit G-5: 15-Minute Validation Measurement Site 6—Perry St./2nd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC **Job #** 160315-AE

SITE IDENTIFICATION: M6 **OBSERVER(s):** Romero, Pappas
START DATE & TIME: 3-28-19 1:53 Pm **END DATE & TIME:** 3-28-19 2:08 Pm
ADDRESS: Vacant Lot Perry / 2nd

ID

TEMP: 51 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE S (SW) W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Weather

INSTRUMENT: LD 820 **TYPE:** (1) 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL 200 **SERIAL #:** 2239

CALIBRATION CHECK: **PRE-TEST** 114.0 dBA SPL **POST-TEST** 114.0 dBA SPL **WINDSCREEN** Yes

SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
M6	1:53	2:08	63.5	71.0	58.4	61.2	62.7	65.3	

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: I-90 EB off/WB on & off

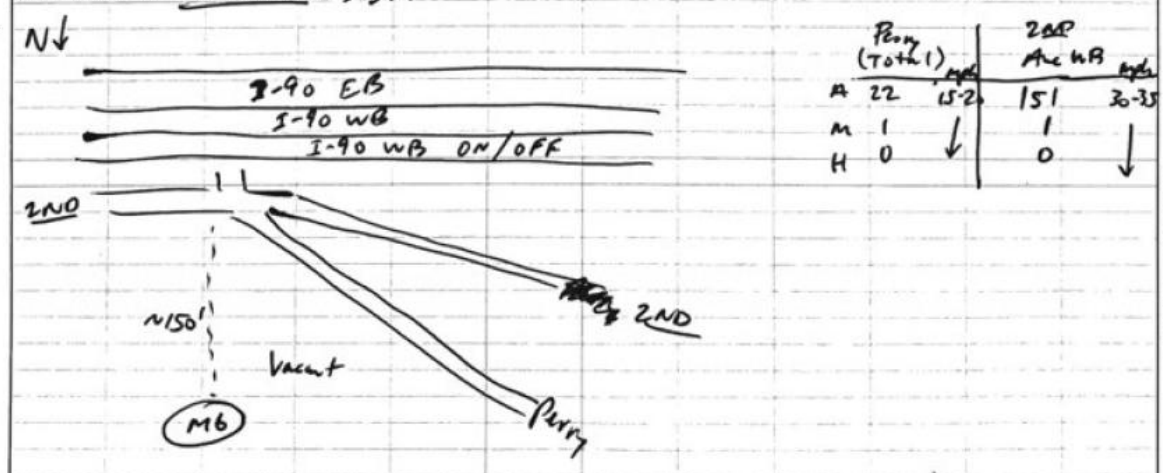
	COUNT #1 DURATION: 15 -MINUTE		SPEED (mph)		COUNT #2: 15 -MINUTE		SPEED (mph)	
	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/EB	SB/(WB)
AUTOS:	768	753	60-65	60-65	99 = 40-45	145 = 40-45		66 = 40-45
MED. TRUCKS:	27	18	↓	↓	3	0		6
HVY TRUCKS:	57	48	↓	↓	3	3		9
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / (DRIVING) / OBSERVER

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Source Info and Traffic Counts

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Res/Vacant land North of I-90/290 IC
SITE SKETCH / PHOTOGRAPHS: Digital



Site Photos, Details, Sketch

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Exhibit G-6: 15-Minute Validation Measurement Site 7—Adjacent to 217 S. Fiske St.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 160315-AE

ID

SITE IDENTIFICATION: M7 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-28-19 2:40 Pm END DATE & TIME: 3-28-19 2:55 Pm
ADDRESS: Adj to R.o.e 217 S. Fiske St.

Weather

TEMP: 55 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-1 MPH DIR: N NE E SE S (SW) W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}
M7	2:40	2:55	71.4	74.5	67.2	69.8	71.3	72.7
____	____	____	____	____	____	____	____	____

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

COUNT #1 DURATION: 15 -MINUTE	Count	Speed (mph)	COUNT #2: 15 -MINUTE	Count	Speed (mph)
	NB/EB / SB/WB	NB/EB / SB/WB		NB/EB / SB/WB	NB/EB / SB/WB
AUTOS:	1326 / 1016	60-65 / 60-65		38 = 30 / 180 = 35-50	65 = 30
MED. TRUCKS:	16 / 8	↓ / ↓		0 ↓ / 8	0
HVY TRUCKS:	34 / 44	____ / ____		0 ↓ / 2	0 ↓
BUSES:	____ / ____	____ / ____		____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____		____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant Res, land Vac; I-90
SITE SKETCH / PHOTOGRAPHS: Drawn

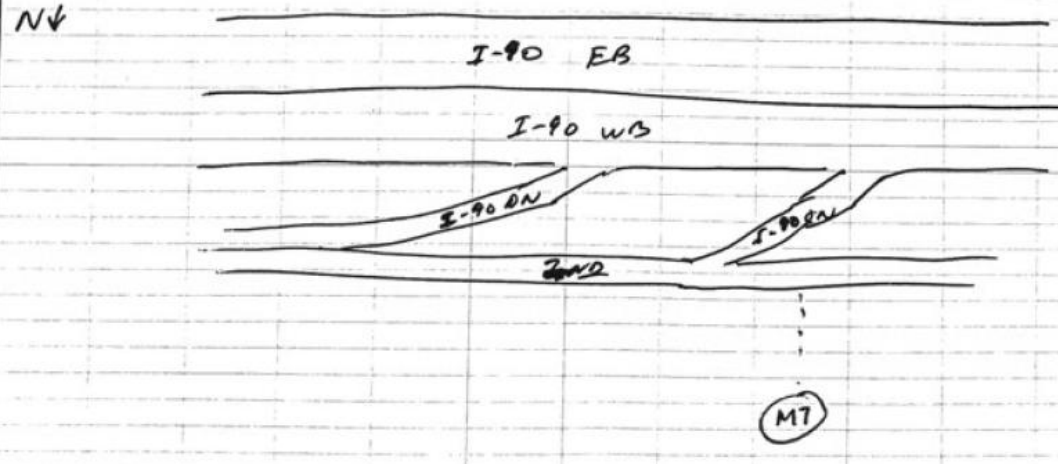

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Exhibit G-7: 15-Minute Validation Measurement Site 8—Cook St./2nd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 160315-AE

ID

SITE IDENTIFICATION: MB OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-28-19 3:08 END DATE & TIME: 3-28-19 3:23
ADDRESS: Cook / 2nd Ave

Weather

TEMP: 55 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE S (SW) W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
MB	3:08	3:18	70.1	74.4	67.6	68.8	70.1	71.1	
____	____	____	____	____	____	____	____	____	____

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT ~~FIRE~~ INDUSTRIAL AMBIENT OTHER: Cook SB / 2nd WB / Cook
COUNT #1 DURATION: 15 -MINUTE SPEED (mph) COUNT #2: 15 -MINUTE SPEED (mph)

	NB/EB	SB/WB	NB/EB	SB/WB	~~NB/EB~~	SB/WB	~~NB/EB~~	SB/WB
AUTOS:	1281	1158	60-65	60-65	106	11	30	25
MED. TRUCKS:	12	18	↓	↓	0	0	↓	↓
HVY TRUCKS:	24	30	↓	↓	0	0	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant / Rolling land, I-90
SITE SKETCH / PHOTOGRAPHS:

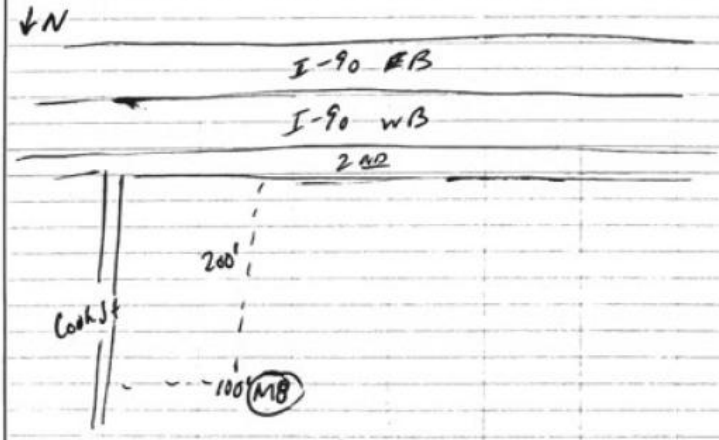

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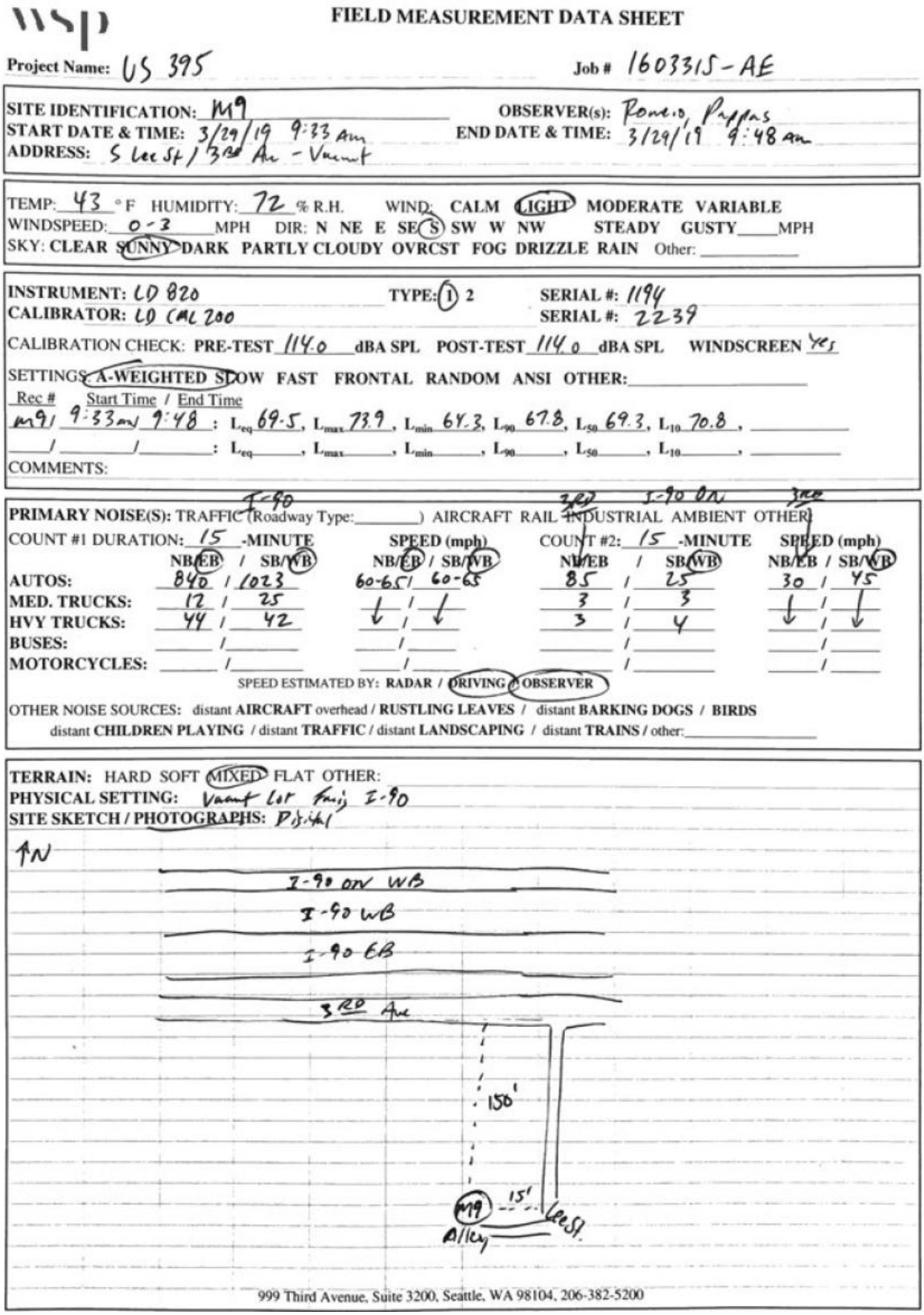
Exhibit G-8: 15-Minute Validation Measurement Site 8—S. Lee St./3rd Ave.—Field Data Sheet



WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 **Job #** 160315-AE

SITE IDENTIFICATION: M9 **OBSERVER(s):** Romero, Pappas
START DATE & TIME: 3/29/19 9:33 AM **END DATE & TIME:** 3/29/19 9:48 AM
ADDRESS: S Lee St / 3rd Ave - Vacant

ID

TEMP: 43 °F HUMIDITY: 72 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE (S) SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Weather

INSTRUMENT: LD 820 **TYPE:** (1) 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL 200 **SERIAL #:** 2239

CALIBRATION CHECK: **PRE-TEST** 114.0 dBA SPL **POST-TEST** 114.0 dBA SPL **WINDSCREEN** Yes

SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M9	9:33 AM / 9:48	L_{eq} 69.5	L_{max} 73.9	L_{min} 64.3	L_{90} 67.8	L_{50} 69.3	L_{10} 70.8	
____ / ____ / ____		L_{eq} ____	L_{max} ____	L_{min} ____	L_{90} ____	L_{50} ____	L_{10} ____	

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (I-90) (Roadway Type: _____) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: 3RD I-90 ON 3RD

	COUNT #1 DURATION: 15 -MINUTE		SPEED (mph)		COUNT #2: 15 -MINUTE		SPEED (mph)	
	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)	NB/(EB)	SB/(WB)
AUTOS:	840	1023	60-65	60-65	85	25	30	45
MED. TRUCKS:	12	25	↓	↓	3	3	↓	↓
HVY TRUCKS:	44	42	↓	↓	3	4	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Source Info and Traffic Counts

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant Lot Fwy I-90
SITE SKETCH / PHOTOGRAPHS: Digital

↑N

I-90 ON WB
I-90 WB
I-90 EB
3RD Ave
150'
M9
15'
Lee St
Alley

Site Photos, Details, Sketch

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Exhibit G-9: 15-Minute Validation Measurement Site 10—S. Haven St./3rd Ave.—Field Data Sheet

wsp

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC Job # 160315-AE

ID

SITE IDENTIFICATION: M10 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3·29·19 10:06 AM END DATE & TIME: 3:29 PM 10:21 AM
ADDRESS: S. Haven / 3rd Ave

Weather

TEMP: 43 °F HUMIDITY: 70 % R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: 0-1 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ____MPH
SKY: CLEAR SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: 1 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M10	10:21	L_{eq} 66.7,	L_{max} 76.0,	L_{min} 62.1,	L_{90} 64.7,	L_{50} 66.4	L_{10} 67.8	
/	10:06 /	L_{eq} ____,	L_{max} ____,	L_{min} ____,	L_{90} ____,	L_{50} ____,	L_{10} ____,	

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: I-90 ON 3RD I-90 ON

COUNT #1 DURATION: 15 -MINUTE	NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB	COUNT #2: 15 -MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB
AUTOS:	915 / 860	60-65 / 60-65	31 / 150	30 / 45
MED. TRUCKS:	11 / 12	↓ / ↓	2 / 5	↓ / ↓
HVY TRUCKS:	43 / 26	↓ / ↓	0 / 9	↓ / ↓
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHYSICAL SETTING: Vacant Lot facing I-90 from Alley.
SITE SKETCH / PHOTOGRAPHS:

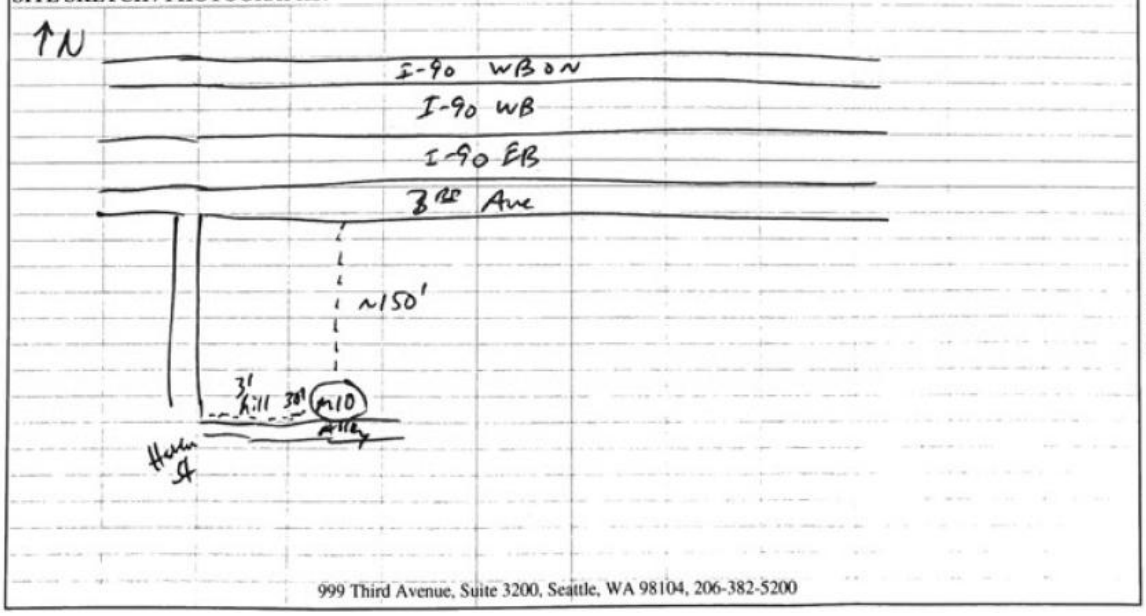

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Exhibit G-10: 15-Minute Validation Measurement Site 11—Dearborn St./4th Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC **Job #** 160331S-AE

SITE IDENTIFICATION: M11 **OBSERVER(s):** Romero, Pappas
START DATE & TIME: 3-29-19 11:10 AM **END DATE & TIME:** 3-29-19 11:25 AM
ADDRESS: 4TH / Dearborn

ID

TEMP: 47 °F **HUMIDITY:** 60 % R.H. **WIND:** CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH **DIR:** N NE E SE S SW W NW **STEADY** **GUSTY**____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other:_____

Weather

INSTRUMENT: LD 820 **TYPE:** (1) 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL 200 **SERIAL #:** 2239
CALIBRATION CHECK: **PRE-TEST** 114.0 **dBA SPL** **POST-TEST** 114.0 **dBA SPL** **WINDSCREEN** Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER:_____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
M11	11:10	11:25	71.8	74.6	66.8	69.8	71.6	73.3	

COMMENTS:

Acoustic Measurements

~~I-90~~ I-90 EB ON

PRIMARY NOISE(S): TRAFFIC (Roadway Type:_____) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

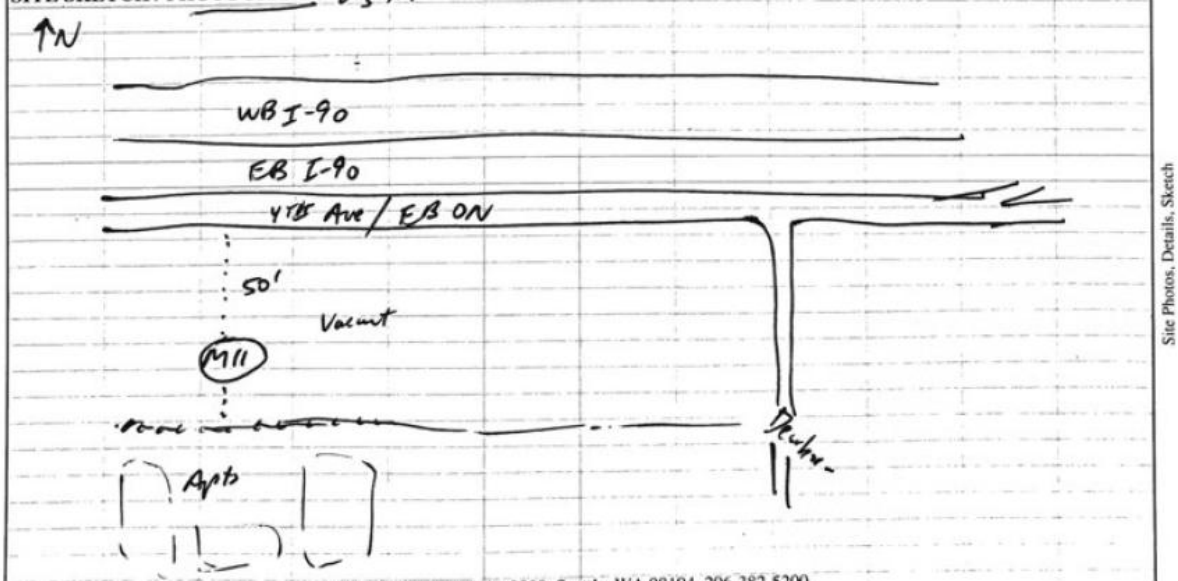
COUNT #1 DURATION: 15 -MINUTE	NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB	COUNT #2: 15 -MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB
AUTOS:	891 / 955	60-65 / 60-65	215 /	35 /
MED. TRUCKS:	16 / 15	↓ / ↓	3 /	↓ /
HVY TRUCKS:	38 / 34	↓ / ↓	9 /	↓ /
BUSES:	/	/	/	/
MOTORCYCLES:	/	/	/	/

SPEED ESTIMATED BY: RADAR / (DRIVING) / OBSERVER

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other:_____

Source Info and Traffic Counts

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant land Adj to Dearborn Apts
SITE SKETCH / PHOTOGRAPHS: digital



Site Photos, Details, Sketch

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Exhibit G-11: 15-Minute Validation Measurement Site 12—402 E. Eastern Rd.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 160331S-AE

ID

SITE IDENTIFICATION: M12 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-29-19 11:42 am END DATE & TIME: 3:29.19 11:57 am
ADDRESS: 402 E. Eastern Rd

Weather

TEMP: 47 °F HUMIDITY: 60 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: N NE E SE (S) SW W NW STEADY GUSTY____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M12	11:42 / 11:57 :	L_{eq} 65.7,	L_{max} 68.9,	L_{min} 63.6,	L_{90} 64.4,	L_{50} 65.6,	L_{10} 66.8,	_____
____	____ / ____ :	L_{eq} ____,	L_{max} ____,	L_{min} ____,	L_{90} ____,	L_{50} ____,	L_{10} ____,	_____

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: I-90 ON, I-90 ON, 4TH

COUNT #1 DURATION: 15 -MINUTE	SPEED (mph)		COUNT #2: 15 -MINUTE	SPEED (mph)	
	NB/EB / SB/WB	NB/EB / SB/WB	NB/EB / SB/WB	NB/EB / SB/WB	
AUTOS:	855 / 804	60-65 / 60-65	210 / 30	45-50 / 30	
MED. TRUCKS:	6 / 6	↓ / ↓	6 / 0	↓ / ↓	
HVY TRUCKS:	39 / 24	↓ / ↓	6 / 0	↓ / ↓	
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____	
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____	

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Adj to Public's Lot
SITE SKETCH / PHOTOGRAPHS: Digital

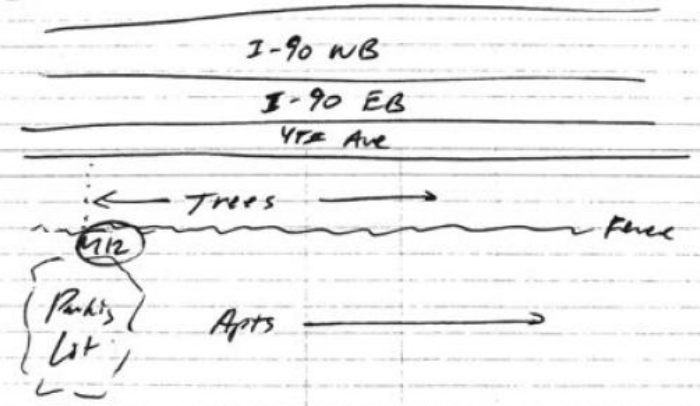

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Exhibit G-12: 15-Minute Validation Measurement Site 13—4903 E. 3rd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US 395 NSC Job # 160331S-AE

ID

SITE IDENTIFICATION: M13 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-29-19 12:05 Pm END DATE & TIME: 3-29-19 12:20 Pm
ADDRESS: 4903 E. 3RD Ave

Weather

TEMP: 53 °F HUMIDITY: 40 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M13	12:05 / 12:20:	L_{eq} 65.9,	L_{max} 74.4,	L_{min} 59.5,	L_{90} 62.4,	L_{50} 64.4,	L_{10} 68.7,	_____
____/____/____:		L_{eq} ____,	L_{max} ____,	L_{min} ____,	L_{90} ____,	L_{50} ____,	L_{10} ____,	_____

COMMENTS:
I-90 I-90 EB 3RD Ave

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type:_____) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

COUNT #1 DURATION: 15 -MINUTE	NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB	COUNT #2: 15 -MINUTE NB/EB / SB/WB	SPEED (mph) NB/EB / SB/WB
AUTOS:	1276 / 1060	60-65 / 60-65	32 / 56	45 / 25
MED. TRUCKS:	22 / 20	↓ / ↓	2 / 0	↓ / ↓
HVY TRUCKS:	40 / 16	↓ / ↓	0 / 0	↓ / ↓
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant (AIRCRAFT) overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other:_____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: ~~Urban Res~~ Adj to Public Utility Bldg at 4903 3RD Ave.
SITE SKETCH / PHOTOGRAPHS: Digital

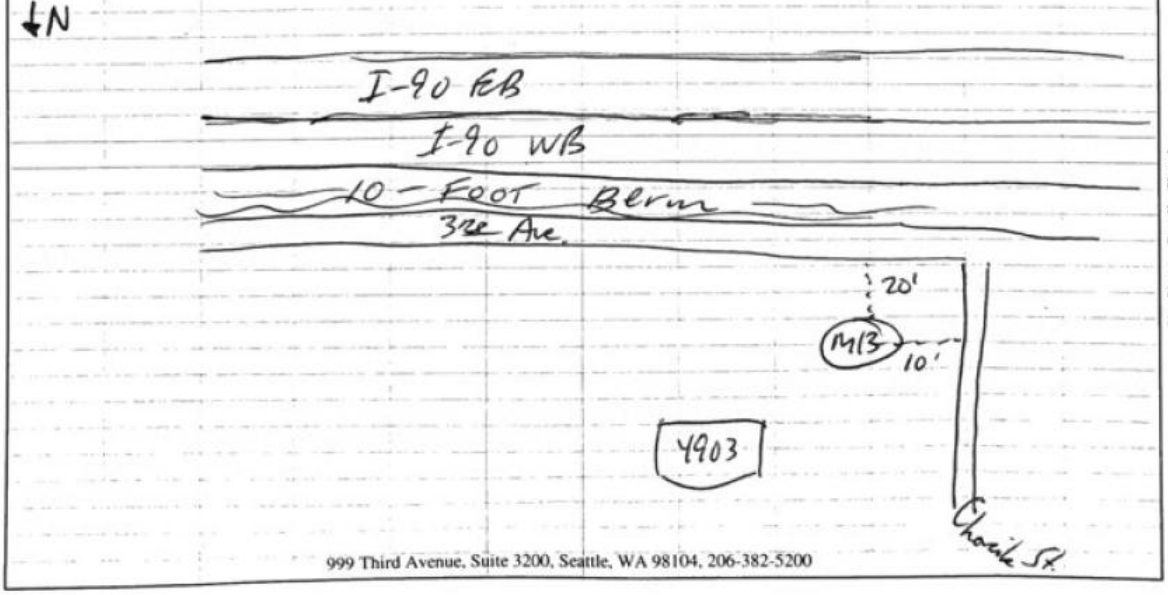

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Exhibit G-13: 15-Minute Validation Measurement Site 14—S. Florida St./E. 2nd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC Job # 1603315-AE

ID

SITE IDENTIFICATION: M14 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-29-19 12:40 pm END DATE & TIME: 3-29-19 12:55 pm
ADDRESS: S Florida St. / E. 2nd Av.

Weather

TEMP: 55 °F HUMIDITY: 40 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-2 MPH DIR: N NE E SE S SW W NW STEADY GUSTY____MPH
SKY: CLEAR SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER:_____

Rec #	Start Time / End Time							
M14	12:40 / 12:55	L_{eq} 67.1	L_{max} 75.3	L_{min} 62.1	L_{90} 64.3	L_{50} 66.7	L_{10} 69.1	
____	____ / ____	L_{eq} ____	L_{max} ____	L_{min} ____	L_{90} ____	L_{50} ____	L_{10} ____	

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: 2nd

COUNT #1 DURATION: 15 -MINUTE	SPEED (mph)		COUNT #2: 15 -MINUTE	SPEED (mph)	
	NB/(EB) / SB/(WB)	NB/(EB) / SB/(WB)	NB/(EB) / SB/WB	NB/(EB) / SB/(WB)	
AUTOS:	993 / 1266	60-65 / 60-65	63 / ____	30 / ____	
MED. TRUCKS:	18 / 12	↓ / ↓	0 / ____	↓ / ____	
HVY TRUCKS:	58 / 15	↓ / ↓	1 / ____	↓ / ____	
BUSES:	____ / ____	____ / ____	____ / ____	____ / ____	
MOTORCYCLES:	____ / ____	____ / ____	____ / ____	____ / ____	

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other:_____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Paved walkway where homes used to stand
SITE SKETCH / PHOTOGRAPHS: Digital

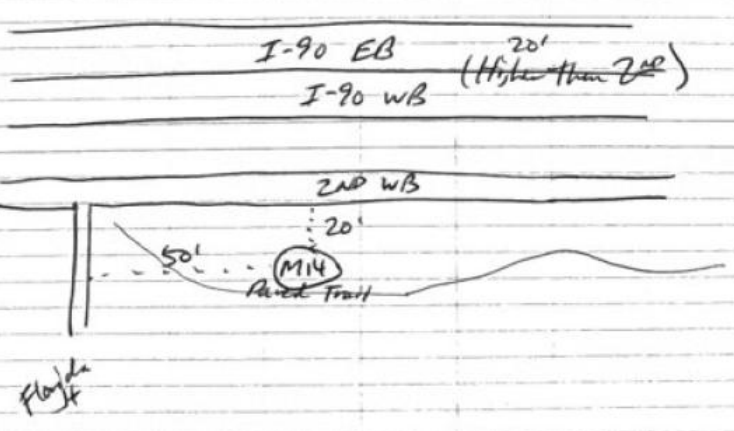

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Exhibit G-14: 15-Minute Validation Measurement Site 15—S. Ralph St./E. 2nd Ave.—Field Data Sheet

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC Job # 160331S-AE

ID

SITE IDENTIFICATION: M15 OBSERVER(s): Romero, Pappas
START DATE & TIME: 3-29-19 1:14 PM END DATE & TIME: 3-29-19 1:29 PM
ADDRESS: S. Ralph St / E. 2nd Ave.

Weather

TEMP: 55 °F HUMIDITY: 40 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-4 MPH DIR: N NE E SE (S) SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 TYPE: (1) 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time							
M15	1:14 / 1:29	L_{eq} 63.1	L_{max} 76.9	L_{min} 58.1	L_{90} 59.7	L_{50} 61.2	L_{10} 64.2	
___ / ___		L_{eq} ___	L_{max} ___	L_{min} ___	L_{90} ___	L_{50} ___	L_{10} ___	

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: 2ND

	COUNT #1 DURATION: 15-MINUTE		SPEED (mph)		COUNT #2: 15-MINUTE		SPEED (mph)	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
AUTOS:	969	970	60-65	60-65	___	227	___	30
MED. TRUCKS:	14	4	↓	↓	___	5	___	↓
HVY TRUCKS:	48	16	↓	↓	___	4	___	___
BUSES:	___	___	___	___	___	___	___	___
MOTORCYCLES:	___	___	___	___	___	___	___	___

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: (distant AIRCRAFT) overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING: Vacant lots west of Commercial on Thor St.
SITE SKETCH / PHOTOGRAPHS: DSC_701

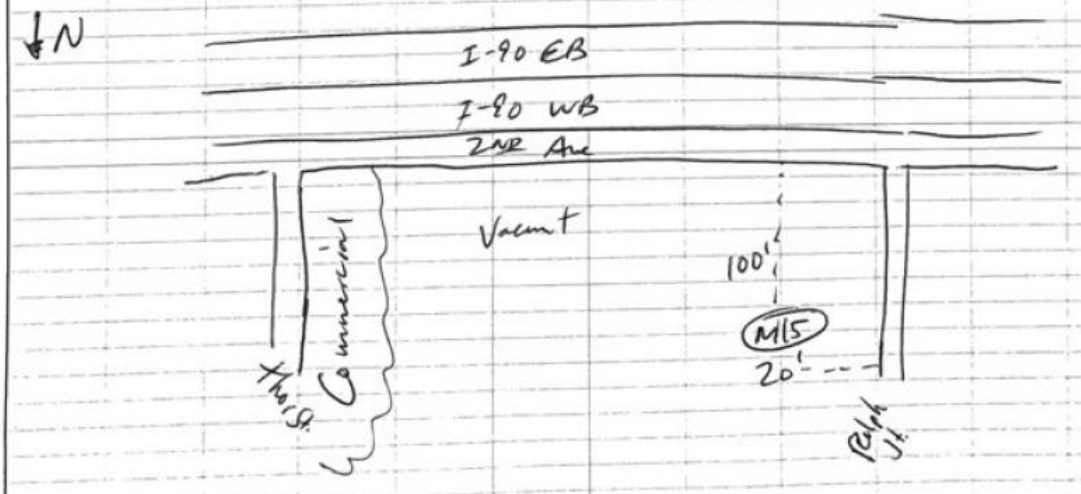

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Exhibit G-15: 15-Minute Validation Measurement Sites 16 and 17—E. 4th St./S. Carnahan St and S. Howe Rd./E. 3rd Ave.—Field Data Sheet

WSP

FIELD MEASUREMENT DATA SHEET

Project Name: US395 NSC **Job #** 1603315-AE

ID

SITE IDENTIFICATION: M16, M17 **OBSERVER(s):** Romero, Pappas
START DATE & TIME: 3-29-19 3:14 pm **END DATE & TIME:** 3-29-19 3:29 pm
ADDRESS: E. 4TH / S. Carnahan St & S. Howe Rd / E. 3RD Ave

Weather

TEMP: 61 °F HUMIDITY: 40 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0-4 MPH DIR: N NE E SE (S) SW W NW STEADY GUSTY ____MPH
SKY: CLEAR (SUNNY) DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: _____

Acoustic Measurements

INSTRUMENT: LD 820 **TYPE:** (1) 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL 200 **SERIAL #:** 2239
CALIBRATION CHECK: **PRE-TEST** 114.0 dBA SPL **POST-TEST** 114.0 dBA SPL **WINDSCREEN** Yes
SETTINGS (A-WEIGHTED) SLOW FAST FRONTAL RANDOM ANSI OTHER: _____

Rec #	Start Time / End Time								
M16	3:14 / 3:29	L_{eq} 74.6	L_{max} 79.5	L_{min} 72.1	L_{90} 73.2	L_{50} 74.3	L_{10} 75.8		
M17	3:14 / 3:29	L_{eq} 64.1	L_{max} 69.9	L_{min} 60.9	L_{90} 62.6	L_{50} 64.1	L_{10} 65.4		

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): TRAFFIC (Roadway Type: I-90 / 2ND) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: I-90 Ramps / 2ND

	COUNT #1 DURATION: 15-MINUTE		SPEED (mph)		COUNT #2: 15-MINUTE		SPEED (mph)	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
AUTOS:	1389	1358	60-65	60-65	186 / 1201	42	55/40	35
MED. TRUCKS:	18	7	↓	↓	0 / 0	5	↓/↓	↓
HVY TRUCKS:	36	30	↓	↓	0 / 0	0	↓/↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / (DRIVING) / (OBSERVER)

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: _____

Site Photos, Details, Sketch

TERRAIN: HARD SOFT (MIXED) FLAT OTHER:
PHYSICAL SETTING:
SITE SKETCH / PHOTOGRAPHS: