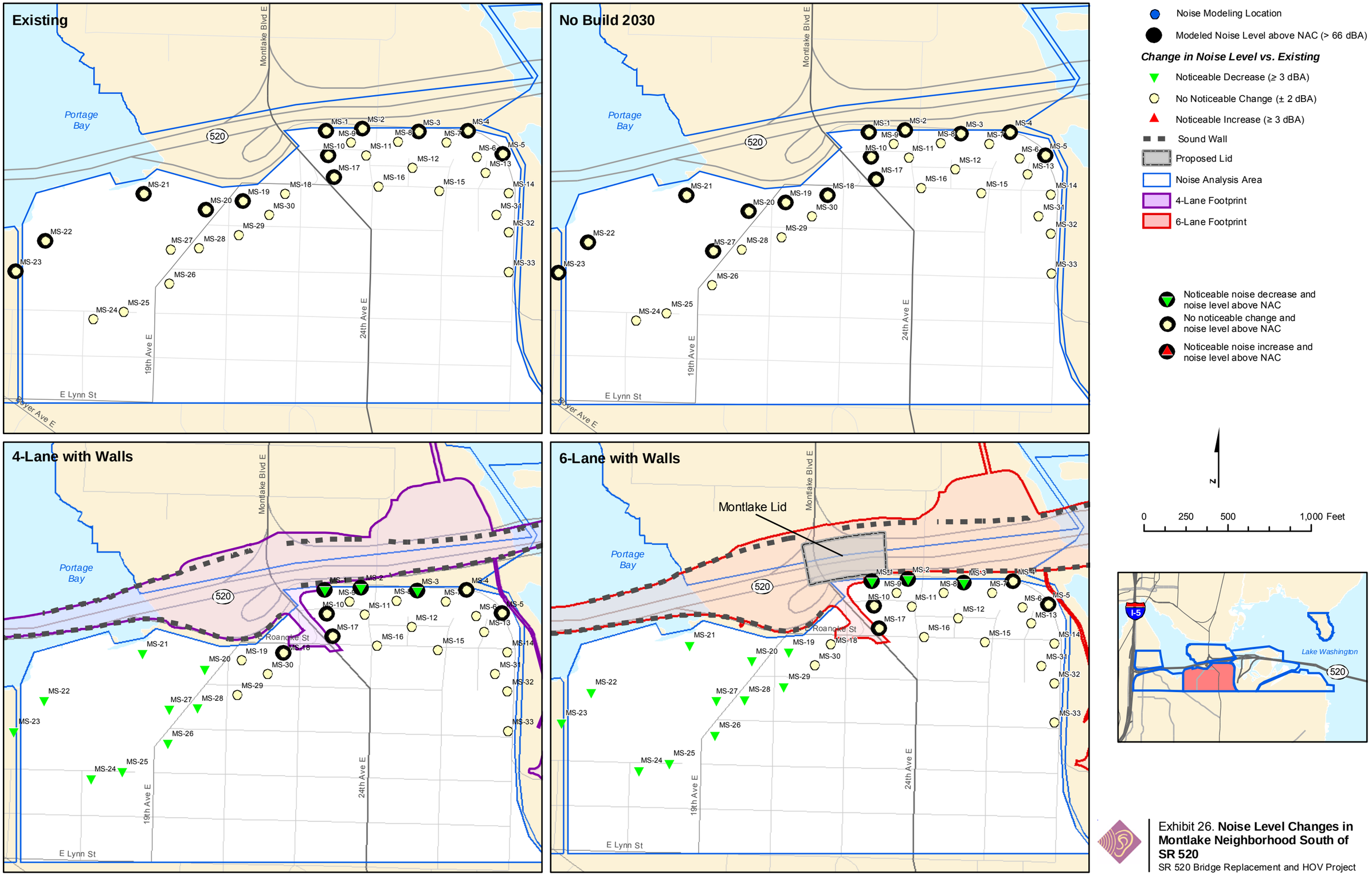
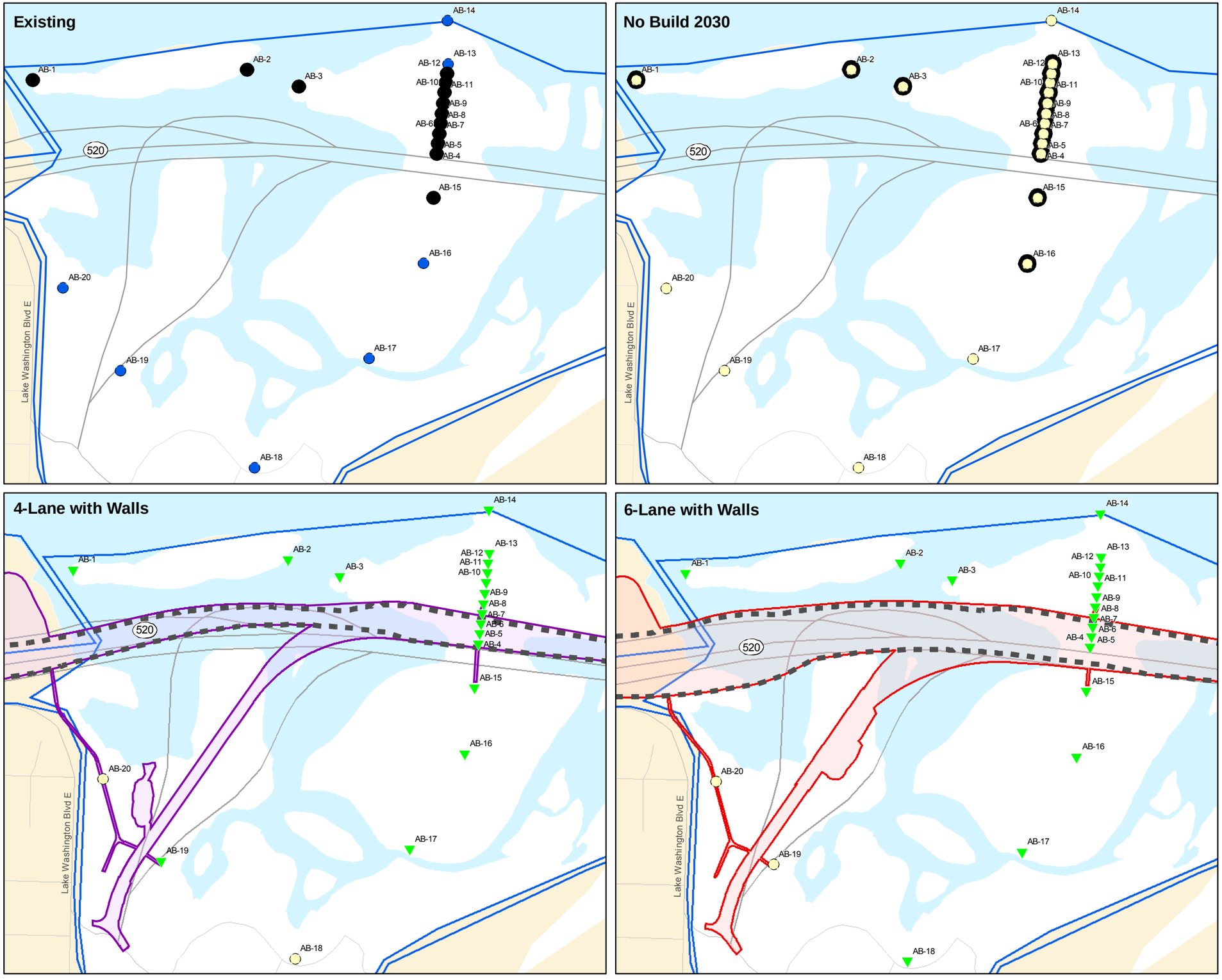


Exhibit 26. **Noise Level Changes in Montlake Neighborhood South of SR 520**

SR 520 Bridge Replacement and HOV Project



Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 Feet

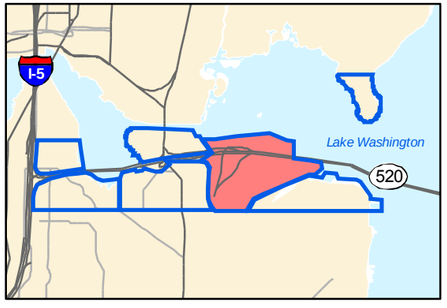
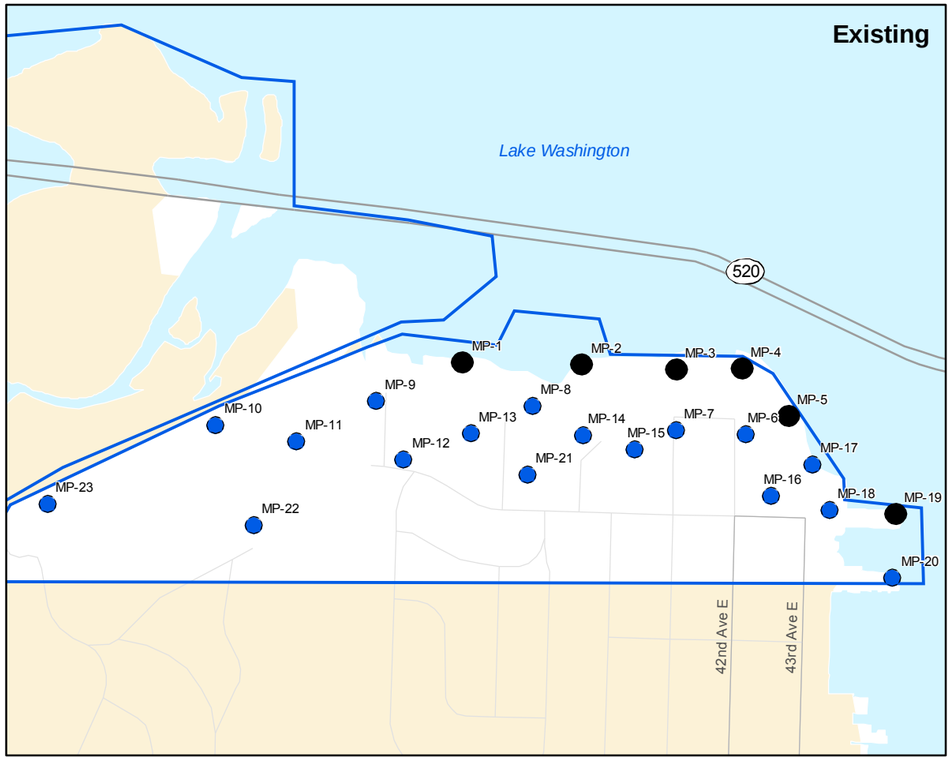
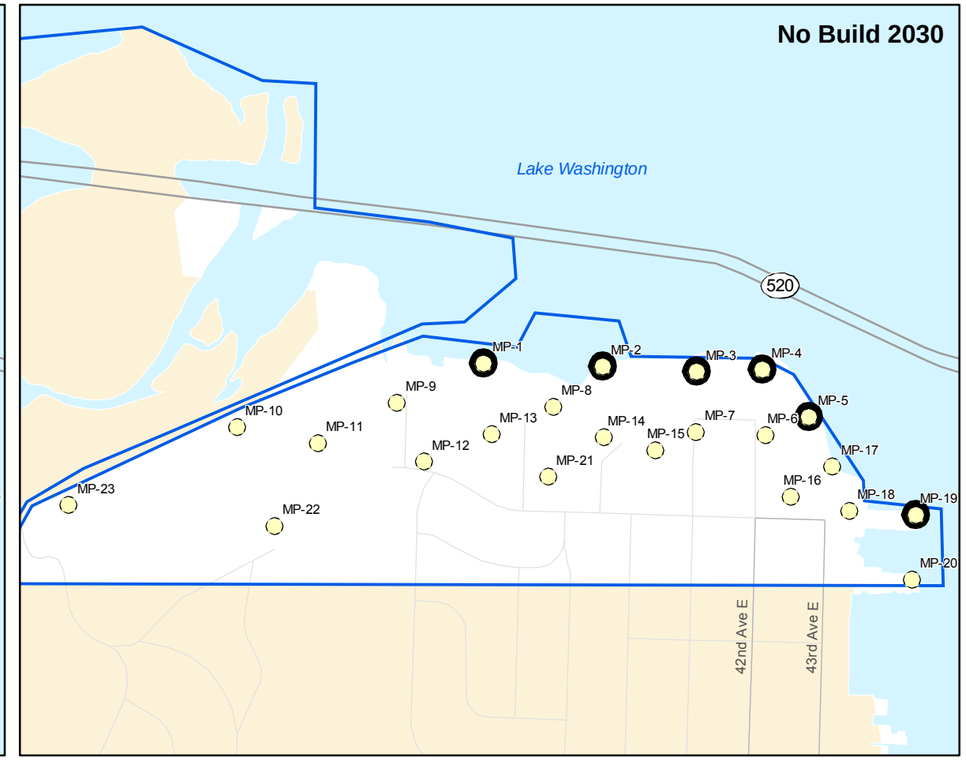
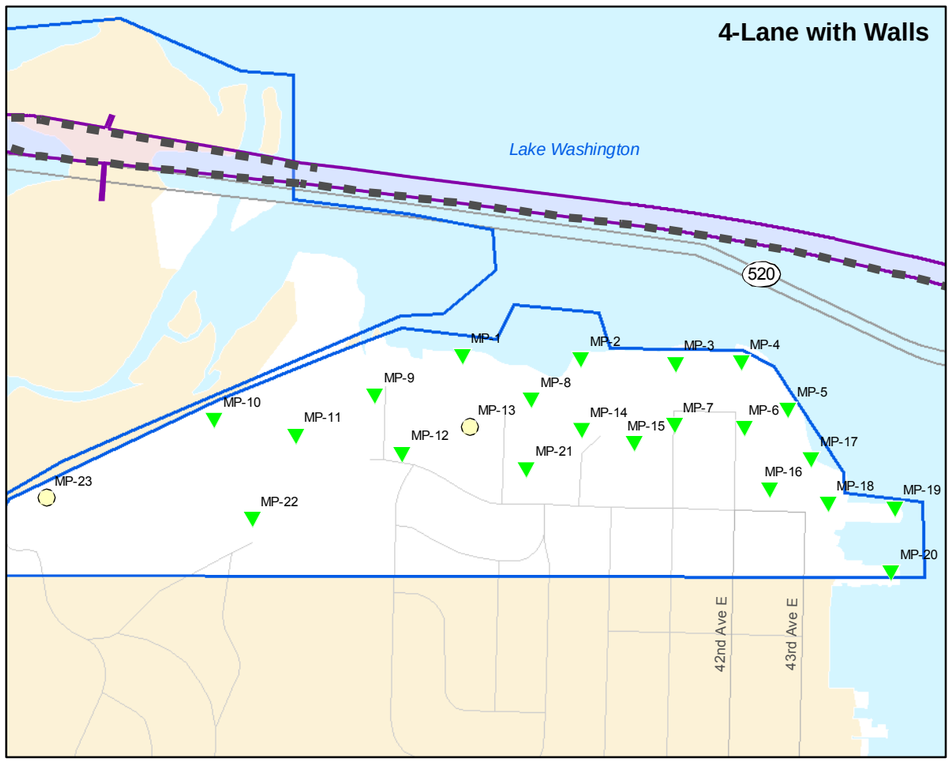


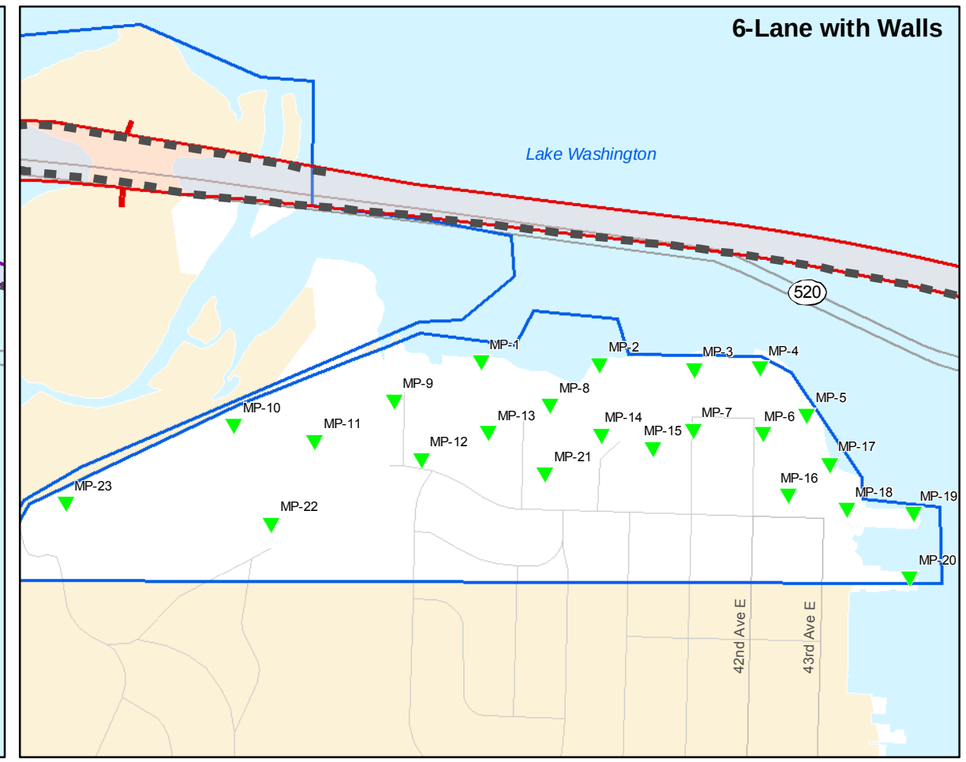
Exhibit 27. **Noise Level Changes in Washington Park Arboretum**

SR 520 Bridge Replacement and HOV Project









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 Feet

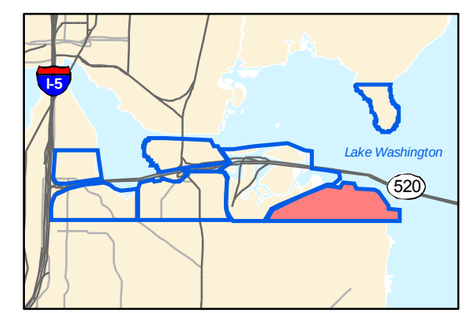


Exhibit 28. **Noise Level Changes in Madison Park Neighborhood**

SR 520 Bridge Replacement and HOV Project

Laurelhurst

The noise discipline team modeled peak-hour traffic noise levels for 7 receiver locations (representing 15 residences) in the Laurelhurst neighborhood. Existing conditions and No Build Alternative noise levels would not exceed the NAC at any receiver location in Laurelhurst.

Under the 4-Lane Alternative, noise levels would increase by 1 to 5 dBA compared to today, but noise levels would not exceed the NAC at any receiver locations. Under the 6-Lane Alternative, noise levels would increase by 1 to 4 dBA, but again noise levels would not exceed the NAC at any receiver locations. An increase of 4 to 5 dBA could be a perceptible change for some residents in Laurelhurst; however, noise levels are projected to be below 63 dBA at all residences in this neighborhood.

Exhibit 29 shows the locations of the receivers for each alternative in Laurelhurst and compares the noise levels under existing conditions to noise levels under the different alternatives. Attachment 1G shows the results for receivers in Laurelhurst and compares the project alternatives to existing peak-hour traffic noise levels.

How would the project affect noise levels in the Eastside project area?

This section discusses the overall effects of the No Build, 4-Lane, and 6-Lane Alternatives in the Eastside project area, followed by discussions of the individual communities and neighborhoods.

Summary of Effects in the Eastside Project Area

No Build Alternative

Under the Catastrophic Failure Scenario, Eastside noise levels would be substantially lower close to Lake Washington and away from major roads and I-405. This assumes that only local traffic would use SR 520 west of I-405 if the floating portion of the Evergreen Point Bridge failed. Overall noise levels could be reduced by up to 20 dBA or more at some locations in Medina and Hunts Point, and up to 10 dBA or more between 92nd Avenue Northeast and Bellevue Way. The estimated noise level reductions are based on minimum evening and nighttime noise levels measured at long-term monitoring sites M55, M57, M65, and M66.

Under the Continued Operation Scenario, peak-hour traffic flow conditions on the Eastside project area roadways represent the worst-case noise levels because the modeling assumed a posted speed of 55 mph (the higher the speed, the more noise from the roadway). The modeling results are presented for each neighborhood within the Eastside project area. Particular attention is paid to any increase in noise levels above existing peak-hour traffic conditions that would cause noise levels at additional residences to exceed the NAC.

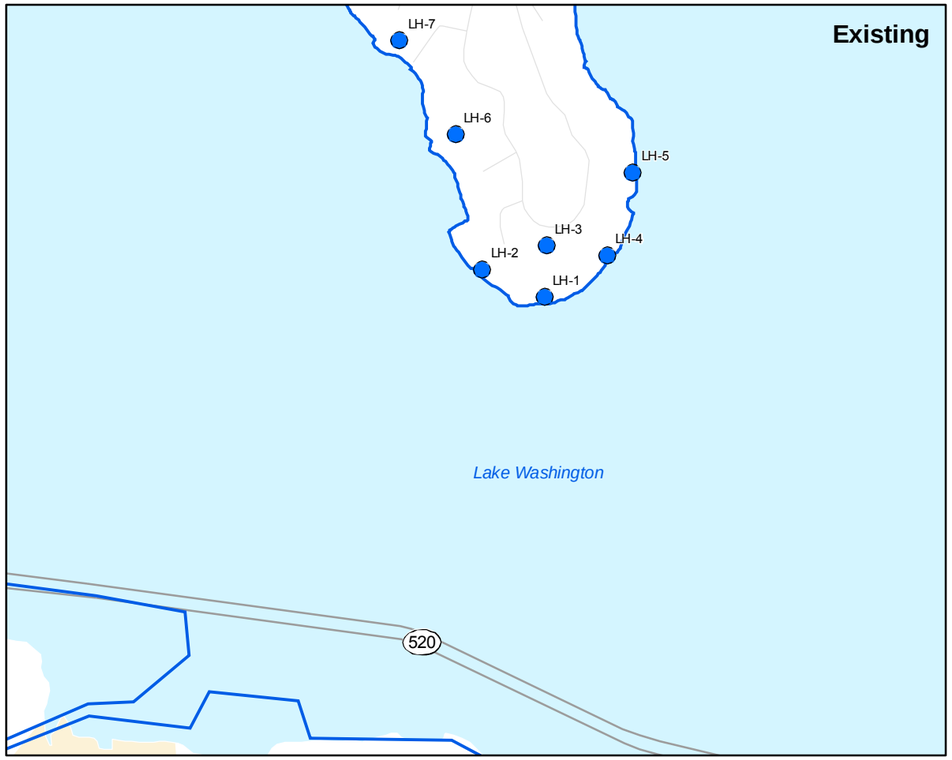
The Continued Operation Scenario peak-hour traffic noise levels were modeled for the same 199 receiver locations on the Eastside as under the existing peak-hour traffic conditions. Noise levels are expected to increase slightly over today because of growth in traffic volumes on SR 520 and other roadways within the study area. Of the 199 modeled receivers, 65 receivers (representing 154 residences) would have noise levels exceeding the NAC of 66 dBA L_{eq}. Under existing conditions, 57 receivers (representing 135 residences) exceed the NAC. Under the No Build Alternative's Continued Operation Scenario, an additional 19 residences would exceed the NAC.

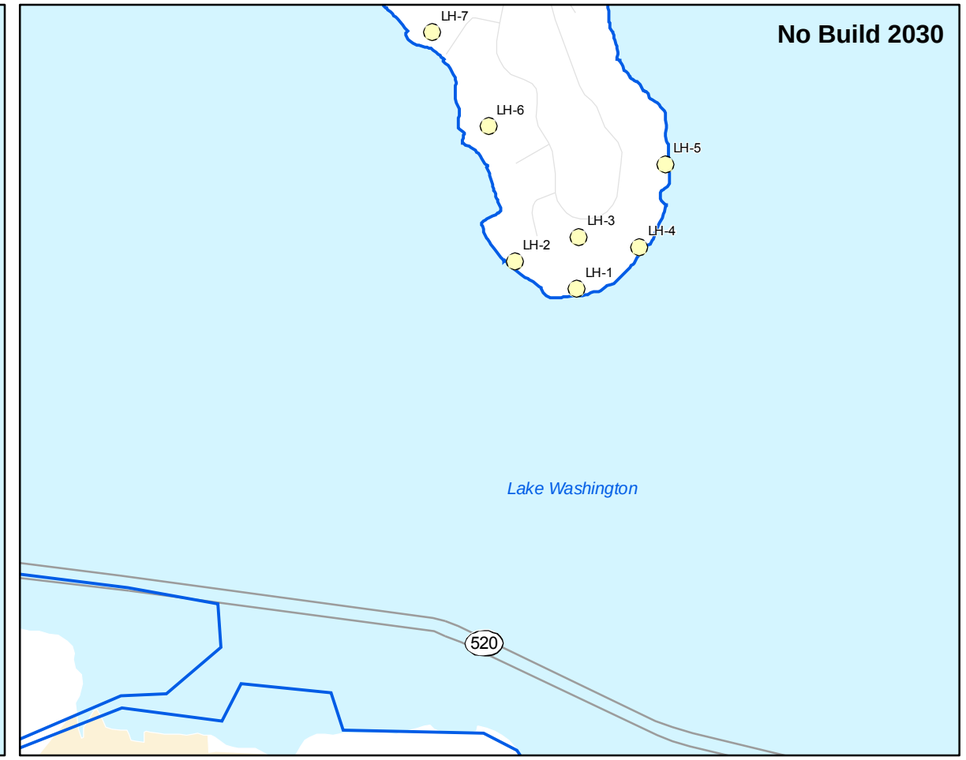
Number of Residences Where Noise Levels Exceed the NAC in the Eastside Project Area			
Existing	**No Build**	**4-Lane**	**6-Lane**
135	154	24	18

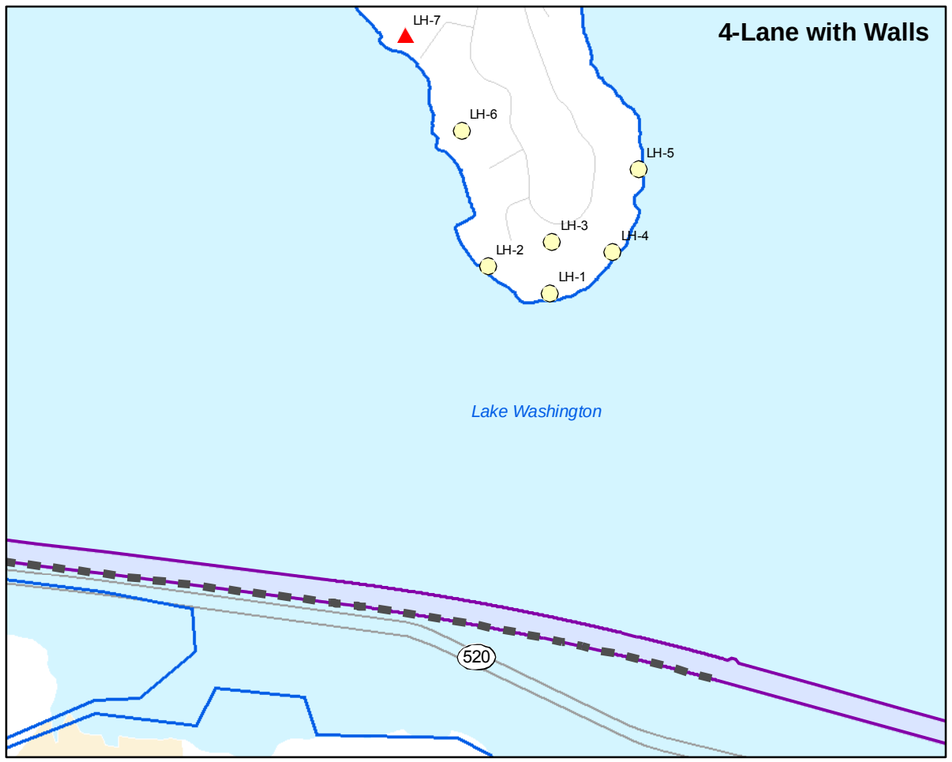
4-Lane and 6-Lane Alternatives

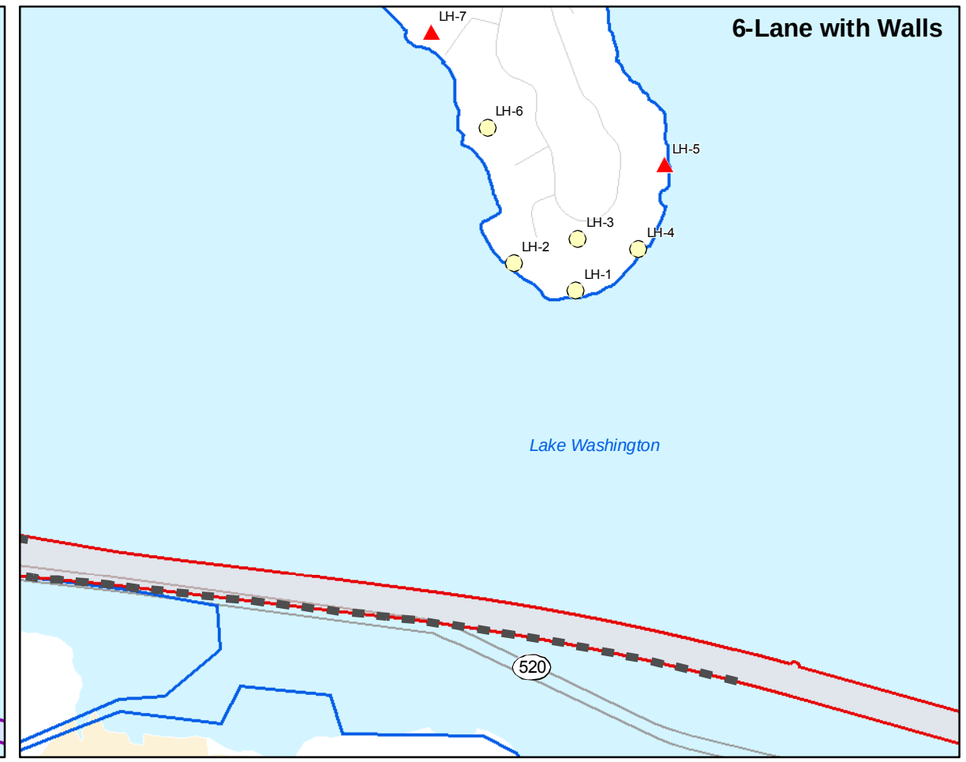
The 4-Lane Alternative and 6-Lane Alternative peak-hour traffic noise levels represent the worst-case traffic noise levels that could be expected with 2030 traffic flow conditions.

The 4-Lane Alternative and 6-Lane Alternative peak-hour traffic noise levels were modeled for the same 199 receiver locations in the Eastside project area as existing peak-hour traffic conditions. Overall, the 4-Lane Alternative would lower the number of residences where noise levels exceed the NAC from 135 under existing conditions to 24. The residences where noise levels would exceed the NAC would not be further benefited by a sound wall because of topographical constraints or because the major noise source is one of the major roads (for example, 84th Avenue Northeast)—not SR 520. The 6-Lane Alternative would be slightly better at reducing noise levels because of the addition of three lids over the highway at Evergreen Point Road and 84th and 92nd Avenues Northeast. Overall, the 6-Lane Alternative would lower the number of residences where noise levels exceed the NAC from 135 today to 18.









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 1,000 Feet

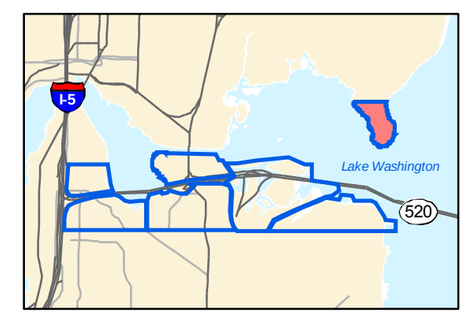


Exhibit 29. **Noise Level Changes in Laurelhurst Neighborhood**

SR 520 Bridge Replacement and HOV Project

Eastside aerial photographs showing the modeling locations and tables with the modeled noise levels are provided in Attachment 2.

Effects of the Project Alternatives on Neighborhoods in the Eastside Project Area

The following sections describe and compare existing conditions with the No Build, 4-Lane, and 6-Lane Alternatives for each neighborhood in the Eastside project area. Exhibits 30 through 34 show changes in noise levels between the alternatives when compared to existing conditions, and identify locations exceeding the NAC. Each Eastside neighborhood area is discussed below.

Medina and Hunts Point North of SR 520

The noise discipline team modeled peak-hour traffic noise levels for 43 receiver locations (representing 118 residences) in Medina and Hunts Point west of 84th Avenue Northeast and north of SR 520. Compared to existing conditions, no additional residences in this portion of the Eastside project area would have noise levels exceeding the NAC under the No Build Alternative.

Under the 4-Lane Alternative, the number of residences where noise levels exceed the NAC would decrease from 29 residences (today) to 4. Under the 6-Lane Alternative, noise levels would not exceed the NAC at any residences in this area. Noise level reductions of 2 to 11 dBA L_{eq} are projected under the 4-Lane Alternative and reductions of 2 to 10 dBA L_{eq} are projected under the 6-Lane Alternative.

Exhibit 30 shows existing noise levels and future noise levels under the No Build, 4-Lane, and 6-Lane Alternatives, including locations that are projected to exceed the NAC and where noise levels are projected to increase, remain the same, or decrease. Attachment 2A provides the detailed noise modeling results and compares the project alternatives to existing peak-hour traffic noise levels.

Medina and Hunts Point South of SR 520

The noise discipline team modeled peak-hour traffic noise levels for 33 receiver locations (representing 109 residences) in Medina and Hunts Point west of 84th Avenue Northeast and south of SR 520. Currently, 37 residences exceed the NAC. Under the No Build Alternative, noise levels at receiver PS-23 (representing 4 additional residences) would exceed the NAC, bringing the total up to 41 residences.

The 4-Lane Alternative would decrease the number of residences exceeding the NAC to 5. Under the 6-Lane Alternative, no residences would exceed the NAC. The more effective noise reduction under the 6-Lane Alternative would be due to the addition of two lids over the highway (at Evergreen Point Road and 84th Avenue Northeast).

Noise level reductions of 3 to 11 dBA L_{eq} are projected under the 4-Lane Alternative. The 6-Lane Alternative would reduce noise levels by 4 to 13 dBA compared to existing conditions.

Exhibit 31 shows the location of receivers that exceed the NAC and a comparison of how noise levels would change under the different alternatives. Attachment 2B shows the results for receivers PS-1 through PS-33 and provides detailed tables that compare the project alternatives to existing peak-hour traffic noise levels.

Hunts Point, Clyde Hill, Yarrow Point, and Kirkland North of SR 520

The noise discipline team modeled peak-hour traffic noise levels for 50 receiver locations (representing 116 residences) in Hunts Point, Clyde Hill, Yarrow Point, and Kirkland east of 84th Avenue Northeast and north of SR 520. Currently, noise levels at 16 residences exceed the NAC. Under the No Build Alternative, noise levels at receiver PK-1 (representing two additional residences) would exceed the NAC, bringing the number of residences exceeding the NAC up to 18.

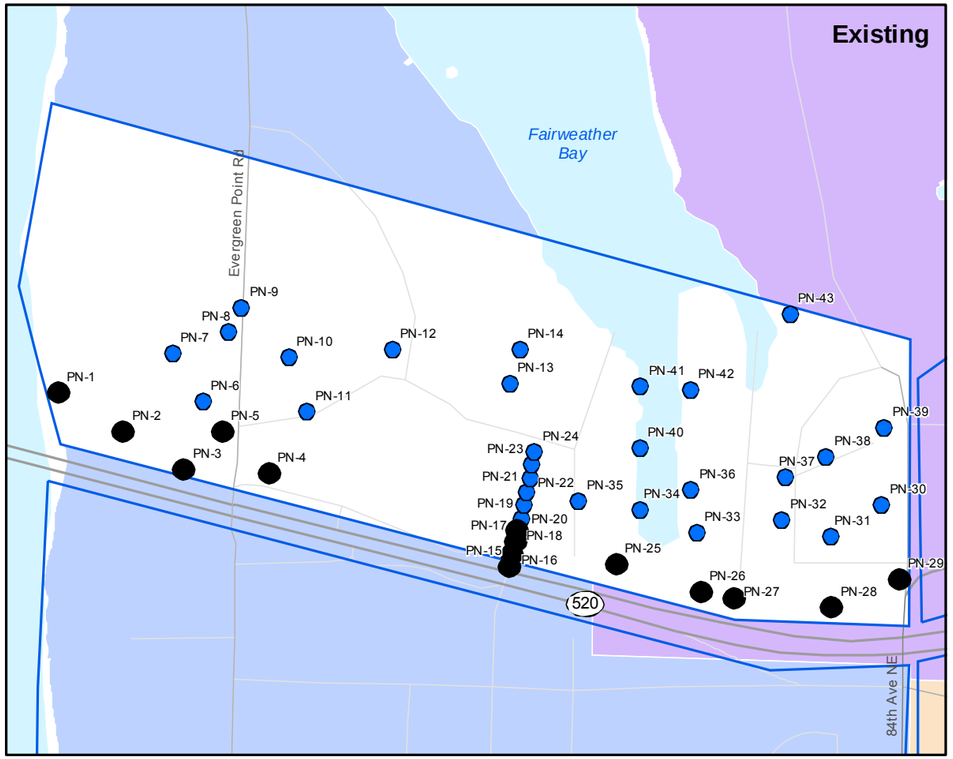
Under the 4-Lane Alternative or 6-Lane Alternative, noise levels at the 16 residences currently exceeding the NAC would no longer exceed the NAC because of the highway lids (under the 6-Lane Alternative) and sound walls.

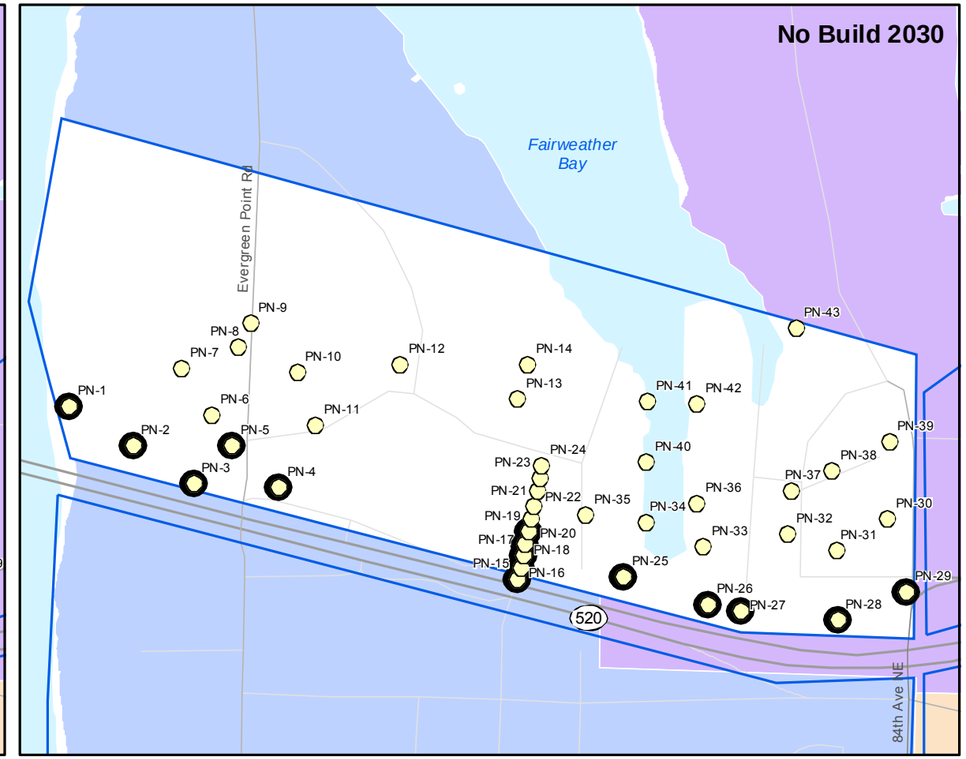
Noise level reductions of 2 to 9 dBA L_{eq} are projected at residences under the 4-Lane Alternative. Noise level reductions of 2 to 8 dBA L_{eq} are projected at residences under the 6-Lane Alternative.

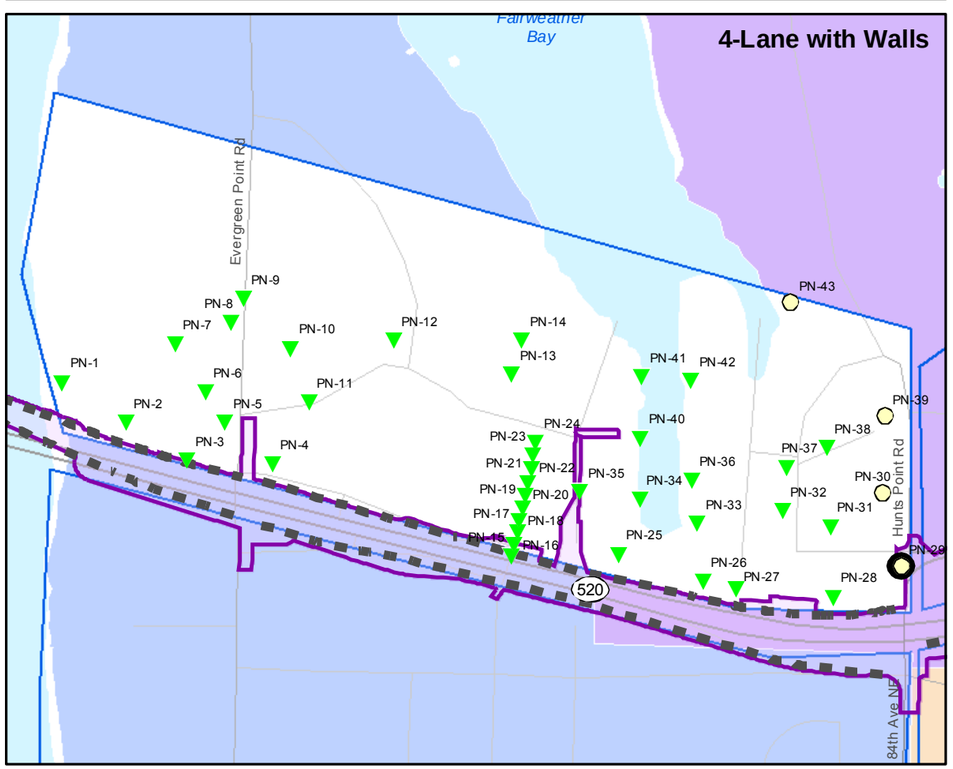
Exhibit 32 compares current (existing) and future noise levels under the No Build, 4-Lane, and 6-Lane Alternatives. Attachment 2C provides the results for receivers PK-1 through PK-50 and compares the project alternatives to existing peak-hour traffic noise levels.

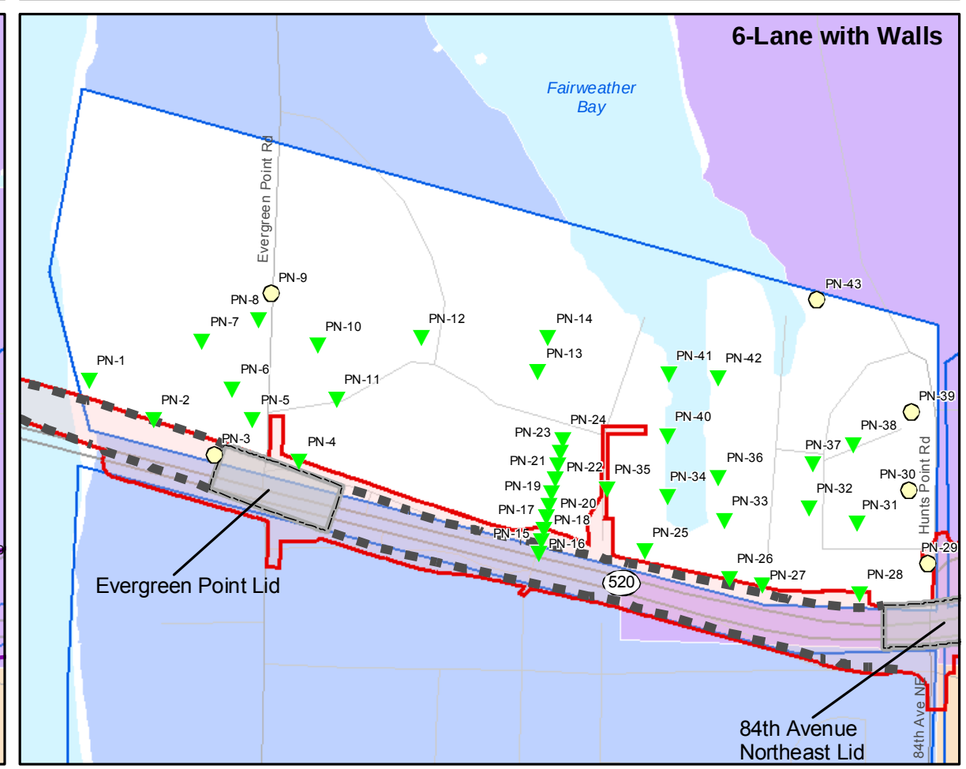
Hunts Point, Clyde Hill, Yarrow Point, and Bellevue South of SR 520

The noise discipline team modeled peak-hour traffic noise levels for 64 receiver locations (representing 243 residences) in Hunts Point, Clyde Hill, Yarrow Point, and Bellevue east of 84th Avenue Northeast









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 Feet

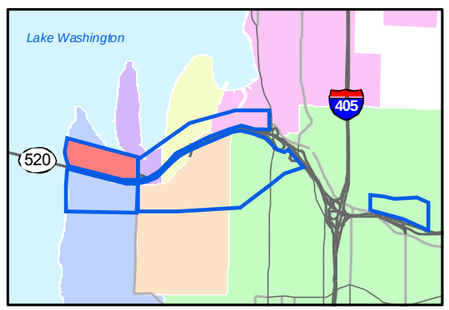
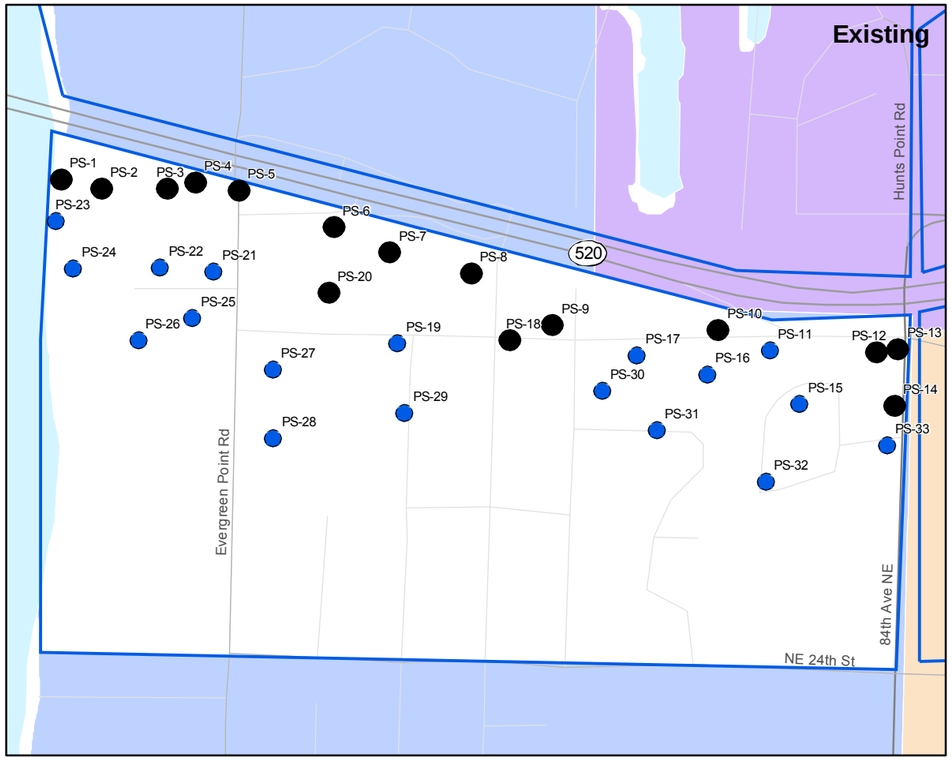
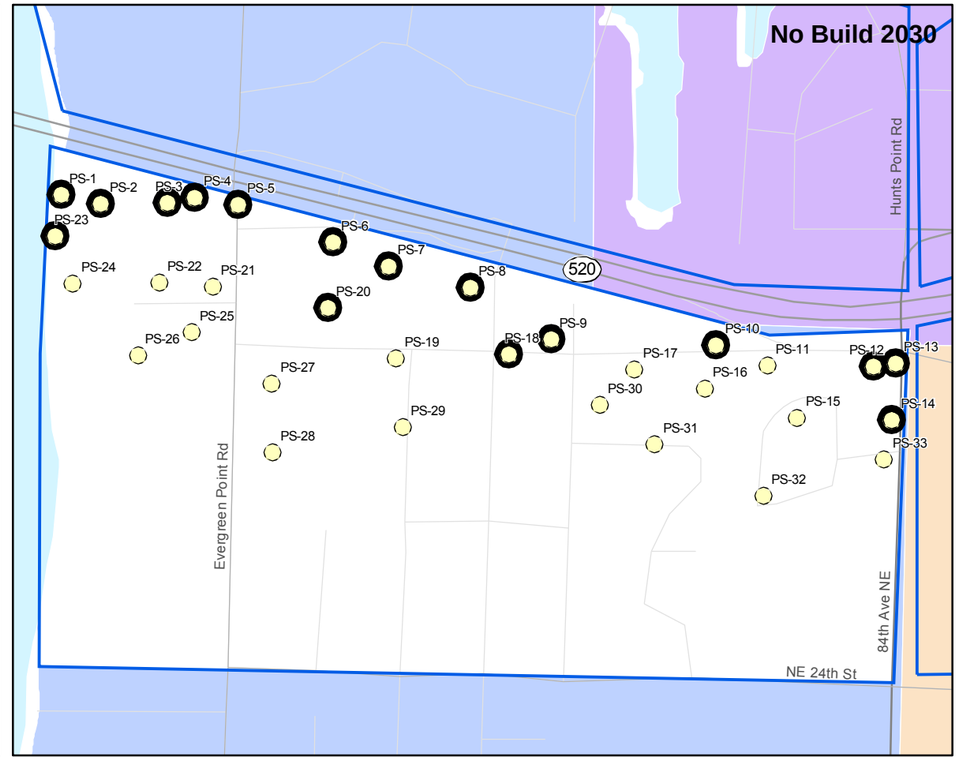
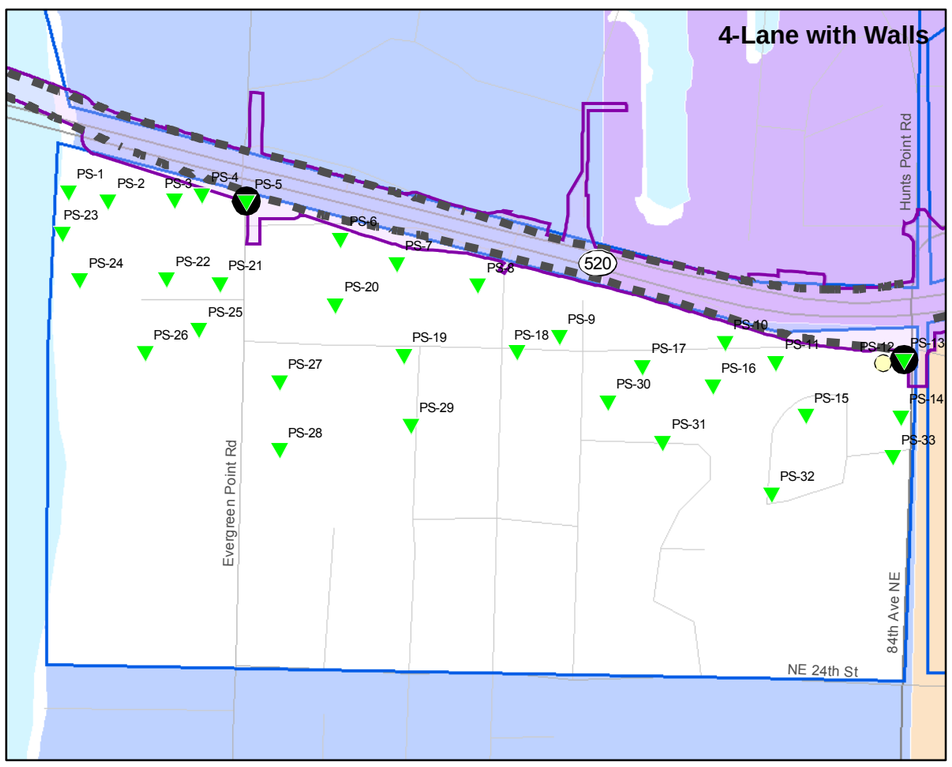


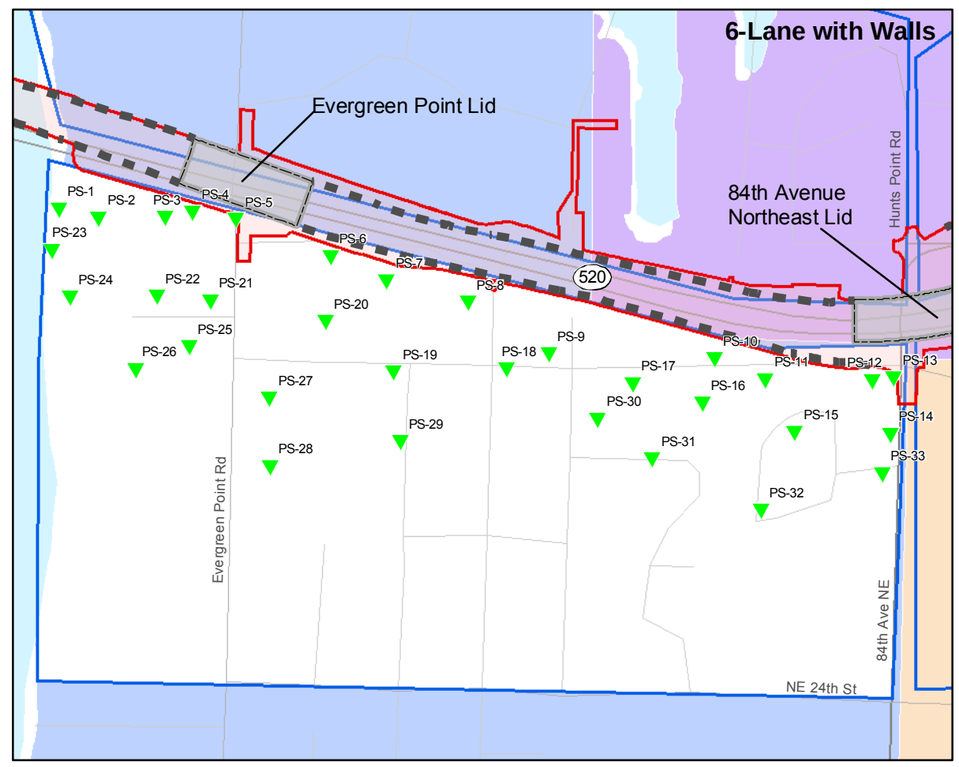
Exhibit 30. **Noise Level Changes in Medina and Hunts Point North of SR 520**

SR 520 Bridge Replacement and HOV Project









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 1,000 Feet

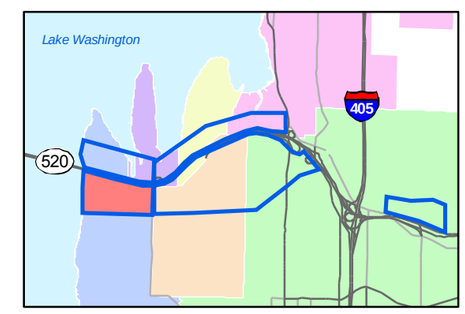
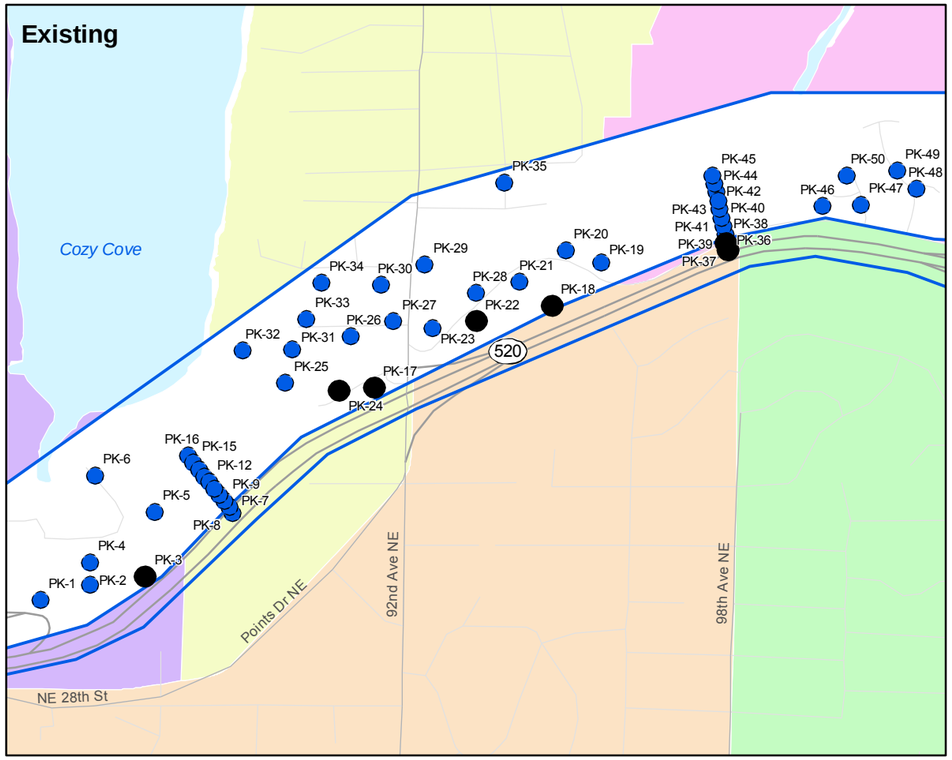
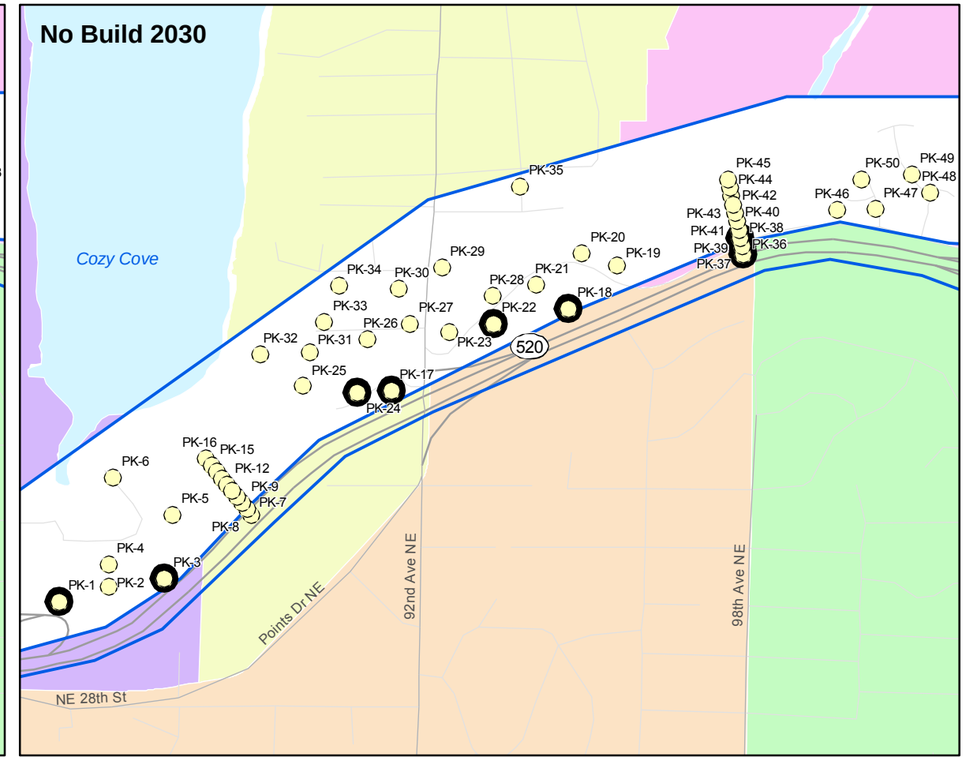
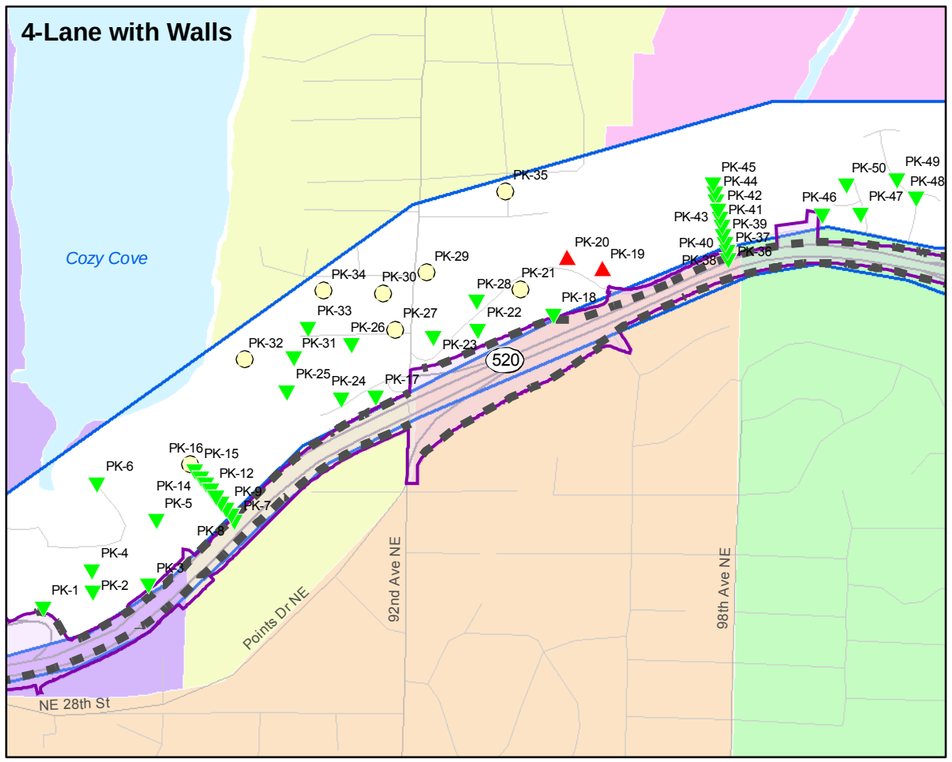


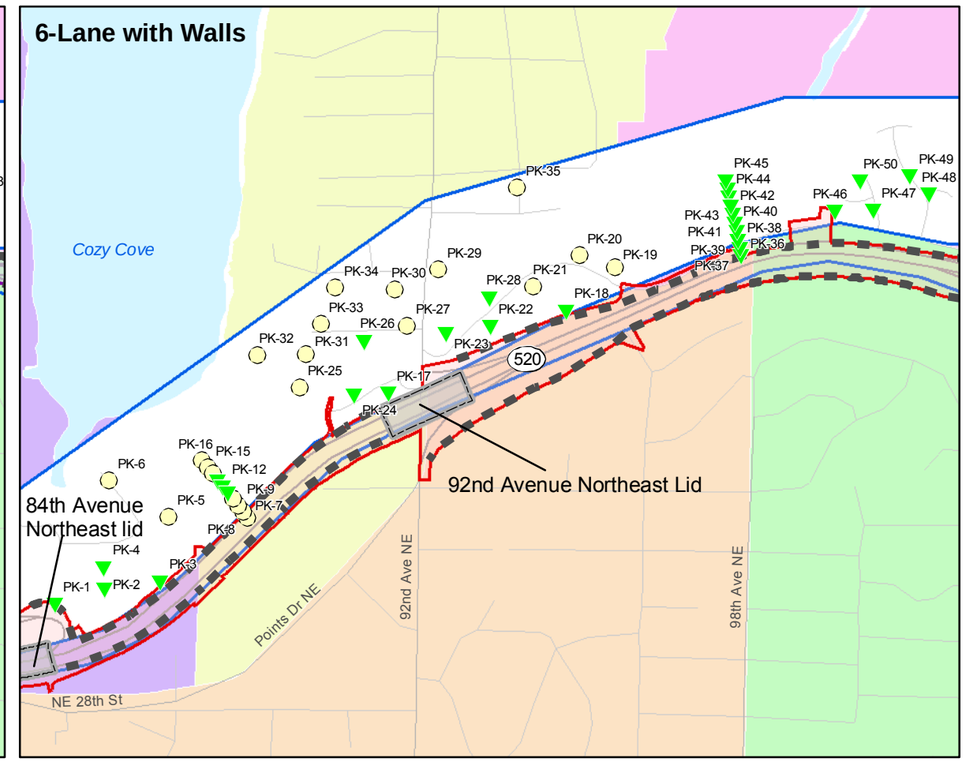
Exhibit 31. **Noise Level Changes in Medina and Hunts Point South of SR 520**

SR 520 Bridge Replacement and HOV Project









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 1,000 1,500 Feet

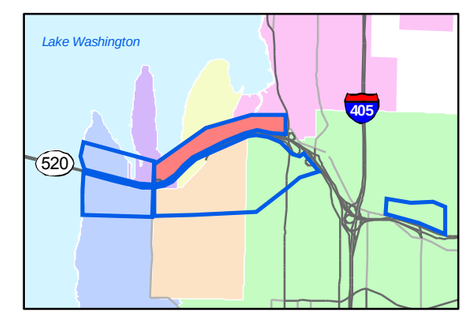
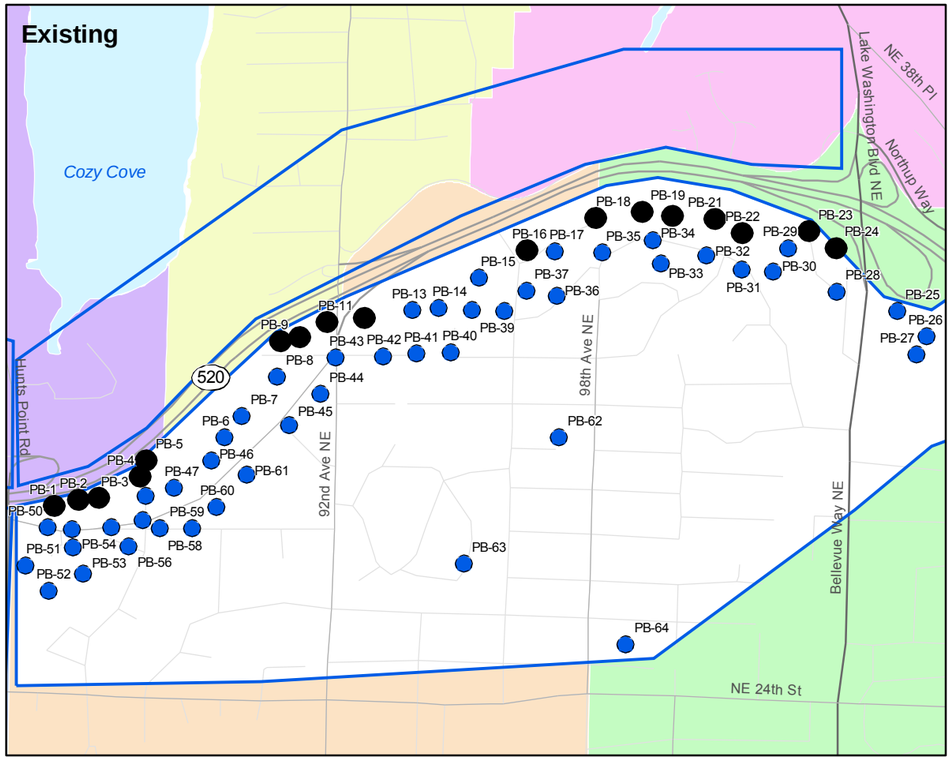
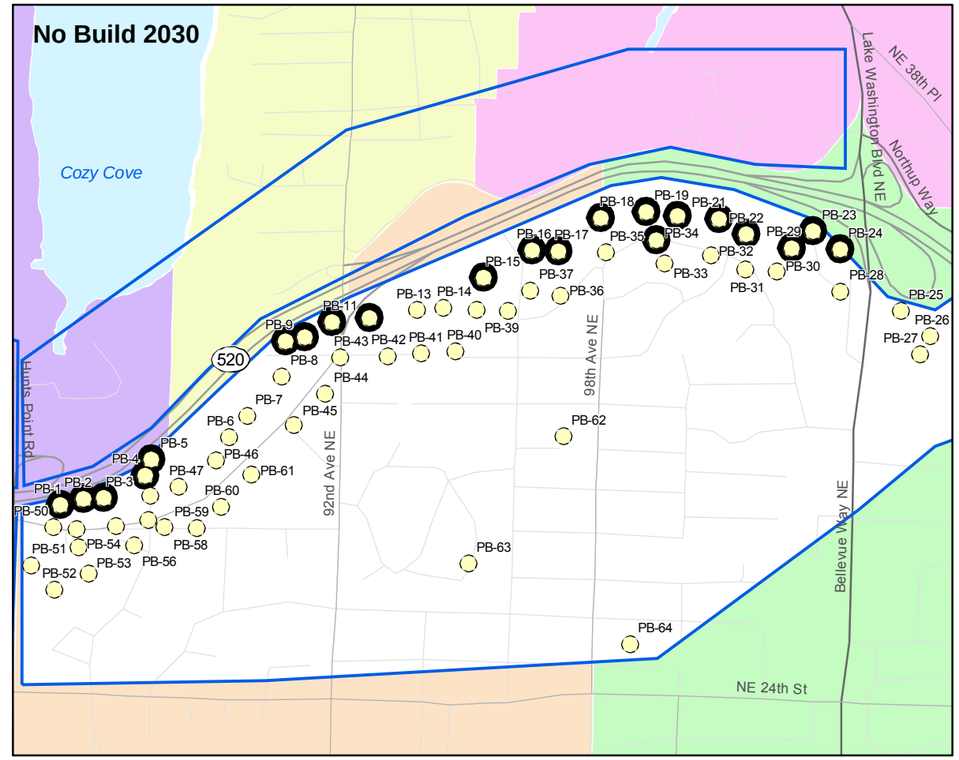
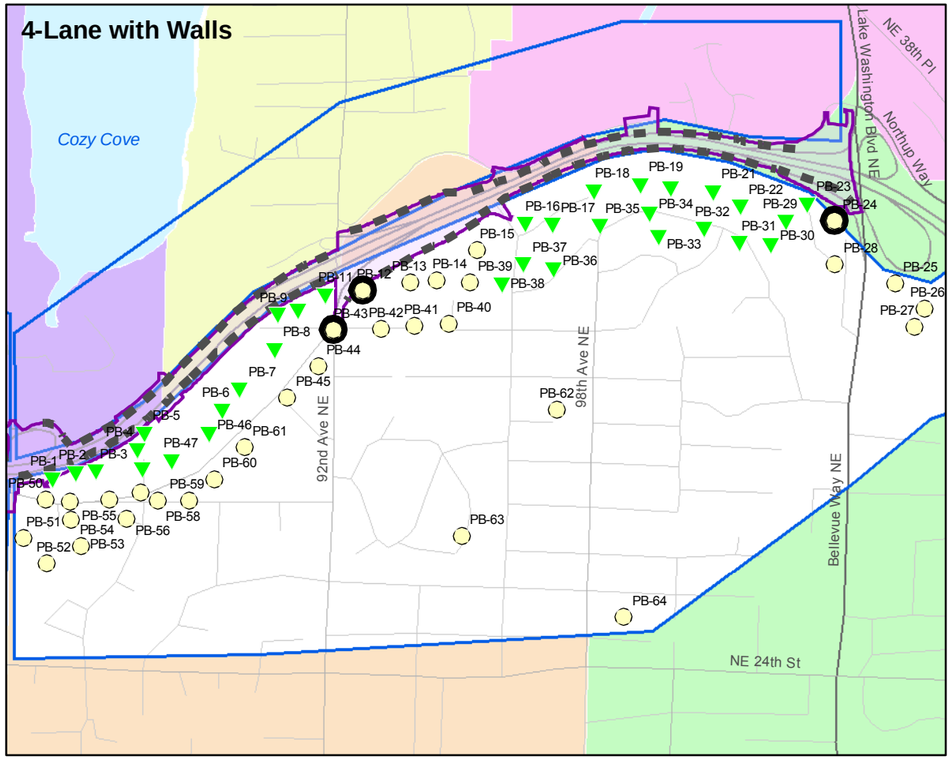


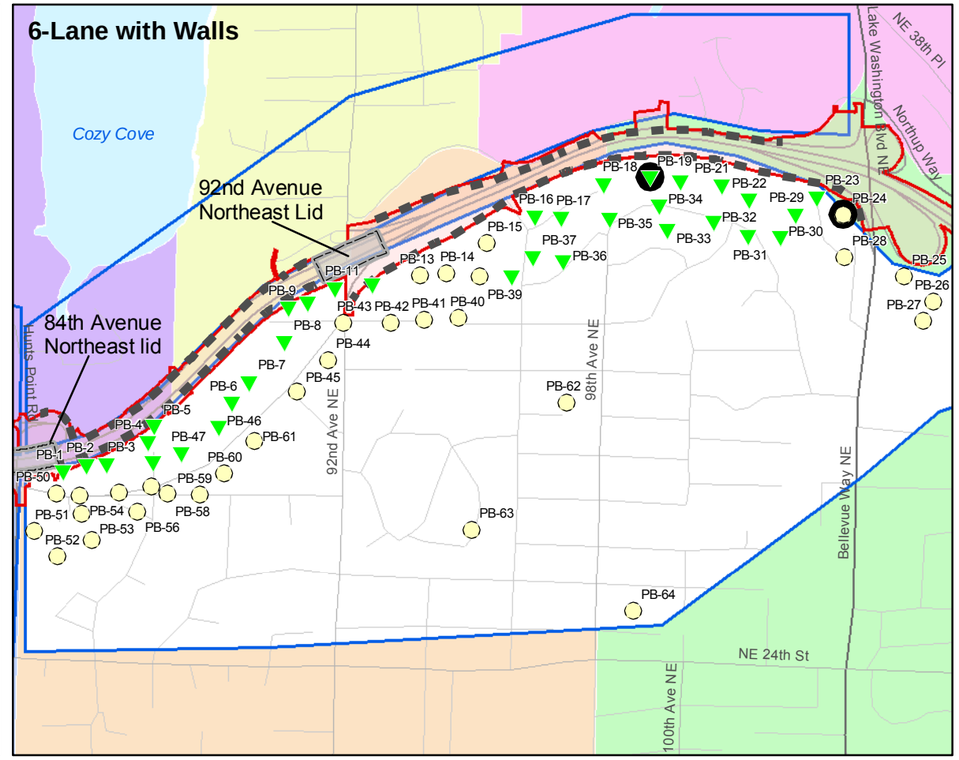
Exhibit 32. **Noise Level Changes in Hunts Point, Clyde Hill, Yarrow Point, and Kirkland North of SR 520**

SR 520 Bridge Replacement and HOV Project









Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 1,000 1,500 Feet

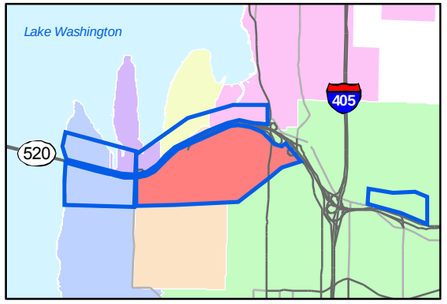
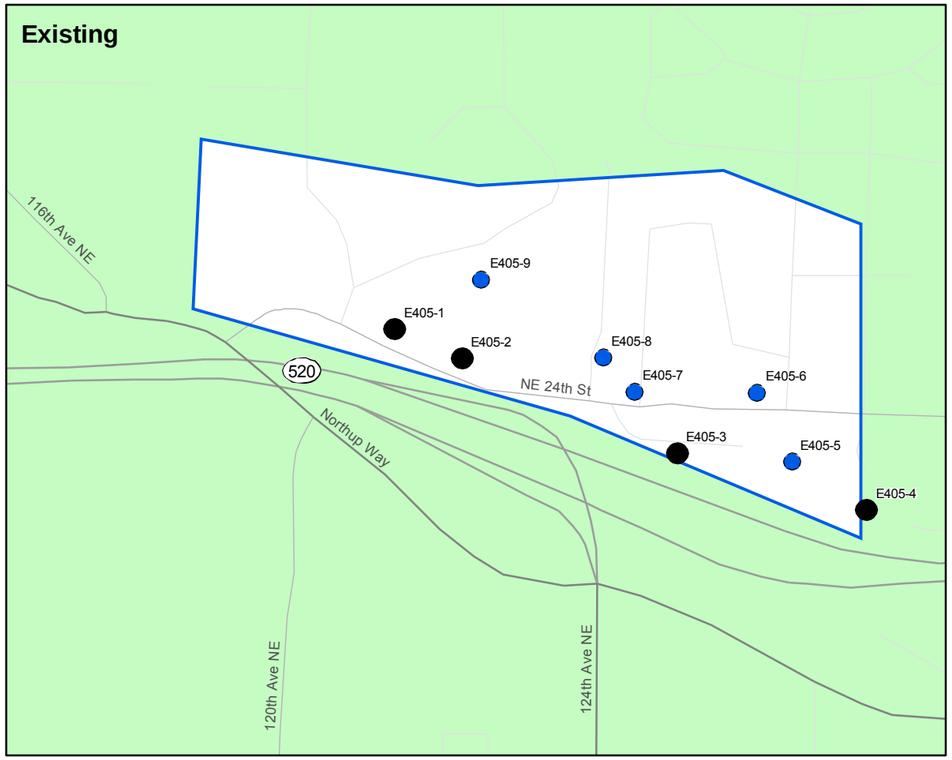
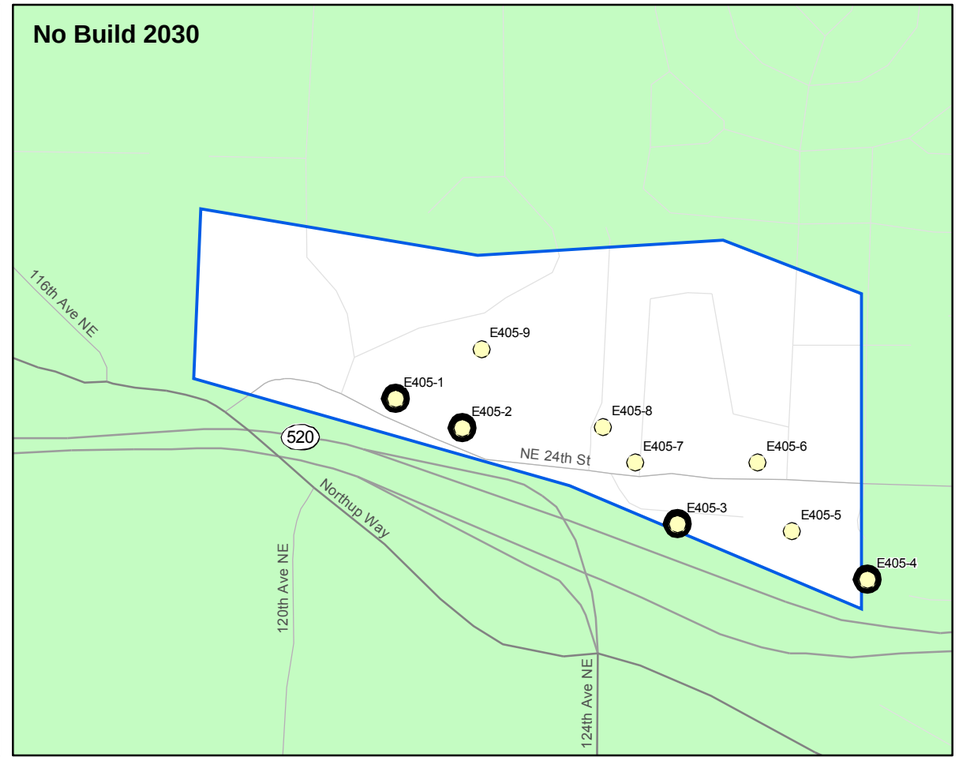
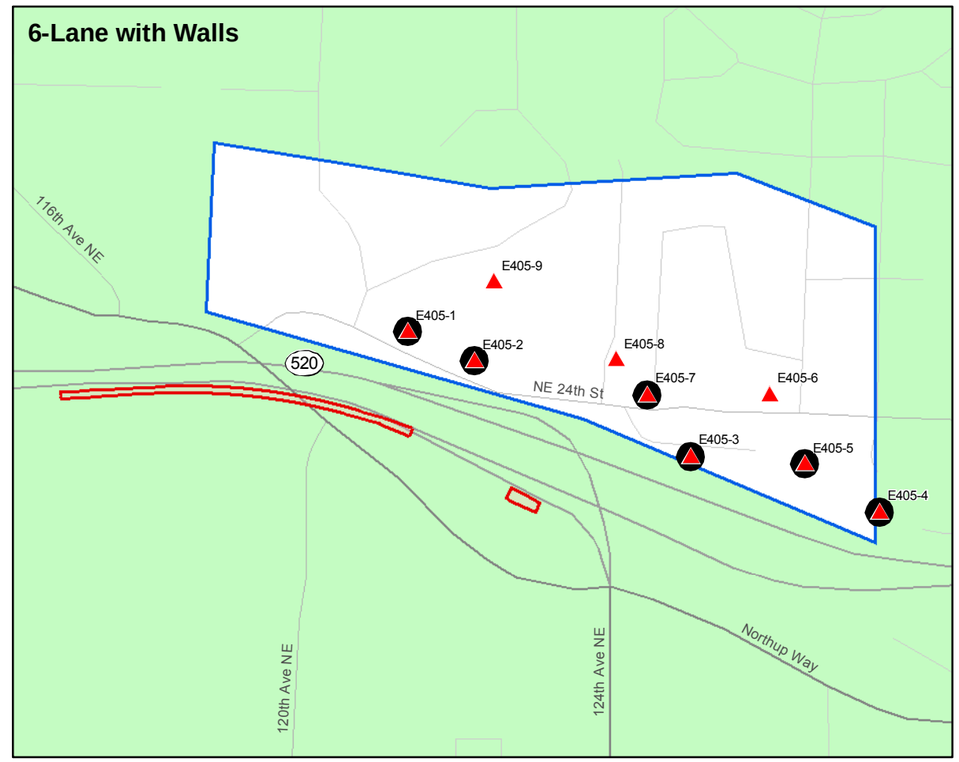


Exhibit 33. **Noise Level Changes in Hunts Point, Clyde Hill, Yarrow Point, and Bellevue South of SR 520**

SR 520 Bridge Replacement and HOV Project







Noise Modeling Location

Modeled Noise Level above NAC (> 66 dBA)

Change in Noise Level vs. Existing

Noticeable Decrease (≥ 3 dBA)

No Noticeable Change (± 2 dBA)

Noticeable Increase (≥ 3 dBA)

Sound Wall

Proposed Lid

Noise Analysis Area

4-Lane Footprint

6-Lane Footprint

Noticeable noise decrease and noise level above NAC

No noticeable change and noise level above NAC

Noticeable noise increase and noise level above NAC

N

0 250 500 Feet

No 4-Lane Alternative Improvements in this Area

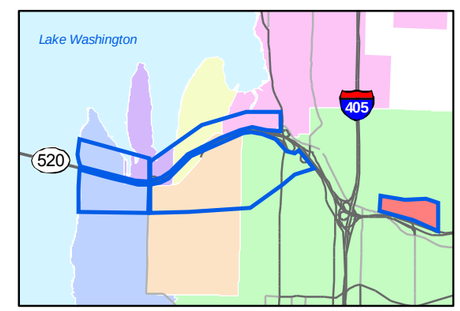


Exhibit 34. **Noise Level Changes in Bellevue East of I-405**

SR 520 Bridge Replacement and HOV Project

and south of SR 520. Currently, 47 residences exceed the NAC. Under the No Build Alternative, noise levels at an additional 4 receivers (13 residences) would exceed the NAC, bringing the total number of residences exceeding the NAC to 60.

Under the 4-Lane Alternative, residences where noise levels would exceed the NAC would decrease to 9 residences compared to 47 today. All of these receivers, which are located along 92nd Avenue Northeast or Bellevue Way Northeast, would exceed the NAC partly because of noise from these two roads. Under the 6-Lane Alternative, the number of residences where noise levels would exceed the NAC would decrease to six. Most of the residences are near Bellevue Way Northeast (PB-24 on Exhibit 33), with one located near 98th Avenue Northeast (PB-19 on Exhibit 33), where topographical conditions and the wider footprint of the 6-Lane Alternative alignment would make noise mitigation more difficult.

Overall, noise level reductions of up to 10 dBA L_{eq} are projected under the 4-Lane and 6-Lane Alternatives.

Exhibit 33 compares the existing and the future noise levels in these communities. Attachment 2E includes the results for receivers PB-1 through PB-64 and compares the project alternatives to existing peak-hour traffic noise levels.

Bellevue East of I-405

The noise discipline team modeled peak-hour traffic noise levels for 9 receiver locations (representing 17 residences) in the study area east of I-405. Under the No Build Alternative, no additional residences would experience noise levels exceeding the NAC east of I-405 in the study area.

Under the 4-Lane Alternative (with no project improvements in this area), peak-hour traffic noise levels would be approximately the same as with the No Build Alternative, with noise level increases of 1 dBA or less at area residences. Under the 6-Lane Alternative, noise levels would increase by 1 to 4 dBA over existing noise levels. The increase in noise levels under the 6-Lane Alternative would be due to increased traffic volumes from the additional lane exiting at 124th Avenue Northeast. Higher noise levels are projected to increase the number of residences exceeding the NAC from 6 to 12 under the 6-Lane Alternative. Because of the topography and traffic on Northeast 24th

Street, sound walls would not be effective at reducing noise levels in this area.

Exhibit 34 shows the receiver locations and changes in noise levels in this section of the project corridor on a separate map for each alternative. Attachment 2F includes the results for receivers E405-1 through E405-9 and compares the project alternatives to existing peak-hour traffic noise levels.

How do the Existing Conditions and No Build, 4-Lane, and 6-Lane Alternatives differ?

This section discusses the differences between the 4-Lane and 6-Lane Alternatives and compares the existing and No Build noise levels. In general, noise levels under the 4-Lane and 6-Lane Alternatives would be comparable throughout the project corridor, with some exceptions in areas where there are lids or where the alignments differ. Also, because the 4-Lane and 6-Lane Alternatives include the construction of sound walls in their analysis, the number of residences experiencing traffic noise effects under these alternatives would be reduced compared to existing conditions.

Number of Residences Where Noise Levels Exceed NAC			
Existing	**No Build**	**4-Lane**	**6-Lane**
406	442	151	127

The 6-Lane Alternative would result in the highest overall decrease in residences where noise levels exceed the NAC, reducing the number of NAC exceedances from the current 406 to 127. The 4-Lane Alternative would reduce the number of residences where noise levels exceed the NAC to 151. Both the 4-Lane and 6-Lane Alternatives meet noise abatement objectives of (1) reducing the overall noise levels in the community; (2) where possible, reducing the noise levels at all residences to below the NAC of 66 dBA L_{eq}; and (3) where possible, providing an average 7 to 10 dBA L_{eq} noise reduction for front-line receivers adjacent to SR 520.

Attachments 1 and 2 contain the complete tabulated results comparing noise levels for the project alternatives with existing conditions for Seattle and the Eastside, respectively. The attachments also show noise levels, number of residences exceeding the NAC, and details on the noise model validation.

How would project construction temporarily affect noise levels?

This section discusses the regulations and criteria governing construction noise, the methods of calculating construction noise levels,

and the estimated worst-case noise levels for project construction. We have also provided an introduction to construction-related vibration and information on how vibration from construction projects affects humans and structures.

Construction Noise Ordinance

Project construction will take place in seven communities, and several different noise ordinances may be applicable to project construction. Most cities in Washington rely on the Washington Administrative Code (WAC), Chapter 173-60, *Maximum Environmental Noise Levels*, for their noise ordinance. Communities in the project corridor that use or base their construction noise ordinance on the WAC include Seattle, Clyde Hill, Yarrow Point, Kirkland, and Bellevue. Medina and Hunts Point have adopted construction regulations specifically for residential and small developments, the type of construction that occurs in those communities.

Front End Loader

For the purpose of discussing construction noise and potential construction noise effects, this study used the WAC. The WAC construction noise ordinance is one of the most stringent noise ordinances in the region and is used by most communities in the project corridor. The construction contracts would contain sections specific to construction noise and address any site-specific requests for variances or other construction-related noise issues associated with the proposed project.

Washington State Construction Noise Regulation

Most project construction can be performed within the WAC noise ordinance if the work is performed during normal daytime hours. If construction were to be performed during nighttime hours, the contractor would have to meet the noise level requirements presented in Exhibit 35, or get a noise variance from the governing jurisdiction.

Besides the property-line noise standards in Exhibit 35, there are exemptions for short-term noise exceedances, including those outlined in Exhibit 36, that are based on the minutes per hour that the noise limit is exceeded.

Exhibit 35. Washington State Noise Control Regulation

Source of Noise	Receiver of Noise (Maximum Allowable Sound Level in dBA[a])		
	Residential	Commercial	Industrial
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

[a] Between the hours of 10:00 pm and 7:00 am, the levels given above are reduced by 10 dBA.

Exhibit 36. Exemptions for Short-Term Noise Exceedances

Minutes Per Hour	Adjustment to Maximum Sound Level
15	+5 dBA
5	+10 dBA
1.5	+15 dBA

The State of Washington has developed a set of construction-specific allowable noise level limits that would apply to the construction of the project. These construction noise regulations are divided by type of noise and include general construction equipment; impulse equipment, such as jack hammers and pile drivers; haul trucks; and safety alarms, such as back-up beepers.

General Construction Equipment Criteria

For construction activities, the limits in Exhibit 35 may be exceeded between 7:00 a.m. and 10:00 p.m. on weekdays, and between 9:00 a.m. and 10:00 p.m. on weekends and holidays according to limits outlined in Exhibit 37.

Exhibit 37. Washington State General Construction Allowable Exceedance

Allowable Exceedance	Equipment Covered
25 dBA	Equipment on construction sites, including but not limited to crawlers, tractors, dozers, rotary drill and augers, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic-powered equipment
20 dBA	Portable powered equipment used for temporary locations in support of construction activities, such as chainsaws, log chippers, lawn and garden equipment, and powered hand tools
15 dBA	Powered equipment used in temporary repair or periodic maintenance of the grounds such as lawn mowers and powered hand tools.

Impact Construction Equipment Criteria

Impact construction equipment may exceed the noise level limits given in Exhibit 37 in any one-hour period between 8 a.m. and 5 p.m. on weekdays and 9 a.m. and 5 p.m. on weekends and holidays. This equipment includes, but is not limited to, pavement breakers, pile-drivers, jackhammers, and sandblasting tools. The allowable noise limit exceedance also applies to other types of equipment or devices that create impulse or impact noise or that are used as impact equipment, as measured at a property line or at 50 feet from the equipment, whichever is greater. However, the noise limits listed in Exhibit 38 should never be exceeded.

Exhibit 38. Washington State General Construction Prohibited Noise Levels

Noise Level (in dBA L_{eq})	Time Duration Exceedance Prohibited
90	Continuously
93	30 minutes
96	15 minutes
99	7½ minutes, with noise variance for noise levels over 99 dBA

Haul Truck Criteria

Maximum permissible sound levels for haul trucks are limited to 86 dBA for speeds of 35 mph or less, and 90 dBA for speeds over 35 mph when measured at 50 feet.

Alarm Criteria

Sounds created by backup alarms are exempt if operated for less than 30 minutes per incident, except between 10:00 p.m. and 7:00 a.m., when backup alarms are prohibited and onsite spotters would be required by Occupation and Health and Safety Administration (OSHA) regulations.

Construction Vibration Prediction Methods and Impact Guidelines

There are no specific regulations or criteria that are applicable to vibration related to construction activities; however, SEPA and NEPA guidelines allow federal, state, and local agencies the authority to determine acceptable levels of construction vibration using guidelines, research, and professional standards. For this project, WSDOT will rely on the USDOT guidelines for acceptable vibration levels from construction activities. The guidelines, based on information given in

Exhibit 39, recommend that the maximum peak-particle velocity levels remain below 1.27 inches per second at structures nearest the construction site. Vibration levels above 1.27 inches per second have the potential to cause architectural damage to normal dwellings. The USDOT also states that vibration levels above 0.64 inch per second can be annoying to people and disrupt normal working or living environments (USDOT 1978).

Peak particle velocity is the maximum vibration velocity of an object during a specific period of measurement.

Exhibit 39. Peak Velocity Guidelines

Vibration Velocity (in/sec)	Effects on Humans	Effects on Buildings
0 to 0.001	Imperceptible to people – no intrusion	Vibrations unlikely to cause damage of any type
0.04 to 0.08	Threshold of perception--possibility of intrusion	Vibrations unlikely to cause damage of any type
0.15	Vibrations perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.64	Level at which continuous vibrations begin to annoy people	Virtually no risk of "architectural" damage to normal buildings
1.27	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relatively short periods of vibrations)	Threshold at which there is a risk of "architectural" damage to normal dwelling-houses with plastered ceilings and walls
2.54 to 3.81	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possible minor structural damage

in/sec = inches per second

Source: USDOT (1978).

Based on the information presented in Exhibit 39, the noise discipline team recommends that the contract specifications contain a section specific to vibration and include vibration monitoring of construction activities that may produce vibration levels near the USDOT maximum recommended vibration level of 1.27 inches per second. This would include pile-driving, vibratory sheet installation, soil compacting, and other construction activities that have the potential to cause high levels of vibration when the activity is within 50 to 75 feet of a vibration-sensitive property. In general, structures that have vibration levels of 0.50 inch per second (or higher) could potentially be affected by vibration.

How are construction noise levels predicted?

The noise discipline team predicted construction noise levels using the methods described in the FHWA *Construction Noise, Measurement, Prediction and Mitigation* (USDOT 1997). In addition to the methods given by the FHWA, we also relied on our personal experience and work on major construction projects to assist in providing the most accurate information available. Information we are providing includes descriptions of the types of construction activities required for this type of project, noise levels associated with specific construction equipment, and overall construction-related noise and vibration projections.

What noise levels can be expected during construction?

Our analysis considered temporary noise effects that construction would cause in the project area, effects that would end when project construction is completed, and traffic noise from the temporary bridges in Seattle.

Equipment required to complete the project includes normal construction equipment that is used for many roadway and structural activities. Exhibit 40 provides a list of the equipment typically used for this type of project, the activities they would be used for, and the corresponding maximum noise level as measured at 50 feet under normal use.

Project Construction Phases and Noise Levels

Several different construction phases would be required to complete the SR 520 Bridge Replacement and HOV Project. To provide the general public with a general understanding of how loud construction might be, we have performed an analysis that assumes worst-case noise levels based on five expected construction activities. The actual noise levels experienced during construction would generally be lower than those given in this report. The noise levels we have presented here are for periods of maximum construction activity.

Typical construction phases for the SR 520 project would include:

- Preparation for construction of new structures
- Construction of new structures and roadway paving
- Miscellaneous activities, including striping, lighting, and signs
- Demolition of existing structures

Exhibit 40. Construction Equipment List, Use, and Reference Maximum Noise Levels

Equipment	Typical Expected Project Use[a]	L_{max}[b] (dBA)	Source[c]
Air Compressors	Used for pneumatic tools and general maintenance - all phases	70 - 76	a, b, c
Backhoe	General construction and yard work	78 - 82	b, c
Concrete Pump	Pumping concrete	78 - 82	b, c
Concrete Saws	Concrete removal, utilities access	75 - 80	b, c
Crane	Materials handling, removal, and replacement	78 - 84	b, c
Excavator	General construction and materials handling	82 - 88	b, c
Forklifts	Staging area work and hauling materials	72	a, b, c
Haul Trucks	Materials handling, general hauling	86	b, c
Jackhammers	Pavement removal	74 - 82	b, c
Loader	General construction and materials handling	86	b, c
Pavers	Roadway paving	88	b
Pile Drivers	Support for structure and hillside	99 - 105	b, c
Power Plants	General construction use, nighttime work	72	b, c
Pumps	General construction use, water removal	62	b, c
Pneumatic Tools	Miscellaneous construction work	78 - 86	c
Service Trucks	Repair and maintenance of equipment	72	b, c
Tractor Trailers	Material removal and delivery	86	c
Utility Trucks	General project work	72	b
Vibratory equipment	Shore up hillside to prevent slides and soil compacting	82 - 88	b, c
Welders	General project work	76	b, c

[a] Typical maximum noise level under normal operation as measured at 50 feet from the noise source.
[b] Maximum noise level as measured at a distance of 50 feet under normal operation.
[c] Sources of noise levels presented:

- Portland, Oregon, light rail, I-5 preservation, and Hawthorne Bridge construction projects
- Measured data from other projects in the Portland, Oregon, area
- USDOT or other construction noise source

Preparation

Major noise-producing equipment used during the preparation stage could include concrete pumps, cranes, excavator, haul trucks, loader, tractor trailers, and vibratory equipment. Maximum noise levels could reach 82 to 86 dBA at the nearest residences (50 to 100 feet) for normal construction activities during this phase.

Other major noise sources that may be required during this phase would include the use of vibratory and impact equipment, such as pile

driving and vibratory sheet installations. The purpose of these activities would be to supply support for temporary bridges and the new structure and to shore up hillsides to stop slides before retaining walls are installed. Pile-driving noise levels are discussed in a separate section below.

Other less notable noise-producing equipment expected during this phase include backhoe, air compressors, forklifts, pumps, power plants, service trucks, and utility trucks.

Construction

The loudest noise sources in use during construction of the new bridges would include cement mixers, concrete pumps, pavers, haul trucks, and tractor trailers. The cement mixers and concrete pumps would be required for construction of the superstructure. The pavers and haul trucks would be used to provide the final surface on the roadway and to construct the transitions from the at-grade roadway to the new structures. Maximum noise levels would range from 82 to 94 dBA at the closest receiver locations.

Miscellaneous Activities

Following heavy construction, general construction such as installation of bridge railing, signage, roadway striping, and other general activities would still need to occur. These less intensive activities are not expected to produce noise levels above 80 dBA at 50 feet except during rare occasions, and even then only for short periods.

Demolition

Demolition of the existing structures would require heavy equipment such as concrete saws, cranes, excavators, hoe-rams, haul trucks, jackhammers, loaders, and tractor trailers. Maximum noise levels could reach 82 to 92 dBA at the nearest residences.

Exhibit 41 provides the noise levels for each of the four typical construction phases as measured at 50 feet from the construction activity. The construction noise analysis assumed that there would be construction staging areas along the proposed work bridges during demolition and construction. The noise levels in Exhibit 41 are the typical maximums and would only occur periodically during the heaviest periods of construction. Actual hourly noise levels could be substantially lower than those stated depending on the level of activity at that time.

Exhibit 41. Noise Levels for Typical Construction Phases

Scenario[a]	Equipment[b]	L_m[c] (dBA)	L_{eq}[d] (dBA)
Construction preparation	Air compressors, backhoe, concrete pumps, crane, excavator, forklifts, haul trucks, loader, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94	87
Construction of new structures and roadway paving	Air compressors, backhoe, cement mixers, concrete pumps, crane, forklifts, haul trucks, loader, pavers, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94	88
Miscellaneous activities, including striping, lighting and signs	Air compressors, backhoe, crane, forklifts, haul trucks, loader, pumps, service trucks, tractor trailers, utility trucks, welders	91	83
Demolition of existing structures	Air compressors, backhoe, concrete saws, crane, excavator, forklifts, haul trucks, jackhammers, loader, power plants, pneumatic tools, pumps, service trucks, utility trucks	93	88

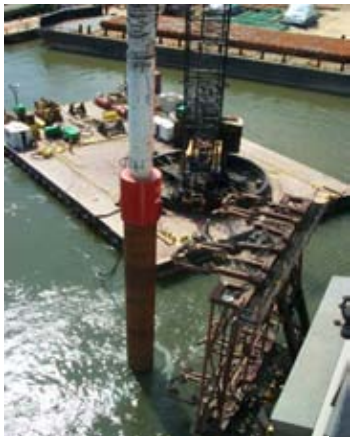
Note: Combined worst-case noise levels for all equipment at a distance of 50 feet from work site.

[a] Operational conditions under which the noise levels are projected.
[b] Normal equipment in operation under the given scenario.
[c] L_m (dBA) is an average maximum noise emission for the construction equipment under the given scenario. For this type of equipment and activities, the L_m is approximately equal to the L_{01}.
[d] L_{eq} (dBA) is an energy average noise emission for construction equipment operating under the given scenario. For this type of equipment, the L_{eq} is approximately equal to the L_{50}.

Using the information given in Exhibit 41, typical construction noise levels were projected for several distances from the project work area. Exhibit 42 graphs a general noise level versus distance for the SR 520 project phases of construction.

Pile Driving

Pile driving will be done in Union Bay and Portage Bay, both for the temporary construction bridges and for the permanent structures. Pile driving can produce maximum short-term noise levels of 99 to 105 dBA at 50 feet. Actual levels can vary, depending on the distance and topographical conditions between the pile-driving location and the receiver location. Furthermore, the noise level limits for pile driving (see Exhibit 38) depend on the frequency of pile driving and the number of pile drivers operating at one time in any one area. Exhibit 43 is a graph of maximum pile-driving noise levels versus distance from 50 to 1,000 feet.



Marine pile driver

Noise from pile driving also has the potential to affect fish and wildlife. Pile driving has the potential to produce noise levels of 190 dB at 150 feet from the source in deep water. However, noise attenuates more quickly in shallow water where most piles would be driven.

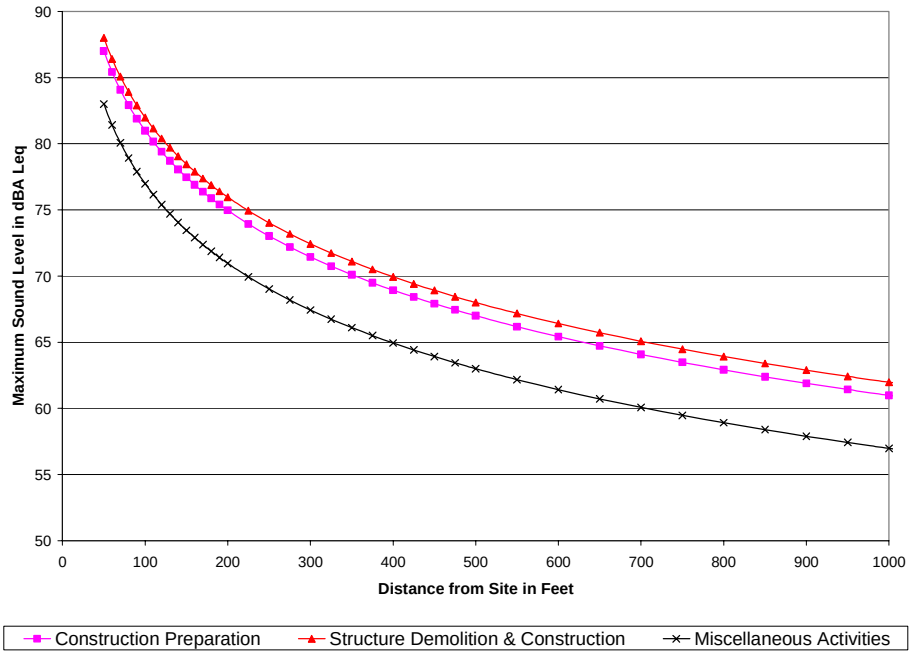


Exhibit 42. Hourly Maximum Construction Noise for Different Distances from Construction Site

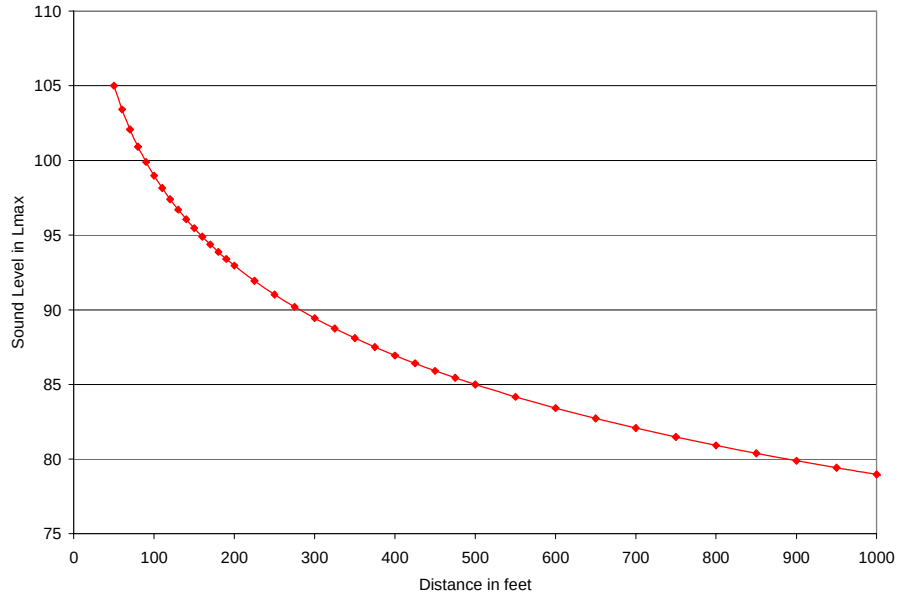


Exhibit 43. Typical Maximum Pile-Driving Noise Levels Assuming 105 dBA at 50 Feet

Studies have shown that waterborne noise levels of 180 dB or more can damage fish and potentially cause mortality.

Several noise-sensitive bird nesting sites were identified near the Arboretum and Broadmoor at distances of approximately 900 to 1,500 feet from the nearest expected pile-driving location. Noise from pile driving is not expected to have a lasting effect on the birds. More detailed information on construction noise and its effects on local wildlife and fish can be found in the Appendix E, *Ecosystems Discipline Report*.

Traffic Noise

To construct the new Portage Bay Bridge and west approach and high-rise of the Evergreen Point Bridge through Seattle, temporary work and traffic bridges would be built to keep the SR 520 corridor open and provide construction work platforms over Portage Bay, the Arboretum, and along Madison Park. A temporary four-lane highway would place traffic closer to several residential areas in Seattle. As a result of the temporary bridges, short-term traffic-related noise level increases would occur in portions of the Arboretum and Madison Park. The traffic noise level increase for residential properties is projected at 3 to 7 dBA over current noise levels, depending on the proximity to the temporary bridge.

Construction Vibration Effects

Vibration associated with general construction can result in vibration effects on surrounding receivers. Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. Activities that have the potential to produce a high level of vibration include pile driving, vibratory shoring, soil compacting, and some hauling and demolition activities. Vibration effects from pile driving or vibratory sheet installations could occur within 50 to 100 feet of sensitive receivers. It is unlikely that vibration levels would exceed 0.5 inch per second at distances greater than 100 feet from the construction sites.

Mitigation

What has been done to avoid or minimize negative effects from noise?

Early in project development, WSDOT agreed that mitigation would be integral to and inseparable from the project design. Using this philosophy, the project design and noise teams worked closely in the early stages of development to include sound walls along most of the project corridor. The sound walls are included in both the 4-Lane and 6-lane Alternatives, as discussed in *Reducing Project Noise Levels*.

The 6-Lane Alternative also includes lidded highway sections that are very effective at reducing noise levels. This is evident in the lower overall number of residences that would exceed the NAC under the 6-Lane Alternative when compared to the 4-Lane Alternative. The lids are integrated with the sound walls and retaining walls. More information on the lids is provided below.

Other Noise-Reducing Design Elements

The project includes a number of design elements that reduce noise levels. These include shifting the roadway alignment away from residences, depressing (lowering) sections of the roadway, and/or placing a lid over portions of the highway.

The 4-Lane and 6-Lane Alternative designs remove the curve in the west approach to the Evergreen Point Bridge and shift the highway away from Madison Park residences. As the highway touches down on the Eastside, the roadway is to the north of the current roadway, which would shift the traffic noise away from the residences to the south but move it closer to the residences to the north.

A depressed roadway can provide substantial noise reduction, depending on the amount of depression. The new roadway would be depressed at several locations, including the approach to the I-5 interchange, the Montlake interchange, and to a lesser extent, at Evergreen Point Road, 84th Avenue Northeast, and 92nd Avenue Northeast. Exhibit 44 illustrates how a depressed roadway reduces noise.

Another design element of the 6-Lane Alternative is five landscaped lids over depressed sections of the roadway. Each lid would be approximately 500 feet in length over the highway, which is short

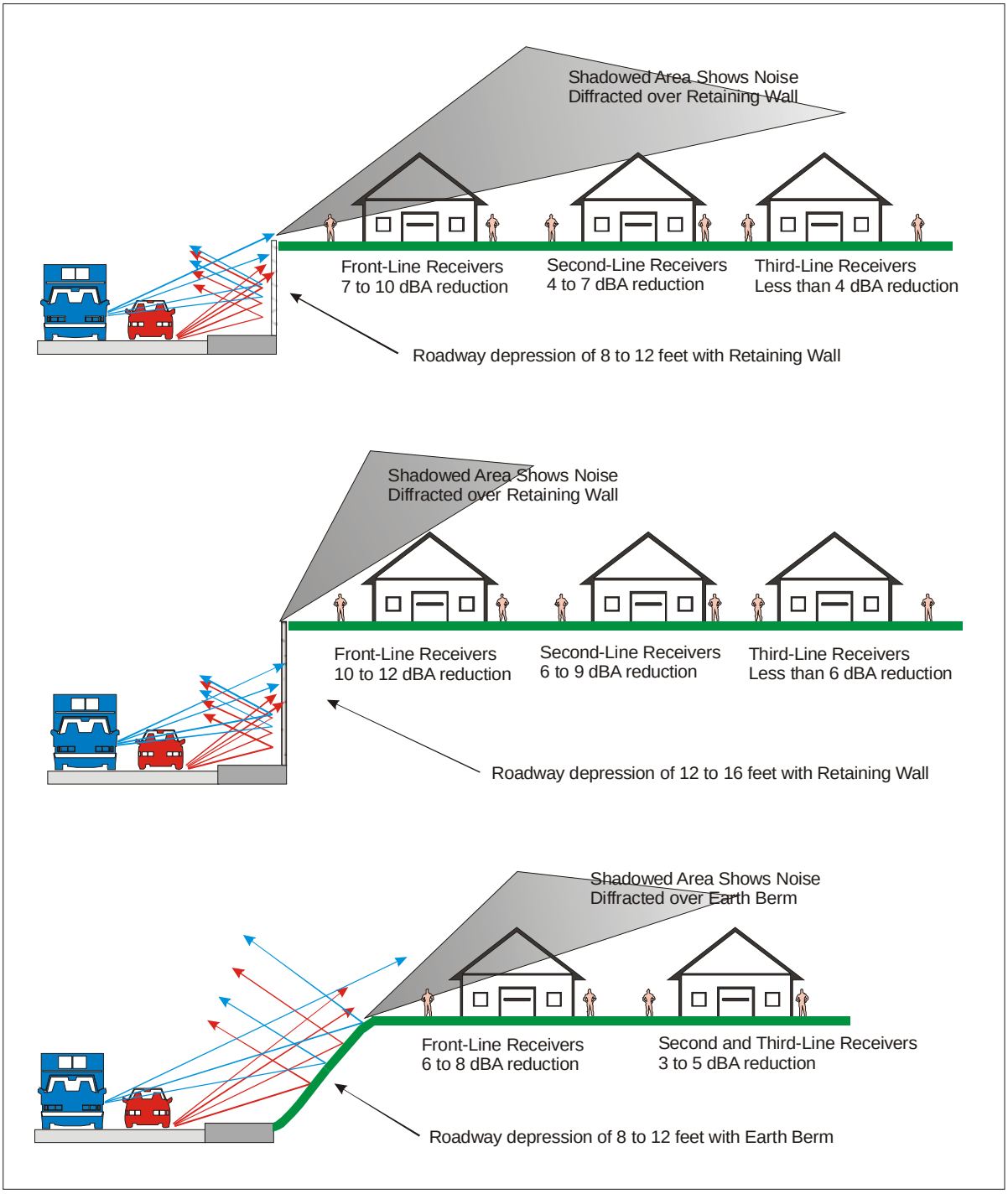


Exhibit 44. Examples of Depressed Roadways and Typical Noise Reduction Characteristics

enough to not require ventilation but long enough to help reconnect the communities along SR 520. The locations of the five lids are:

- 10th Avenue East and East Delmar Drive
- Montlake Boulevard
- Evergreen Point Drive
- 84th Avenue Northeast
- 92nd Avenue Northeast

Although these lids were included in the 6-Lane Alternative as community enhancements, they are also very effective at preventing sound from reaching noise-sensitive receiver locations near the lidded area. It is because of the lids that the 6-Lane Alternative would affect fewer residences than the 4-Lane Alternative. See *How do the 4-Lane and 6-Lane Alternatives Compare?* for the comparison. Exhibit 45 shows an example of a depressed roadway with a lid and how the vehicle noise is contained.

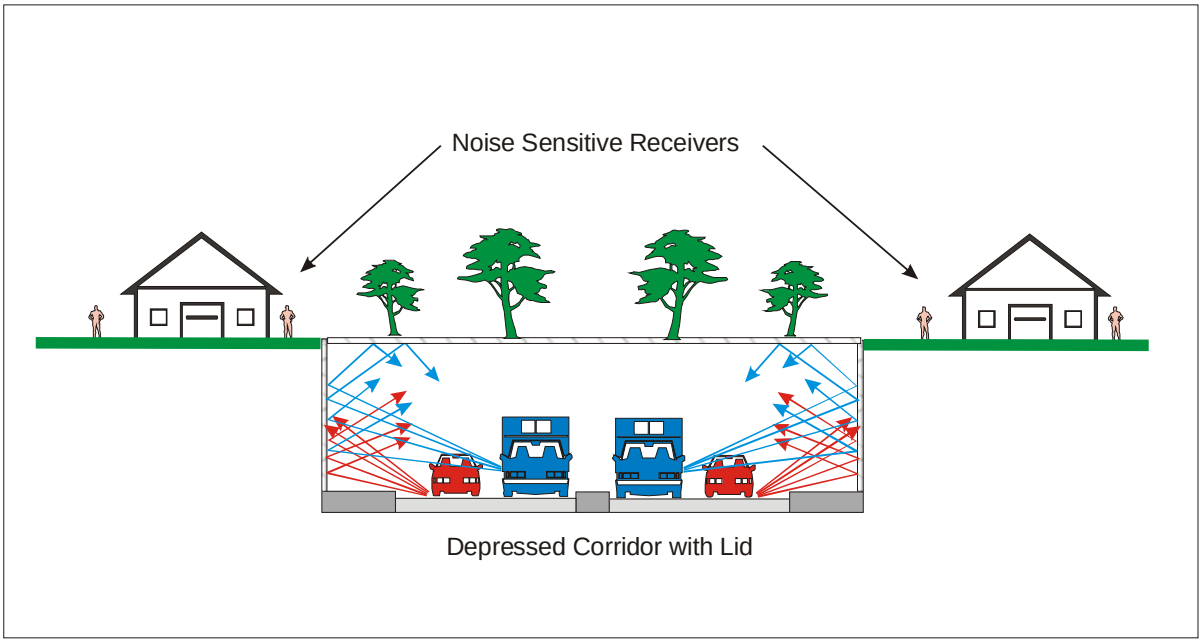


Exhibit 45. Example of a Depressed Roadway with a Lid

How could the project compensate for noise levels above the noise abatement criteria?

Although the 4-Lane and 6-Lane Alternatives would include sound walls, noise levels at some residences would continue to exceed the NAC. In accordance with FHWA and WSDOT requirements, noise mitigation measures are considered at locations along the alignments

where traffic noise levels are predicted to exceed the NAC as a result of the project. There are several locations where the NAC exceedances would not be due entirely to the project, and there are no reasonable or feasible methods of reducing noise. The following sections summarize the locations expected to exceed the NAC even with the proposed noise abatement measures, and why no additional noise abatement measures are recommended.

Seattle

In Seattle, noise levels at several residential locations would continue to exceed the NAC even with the proposed noise reducing design options and noise abatement measures. Receivers HR-1 through HR-3 and HR-14 and HR-15 in the Portage Bay/Roanoke neighborhood would exceed the NAC under both the 4-Lane and 6-Lane Alternatives. One additional receiver (HR-4) would exceed the NAC under the 4-Lane Alternative, but not under the 6-Lane Alternative because of the noise-reducing benefits of the 10th and Delmar lid. All of these receiver locations are close to I-5 and adjacent to Harvard Avenue East or East Roanoke Street, or both. The combined noise from I-5 and these local major arterials are the main reason for noise levels above the NAC. No additional noise abatement is being recommended because the proposed project is not modifying any of these roadways. Furthermore, there is no reasonable or feasible method of providing additional noise abatement in the area that would be within the scope of this project.

Several receiver locations in the North Capitol Hill neighborhood are also projected to exceed the NAC under the build alternatives (CH-1 through CH4, CH-11 through CH-16 and CH-28 under the 4-Lane Alternative, and CH-1, CH-2, and CH-13 through CH-16 and CH-28 under the 6-Lane Alternative). Fewer receivers would exceed the NAC under the 6-Lane Alternative because of the 10th and Delmar lid. Major noise sources for all receivers in this area include I-5 and 10th Avenue East. As with Portage Bay/Roanoke, no additional noise abatement is being recommended on North Capitol Hill because the proposed project is not modifying any of these roadways.

In the Montlake neighborhood, several receiver locations would continue to exceed the NAC because of traffic on Montlake Boulevard and Lake Washington Boulevard (MN-7, MN-8, MN-17, MN-18 and MN-23 on the north side of SR 520, and MS-1 through MS-5, MS-10 and MS-17 on the south side of SR 520). One additional receiver location (MS-30) would also exceed the NAC under the 4-Lane Alternative, but

not under the 6-Lane Alternative because of the noise-reducing benefits of the Montlake lid. No additional noise abatement is recommended because the project is not modifying any of these roadways.

Eastside

Because of the topographical features on the Eastside, there are fewer residential locations where the project could not provide effective noise abatement. Under the 4-Lane Alternative, six receiver locations would exceed the NAC. Under the 6-Lane Alternative, only two receiver locations would exceed the NAC.

Receivers where noise levels would exceed the NAC under the 4-Lane Alternative include PS-5 on Evergreen Point Road, PN-29 and PS-13 on 84th Avenue Northeast, PB-43 and PB-44 on 92nd Avenue Northeast and PB-24 near Bellevue Way. All of these receivers would exceed the criteria because they are located on main arterial roads near the openings in the walls for the bridges over SR 520. The project would, however, prevent any noticeable increases in noise at these same locations by reducing noise from the highway to within +/- 2dBA of the current levels.

Under the 6-Lane Alternative, noise levels at only two receiver locations (PB-19 and PB-24) would exceed the criteria. Receiver PB-24 is on Bellevue Way and therefore receives noise from Bellevue Way. Receiver PB-19 is located uphill from the SR 520 corridor; this receiver would have a 7 dBA noise level reduction because of the sound wall, with resulting noise levels of 66.5 dBA (rounded to 66 dBA for the analysis). Receivers that would exceed the NAC under the 4-Lane Alternative, but not under the 6-Lane Alternative, would receive noise-reducing benefits of the Evergreen Point, 84th Avenue Northeast, and 92nd Avenue Northeast lids.

What construction noise and vibration mitigation measures could be used on this project?

Construction Noise Mitigation

Several construction noise abatement methods, including operational methods, equipment choice, or acoustical treatments, could be implemented to limit the effects of construction noise. The methods used may vary in the project corridor depending on the project's construction criteria. Operation of construction equipment could be prohibited within 500 feet of any occupied dwelling unit in evening or

nighttime hours (7 p.m. to 7 a.m.) or on Sundays or legal holidays, when noise and vibration would have the most severe effect. All engine-powered equipment would be required to have mufflers installed according to the manufacturer's specifications, and all equipment would be required to comply with U.S. Environmental Protection Agency equipment noise standards.

WSDOT could limit activities that produce the highest noise levels (such as hauling, loading spoils, jackhammering, and using other demolition equipment) to 7:00 a.m. to 7:00 p.m. As stated previously in *What can be expected from pile driving?*, maximum noise levels associated with pile driving could reach 105 dBA at distances of 50 feet. Mitigation of the noise associated with pile driving could include auguring rather than driving piles (however, using an augur is not likely to be feasible for this project), or limiting the time the activity can take place. Other less effective methods of reducing noise from pile driving could include coating the piles, using pile pads, or using piston mufflers.

The pile-driving effects on fish could be mitigated using wood piles instead of metal whenever possible and, if required, bubble curtains. A bubble curtain is a method used to reduce the level of waterborne noise from pile driving by placing a wall of bubbles between the pile and fish. More information on pile driving and bubble curtains can be found in Appendix H, *Geology and Soils Discipline Report*.

A construction log should be kept for each of the construction staging areas. The log would contain general construction information such as the time an activity took place, type of equipment used, and any other information that may help with potential noise effects.

A complaint hot-line could also be established to investigate noise complaints and compare them to the construction logs. A construction monitoring and complaint program could help to ensure that all equipment meets state, local, and any manufacturer’s specifications for noise emissions. Equipment not meeting the standards could be removed from service until proper repairs can be made, and the equipment re-tested for compliance. This procedure is recommended for all haul trucks, loaders, excavators, and other equipment that would have extensive use at the construction sites and are major contributors to potential noise effects.

The following is a list of recommended noise mitigation measures that should be contained in the contract specifications:

- Require all engine-powered equipment to have mufflers installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Limit jackhammers, concrete breakers, saws, and other forms of demolition to daytime hours of 8:00 a.m. to 5:00 p.m. on weekdays with more stringent restrictions on weekends.
- Minimize noise by regular inspection and replacement of defective mufflers and parts that do not meet the manufacturer's specifications.
- Install temporary or portable acoustic barriers around stationary construction noise sources and along the sides of the temporary bridge structures where feasible.
- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in complaints.
- Notify nearby residents whenever extremely noisy work would be occurring.
- Restrict the use of back-up beepers during evening and nighttime hours.

Additional noise mitigation measures may be implemented as more detail on the actual construction processes are identified.

Construction Vibration Mitigation

The construction contract specifications could contain a section specific to vibration that could require vibration monitoring of all activities that may produce vibration levels at or above 0.5 inch per second whenever there are structures located near the construction activity. This would include pile driving, vibratory sheet installation, soil compacting, and other construction activities that have the potential to cause high levels of vibration. There is virtually no effective method to reduce vibration effects from construction; however, by restricting and monitoring vibration-producing activities, vibration effects from construction could be kept to a minimum.

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Attachment 1

Noise Levels in the Seattle Project Area

1A: Portage Bay/Roanoke Neighborhoods

Exhibit 1A-1. Noise Model Validation Summary for the Portage Bay/Roanoke Neighborhoods

TNM Modeling #	Monitoring #	Measured[a]	Modeled[a]	Difference (modeled - measured)
HR-1	M3	76	75	-1
HR-4	M6	63	63	0
HR-7	M7	61	63	2
HR-17	M1	59	61	2
HR-18	M2	59	59	0
HR-20	M4	57	59	2
HR-23	M5	59	59	0

[a] Measured and modeled L_{eq} noise level in decibels with A-weighting (dBA).

Exhibit 1A-2. Existing Peak-Hour Traffic Noise Levels for Portage Bay/Roanoke Neighborhoods

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
HR-1	66	**77**	4
HR-2	66	**75**	4
HR-3	66	**72**	2
HR-4	66	**66**	3
HR-5	66	**67**	3
HR-6	66	**75**	1
HR-7	66	64	--
HR-8	66	62	--
HR-9	66	**68**	1
HR-10	66	63	--
HR-11	66	56	--
HR-12	66	63	--
HR-13	66	64	--
HR-14	66	**67**	3
HR-15	66	**74**	3
HR-16	66	64	--
HR-17	66	63	--
HR-18	66	61	--
HR-19	66	61	--
HR-20	66	60	--
HR-21	66	58	--
HR-22	66	63	--
HR-23	66	61	--

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1A-3. No Build Alternative Peak-Hour Traffic Noise Levels for Portage Bay/Roanoke Neighborhoods

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
HR-1	66	**77**	**78**	1	4
HR-2	66	**75**	**76**	1	4
HR-3	66	**72**	**73**	1	2
HR-4	66	**66**	**67**	1	3
HR-5	66	**67**	**68**	1	3
HR-6	66	**75**	**76**	1	1
HR-7	66	64	65	1	0
HR-8	66	62	63	1	0
HR-9	66	**68**	**68**	0	1
HR-10	66	63	64	1	0
HR-11	66	56	57	1	0
HR-12	66	63	64	1	0
HR-13	66	64	65	1	0
HR-14	66	**67**	**68**	1	3
HR-15	66	**74**	**75**	1	3
HR-16	66	64	65	1	0
HR-17	66	63	64	1	0
HR-18	66	61	62	1	0
HR-19	66	61	62	1	0
HR-20	66	60	61	1	0
HR-21	66	58	58	0	0
HR-22	66	63	64	1	0
HR-23	66	61	62	1	0

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1A-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for Portage Bay/Roanoke Neighborhoods

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
HR-1	4	66	**77**	**78**	**78**	0
HR-2	4	66	**75**	**76**	**76**	0
HR-3	2	66	**72**	**74**	**74**	0
HR-4	3	66	**66**	**71**	**66**	-5
HR-5	3	66	**67**	**72**	65	-7
HR-6	1	66	**75**	**--**	**--**	**--**
HR-7	2	66	64	**67**	58	-9
HR-8	1	66	62	**67**	56	-11
HR-9	1	66	**68**	**67**	55	-12
HR-10	4	66	63	**66**	56	-10
HR-11	4	66	56	59	56	-3
HR-12	4	66	63	**67**	62	-5
HR-13	0	66	64	**66**	64	-2
HR-14	3	66	**67**	**67**	**67**	0
HR-15	3	66	**74**	**72**	**72**	0
HR-16	1	66	64	65	64	-1
HR-17	3	66	63	64	63	-1
HR-18	4	66	61	63	60	-3
HR-19	4	66	61	63	53	-10
HR-20	4	66	60	61	53	-8
HR-21	3	66	58	61	54	-7
HR-22	5	66	63	62	53	-9
HR-23	6	66	61	60	54	-6

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1A-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for Portage Bay/Roanoke Neighborhoods

Receiver Number	Residential Structures	NAC		6-Lane Alternative		Sound Wall Reduction[a]
			Existing[a,b]	No Wall[a]	w/ Wall[a]	
HR-1	4	66	**77**	**78**	**78**	0
HR-2	4	66	**75**	**76**	**75**	-1
HR-3	2	66	**72**	**73**	**72**	-1
HR-4	3	66	**66**	**67**	65	-2
HR-5	3	66	**67**	**68**	63	-5
HR-6	1	66	**75**	**--**	**--**	**--**
HR-7	2	66	64	**67**	57	-10
HR-8	1	66	62	**68**	56	-12
HR-9	1	66	**68**	**68**	55	-13
HR-10	4	66	63	**66**	55	-11
HR-11	4	66	56	57	55	-2
HR-12	4	66	63	65	61	-4
HR-13	0	66	64	65	63	-2
HR-14	3	66	**67**	**67**	**66**	-1
HR-15	3	66	**74**	**72**	**72**	0
HR-16	1	66	64	65	64	-1
HR-17	3	66	63	64	63	-1
HR-18	4	66	61	62	59	-3
HR-19	4	66	61	62	53	-9
HR-20	4	66	60	61	53	-8
HR-21	3	66	58	61	54	-7
HR-22	5	66	63	63	53	-10
HR-23	6	66	61	60	54	-6

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

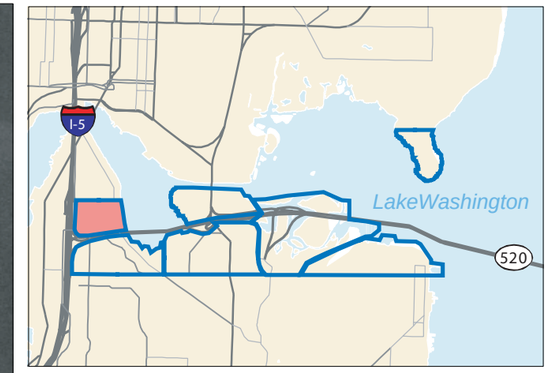
Exhibit 1A-6. Comparison of Future Peak-Hour Traffic Noise Levels for Portage Bay/Roanoke Neighborhoods

Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane w/ walls	6-Lane w/ walls
HR-1	**77**	**78**	**78**	**78**	1	1	1
HR-2	**75**	**76**	**76**	**75**	1	1	0
HR-3	**72**	**73**	**74**	**72**	1	2	0
HR-4	**66**	**67**	**66**	65	1	0	-1
HR-5	**67**	**68**	65	63	1	-2	-4
HR-6	**75**	**76**	**--**	**--**	1	**--**	**--**
HR-7	64	65	58	57	1	-6	-7
HR-8	62	63	56	56	1	-6	-6
HR-9	**68**	**68**	55	55	0	-13	-13
HR-10	63	64	56	55	1	-7	-8
HR-11	56	57	56	55	1	0	-1
HR-12	63	64	62	61	1	-1	-2
HR-13	64	65	64	63	1	0	-1
HR-14	**67**	**68**	**67**	**66**	1	0	-1
HR-15	**74**	**75**	**72**	**72**	1	-2	-2
HR-16	64	65	64	64	1	0	0
HR-17	63	64	63	63	1	0	0
HR-18	61	62	60	59	1	-1	-2
HR-19	61	62	53	53	1	-8	-8
HR-20	60	61	53	53	1	-7	-7
HR-21	58	58	54	54	0	-4	-4
HR-22	63	64	53	53	1	-10	-10
HR-23	61	62	54	54	1	-7	-7

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.



Location map showing noise analysis area

Modeling location

Monitoring and modeling location

Noise analysis area

HR-19 Ex NB 4 6 64 65 63 63 - - 61 62

Modeling number

Alternatives (Existing, No Build, 4-Lane, 6-Lane)

Noise level in decibels without wall

Noise level in decibels with wall

N

0 200 400 Feet

Exhibit 1A-7. **Noise Modeling Locations, Portage Bay/Roanoke**

SR 520 Bridge Replacement and HOV Project

1B: North Capitol Hill Neighborhood

Exhibit 1B-1. Noise Model Validation Summary for North Capitol Hill Neighborhood

TNM Modeling #	Monitoring #	Measured[a]	Modeled[a]	Difference (modeled - measured)
CH-1	M10	72	71	-1
CH-3	M11	63	64	1
CH-9	M15	66	65	-1
CH-17	M12	60	61	1
CH-19	M13	60	61	1
CH-28	M8	67	67	0
CH-29	M9	57	59	2
CH-31	M14	56	58	2

[a] Measured and modeled L_{eq} noise level in decibels with A-weighting (dBA).

Exhibit 1B-2. Existing Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
CH-1	66	**73**	3
CH-2	66	**71**	2
CH-3	66	**66**	4
CH-4	66	64	--
CH-5	66	65	--
CH-6	66	**70**	18
CH-7	66	**68**	4
CH-8	66	**67**	24
CH-9	66	**67**	8
CH-10	66	64	--
CH-11	66	63	--
CH-12	66	65	--
CH-13	66	**69**	6
CH-14	66	65	--
CH-15	66	**66**	6
CH-16	66	**66**	20
CH-17	66	63	--
CH-18	66	62	--
CH-19	66	63	--
CH-20	66	63	--
CH-21	66	64	--
CH-22	66	64	--
CH-23	66	64	--
CH-24	66	62	--
CH-25	66	63	--
CH-26	66	62	--
CH-27	66	62	--
CH-28	66	**69**	4
CH-29	66	61	--
CH-30	66	61	--

Exhibit 1B-2. Existing Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
CH-31	66	60	--
CH-32	66	61	--

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1B-3. No Build Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
CH-1	66	**73**	**73**	0	3
CH-2	66	**71**	**72**	1	2
CH-3	66	**66**	**67**	1	4
CH-4	66	64	65	1	0
CH-5	66	65	**66**	1	2
CH-6	66	**70**	**71**	1	18
CH-7	66	**68**	**69**	1	4
CH-8	66	**67**	**67**	0	24
CH-9	66	**67**	**67**	0	8
CH-10	66	64	65	1	0
CH-11	66	63	64	1	0
CH-12	66	65	**66**	1	8
CH-13	66	**69**	**69**	0	6
CH-14	66	65	65	0	0
CH-15	66	**66**	**66**	0	6
CH-16	66	**66**	**67**	1	20
CH-17	66	63	64	1	0
CH-18	66	62	63	1	0
CH-19	66	63	64	1	0
CH-20	66	63	64	1	0
CH-21	66	64	65	1	0
CH-22	66	64	65	1	0
CH-23	66	64	65	1	0
CH-24	66	62	63	1	0
CH-25	66	63	63	0	0
CH-26	66	62	63	1	0
CH-27	66	62	62	0	0
CH-28	66	**69**	**69**	0	4
CH-29	66	61	62	1	0
CH-30	66	61	61	0	0

Exhibit 1B-3. No Build Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
CH-31	66	60	61	1	0
CH-32	66	61	62	1	0

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1B-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
CH-1	3	66	**73**	**72**	**72**	0
CH-2	2	66	**71**	**73**	**73**	0
CH-3	4	66	**66**	**71**	**69**	-2
CH-4	4	66	64	**69**	**67**	-2
CH-5	2	66	65	**67**	63	-4
CH-6	18	66	**70**	**69**	58	-11
CH-7	4	66	**68**	**67**	59	-8
CH-8	24	66	**67**	65	59	-6
CH-9	8	66	**67**	**66**	59	-7
CH-10	1	66	64	65	64	-1
CH-11	3	66	63	**67**	**66**	-1
CH-12	8	66	65	**69**	**68**	-1
CH-13	6	66	**69**	**71**	**70**	-1
CH-14	5	66	65	65	65	0
CH-15	6	66	**66**	**67**	**66**	-1
CH-16	20	66	**66**	**69**	**69**	0
CH-17	6	66	63	**66**	65	-1
CH-18	4	66	62	65	64	-1
CH-19	2	66	63	63	62	-1
CH-20	4	66	63	63	58	-5
CH-21	14	66	64	63	57	-6
CH-22	16	66	64	63	57	-6
CH-23	8	66	64	63	57	-6
CH-24	14	66	62	62	57	-5
CH-25	6	66	63	63	59	-4
CH-26	7	66	62	63	61	-2
CH-27	6	66	62	63	62	-1
CH-28	4	66	**69**	**71**	**71**	0
CH-29	3	66	61	62	62	0
CH-30	5	66	61	61	60	-1

Exhibit 1B-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
CH-31	1	66	60	60	59	-1
CH-32	1	66	61	62	60	-2

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1B-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	Residential Structures	NAC	Existing[a,b]	6-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
CH-1	3	66	73	**72**	**72**	0
CH-2	2	66	71	**71**	**71**	0
CH-3	4	66	66	64	64	0
CH-4	4	66	64	65	64	-1
CH-5	2	66	65	**67**	65	-2
CH-6	18	66	70	**70**	58	-12
CH-7	4	66	68	**68**	59	-9
CH-8	24	66	67	**66**	59	-7
CH-9	8	66	67	**66**	59	-7
CH-10	1	66	64	65	64	-1
CH-11	3	66	63	63	63	0
CH-12	8	66	65	**66**	**66**	0
CH-13	6	66	69	**69**	**69**	0
CH-14	5	66	65	65	65	0
CH-15	6	66	66	65	**66**	1
CH-16	20	66	66	**68**	**68**	0
CH-17	6	66	63	64	63	-1
CH-18	4	66	62	64	63	-1
CH-19	2	66	63	63	62	-1
CH-20	4	66	63	64	59	-5
CH-21	14	66	64	65	58	-7
CH-22	16	66	64	64	57	-7
CH-23	8	66	64	64	57	-7
CH-24	14	66	62	63	57	-6
CH-25	6	66	63	63	61	-2
CH-26	7	66	62	62	61	-1
CH-27	6	66	62	62	61	-1
CH-28	4	66	69	**70**	**70**	0
CH-29	3	66	61	61	61	0
CH-30	5	66	61	61	60	-1

Exhibit 1B-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	Residential Structures	NAC	Existing[a,b]	6-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
CH-31	1	66	60	60	59	-1
CH-32	1	66	61	62	60	-2

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1B-6. Comparison of Future Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

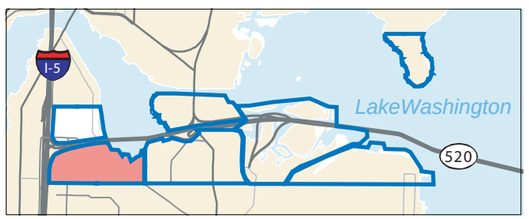
Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane	6-Lane
CH-1	**73**	**73**	**72**	**72**	0	-1	-1
CH-2	**71**	**72**	**73**	**71**	1	2	0
CH-3	**66**	**67**	**69**	64	1	3	-2
CH-4	64	65	**67**	64	1	3	0
CH-5	65	**66**	63	65	1	-2	0
CH-6	**70**	**71**	58	58	1	-12	-12
CH-7	**68**	**69**	59	59	1	-9	-9
CH-8	**67**	**67**	59	59	0	-8	-8
CH-9	**67**	**67**	59	59	0	-8	-8
CH-10	64	65	64	64	1	0	0
CH-11	63	64	**66**	63	1	3	0
CH-12	65	**66**	**68**	**66**	1	3	1
CH-13	**69**	**69**	**70**	**69**	0	1	0
CH-14	65	65	65	65	0	0	0
CH-15	**66**	**66**	**66**	**66**	0	0	0
CH-16	**66**	**67**	**69**	**68**	1	3	2
CH-17	63	64	65	63	1	2	0
CH-18	62	63	64	63	1	2	1
CH-19	63	64	62	62	1	-1	-1
CH-20	63	64	58	59	1	-5	-4
CH-21	64	65	57	58	1	-7	-6
CH-22	64	65	57	57	1	-7	-7
CH-23	64	65	57	57	1	-7	-7
CH-24	62	63	57	57	1	-5	-5
CH-25	63	63	59	61	0	-4	-2
CH-26	62	63	61	61	1	-1	-1
CH-27	62	62	62	61	0	0	-1
CH-28	**69**	**69**	**71**	**70**	0	2	1
CH-29	61	62	62	61	1	1	0
CH-30	61	61	60	60	0	-1	-1

Exhibit 1B-6. Comparison of Future Peak-Hour Traffic Noise Levels for North Capitol Hill Neighborhood

Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane	6-Lane
CH-31	60	61	59	59	1	-1	-1
CH-32	61	62	60	60	1	-1	-1

[a] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.



Location map showing noise analysis area

Modeling location

Monitoring and modeling location

Noise analysis area

CH-19 Ex NB 4 6 64 65 63 63 - - 61 62

Modeling number

Alternatives (Existing, No Build, 4-Lane, 6-Lane)

Noise level in decibels without wall

Noise level in decibels with wall

N

0 100 200 Feet

Exhibit 1B-7. **Noise Modeling Locations, North Capitol Hill**

SR 520 Bridge Replacement and HOV Project

1C: Montlake Neighborhood North of SR 520

Exhibit 1C-1. Noise Model Validation Summary for Montlake Neighborhood North of SR 520

TNM Modeling #	Monitoring #	Measured[a]	Modeled[a]	Difference (modeled - measured)
MN-1	M19	67	67	0
MN-4	M25	65	66	1
MN-5	M24	68	66	-2
MN-7	M23	65	67	2
MN-11	M18	67	65	-2
MN-13	M17	63	63	0
MN-15	M20	63	62	-1
MN-18	M21	71	72	1
MN-20	M22	59	59	0

[a] Measured and modeled L_{eq} noise level in decibels with A-weighting (dBA).

Exhibit 1C-2. Existing Peak-Hour Traffic Noise Levels for Montlake Neighborhood North of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
MN-1	66	**69**	0
MN-2	66	**66**	0
MN-3	66	**75**	0
MN-4	66	**67**	2
MN-5	66	**67**	3
MN-6	66	**66**	3
MN-7	66	**69**	2
MN-8	66	**68**	3
MN-9	66	64	--
MN-10	66	64	--
MN-11	66	**66**	0
MN-12	66	65	--
MN-13	66	64	--
MN-14	66	64	--
MN-15	66	64	--
MN-16	66	63	--
MN-17	66	**68**	4
MN-18	66	**72**	3
MN-19	66	62	--
MN-20	66	60	--
MN-21	66	61	--
MN-22	66	63	--
MN-23	66	**68**	4
MN-24	66	62	--

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise exceeding the NAC.

Exhibit 1C-3. No Build Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood North of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
MN-1	66	**69**	**69**	0	0
MN-2	66	**66**	**67**	1	0
MN-3	66	**75**	**75**	0	0
MN-4	66	**67**	**68**	1	2
MN-5	66	**67**	**68**	1	3
MN-6	66	**66**	**66**	0	3
MN-7	66	**69**	**70**	1	2
MN-8	66	**68**	**68**	0	3
MN-9	66	64	65	1	0
MN-10	66	64	65	1	0
MN-11	66	**66**	**67**	1	0
MN-12	66	65	**66**	1	0
MN-13	66	64	65	1	0
MN-14	66	64	65	1	0
MN-15	66	64	64	0	0
MN-16	66	63	64	1	0
MN-17	66	**68**	**68**	0	4
MN-18	66	**72**	**72**	0	3
MN-19	66	62	62	0	0
MN-20	66	60	61	1	0
MN-21	66	61	61	0	0
MN-22	66	63	64	1	0
MN-23	66	**68**	**68**	0	4
MN-24	66	62	63	1	0

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1C-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood North of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MN-1	0	66	**69**	**69**	57	-12
MN-2	0	66	**66**	**67**	61	-6
MN-3	0	66	**75**	**--**	**--**	**--**
MN-4	2	66	**67**	**69**	63	-6
MN-5	3	66	**67**	**68**	63	-5
MN-6	3	66	**66**	**67**	64	-3
MN-7	2	66	**69**	**71**	**69**	-2
MN-8	3	66	**68**	**69**	**67**	-2
MN-9	3	66	64	65	62	-3
MN-10	4	66	64	65	59	-6
MN-11	0	66	**66**	**66**	56	-10
MN-12	0	66	65	65	55	-10
MN-13	4	66	64	64	54	-10
MN-14	3	66	64	64	55	-9
MN-15	4	66	64	64	56	-8
MN-16	4	66	63	64	60	-4
MN-17	4	66	**68**	**68**	**66**	-2
MN-18	3	66	**72**	**72**	**69**	-3
MN-19	5	66	62	63	60	-3
MN-20	3	66	60	61	60	-1
MN-21	3	66	61	62	60	-2
MN-22	0	66	63	63	60	-3
MN-23	4	66	**68**	**68**	**66**	-2
MN-24	3	66	62	62	52	-10

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1C-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood North of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	6-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MN-1	0	66	69	**69**	60	-9
MN-2	0	66	66	**68**	61	-7
MN-3	0	66	75	**--**	**--**	**--**
MN-4	2	66	67	**72**	64	-8
MN-5	3	66	67	**69**	63	-6
MN-6	3	66	66	**67**	64	-3
MN-7	2	66	69	**70**	**69**	-1
MN-8	3	66	68	**69**	**67**	-2
MN-9	3	66	64	65	62	-3
MN-10	4	66	64	65	59	-6
MN-11	0	66	66	**67**	59	-8
MN-12	0	66	65	**66**	55	-11
MN-13	4	66	64	65	55	-10
MN-14	3	66	64	65	57	-8
MN-15	4	66	64	65	57	-8
MN-16	4	66	63	64	60	-4
MN-17	4	66	68	**68**	**66**	-2
MN-18	3	66	72	**70**	**69**	-1
MN-19	5	66	62	61	60	-1
MN-20	3	66	60	60	60	0
MN-21	3	66	61	62	60	-2
MN-22	0	66	63	64	59	-5
MN-23	4	66	68	**68**	**66**	-2
MN-24	3	66	62	64	53	-11

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1C-6. Comparison of Future Peak-Hour Traffic Noise Levels for Montlake Neighborhood North of SR 520

Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane	6-Lane
MN-1	**69**	**69**	57	60	0	-12	-9
MN-2	**66**	**67**	61	61	1	-5	-5
MN-3	**75**	**75**	**--**	**--**	0	**--**	**--**
MN-4	**67**	**68**	63	64	1	-4	-3
MN-5	**67**	**68**	63	63	1	-4	-4
MN-6	**66**	**66**	64	64	0	-2	-2
MN-7	**69**	**70**	**69**	**69**	1	0	0
MN-8	**68**	**68**	**67**	**67**	0	-1	-1
MN-9	64	65	62	62	1	-2	-2
MN-10	64	65	59	59	1	-5	-5
MN-11	**66**	**67**	56	59	1	-10	-7
MN-12	65	**66**	55	55	1	-10	-10
MN-13	64	65	54	55	1	-10	-9
MN-14	64	65	55	57	1	-9	-7
MN-15	64	64	56	57	0	-8	-7
MN-16	63	64	60	60	1	-3	-3
MN-17	**68**	**68**	**66**	**66**	0	-2	-2
MN-18	**72**	**72**	**69**	**69**	0	-3	-3
MN-19	62	62	60	60	0	-2	-2
MN-20	60	61	60	60	1	0	0
MN-21	61	61	60	60	0	-1	-1
MN-22	63	64	60	59	1	-3	-4
MN-23	**68**	**68**	**66**	**66**	0	-2	-2
MN-24	62	63	52	53	1	-10	-9

-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

[a] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

1D: Montlake Neighborhood South of SR 520

Exhibit 1D-1. Noise Model Validation Summary for Montlake Neighborhood South of SR 520

TNM Modeling #	Monitoring #	Measured[a]	Modeled[a]	Difference (modeled - measured)
MS-1	M27	71	73	2
MS-3	M30	73	73	0
MS-11	M28	61	59	-2
MS-12	M31	57	56	-1
MS-13	M32	58	57	-1
MS-17	M29	69	70	1
MS-20	M26	63	65	2
MS-23	M16	64	65	1

[a] Measured and modeled L_{eq} noise level in decibels with A-weighting (dBA).

Exhibit 1D-2. Existing Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
MS-1	66	**74**	4
MS-2	66	**74**	4
MS-3	66	**74**	6
MS-4	66	**72**	3
MS-5	66	**70**	5
MS-6	66	59	--
MS-7	66	59	--
MS-8	66	61	--
MS-9	66	62	--
MS-10	66	**67**	4
MS-11	66	60	--
MS-12	66	56	--
MS-13	66	58	--
MS-14	66	60	--
MS-15	66	56	--
MS-16	66	62	--
MS-17	66	**73**	2
MS-18	66	65	--
MS-19	66	**66**	4
MS-20	66	**66**	3
MS-21	66	**70**	0
MS-22	66	**69**	0
MS-23	66	**66**	0
MS-24	66	63	--
MS-25	66	63	--
MS-26	66	63	--
MS-27	66	65	--
MS-28	66	64	--
MS-29	66	63	--
MS-30	66	64	--
MS-31	66	58	--

Exhibit 1D-2. Existing Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	Residences Exceeding NAC[d]
MS-32	66	61	--
MS-33	66	64	--

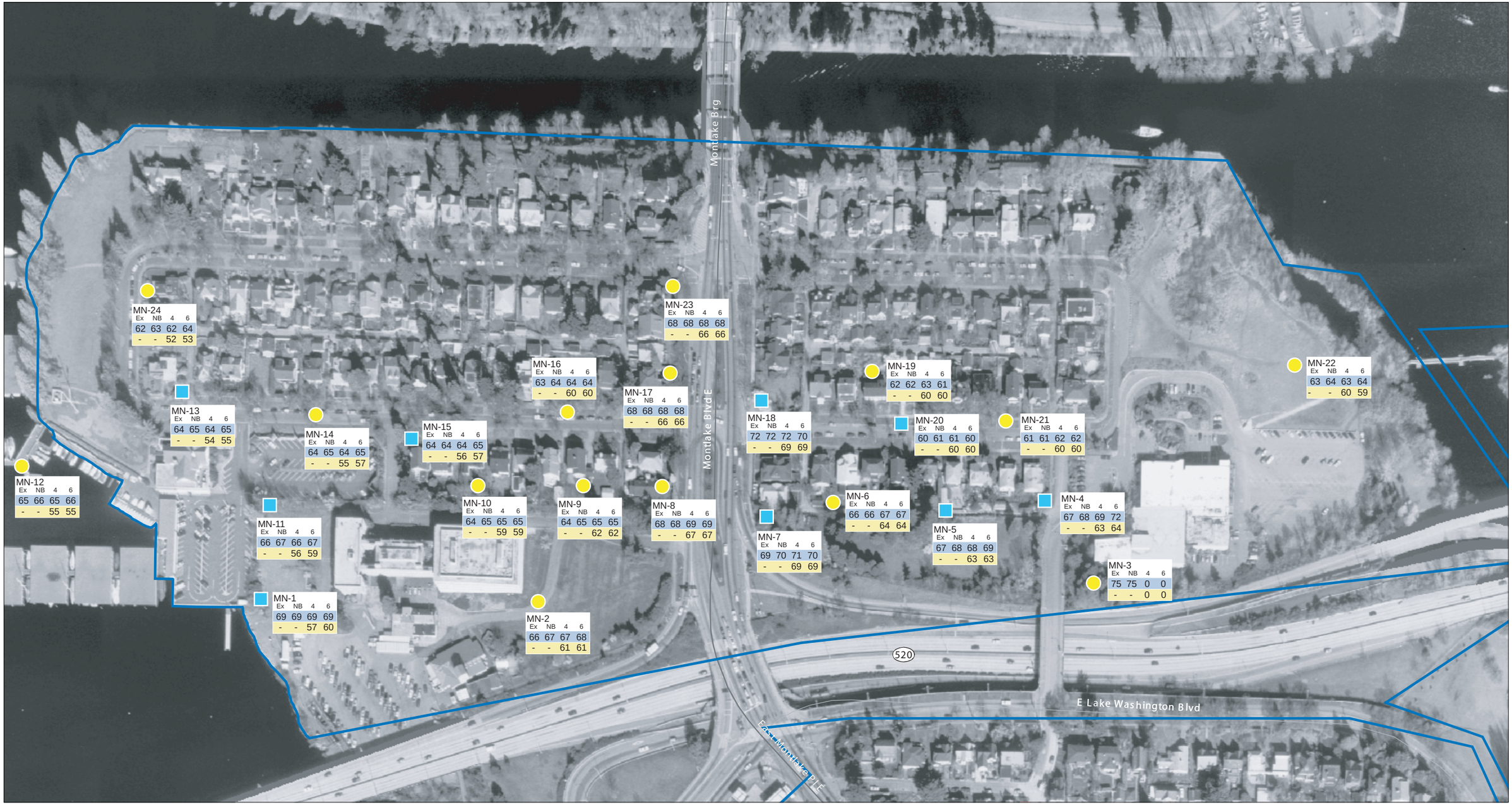
-- = Receiver location in new highway right-of-way; therefore, no noise levels were calculated.

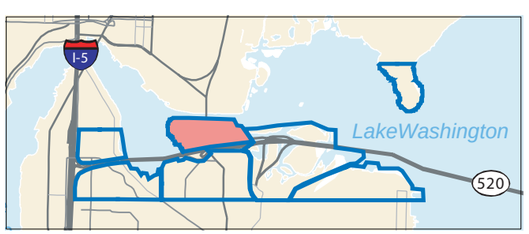
[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.





Location map showing noise analysis area

Modeling location

Monitoring and modeling location

Noise analysis area

MN-19 Ex NB 4 6 64 65 63 63 - - 61 62

Modeling number

Alternatives (Existing, No Build, 4-Lane, 6-Lane)

Noise level in decibels without wall

Noise level in decibels with wall

N

0 100 200 Feet

Exhibit 1C-7. **Noise Modeling Locations, Montlake North of SR 520**

SR 520 Bridge Replacement and HOV Project

Exhibit 1D-3. No Build Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
MS-1	66	**74**	**75**	1	4
MS-2	66	**74**	**74**	0	4
MS-3	66	**74**	**74**	0	6
MS-4	66	**72**	**73**	1	3
MS-5	66	**70**	**71**	1	5
MS-6	66	59	59	0	0
MS-7	66	59	60	1	0
MS-8	66	61	62	1	0
MS-9	66	62	63	1	0
MS-10	66	**67**	**67**	0	4
MS-11	66	60	60	0	0
MS-12	66	56	57	1	0
MS-13	66	58	58	0	0
MS-14	66	60	61	1	0
MS-15	66	56	56	0	0
MS-16	66	62	62	0	0
MS-17	66	**73**	**73**	0	2
MS-18	66	65	**66**	1	4
MS-19	66	**66**	**66**	0	4
MS-20	66	**66**	**66**	0	3
MS-21	66	**70**	**71**	1	0
MS-22	66	**69**	**70**	1	0
MS-23	66	**66**	**67**	1	0
MS-24	66	63	64	1	0
MS-25	66	63	64	1	0
MS-26	66	63	64	1	0
MS-27	66	65	**66**	1	3
MS-28	66	64	65	1	0
MS-29	66	63	64	1	0
MS-30	66	64	64	0	0
MS-31	66	58	58	0	0

Exhibit 1D-3. No Build Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	NAC[a]	Existing Noise Level[b,c]	2030 No Build Noise Level	Change in Noise Level	No Build Alternative Residences Exceeding NAC[d]
MS-32	66	61	61	0	0
MS-33	67	64	65	1	0

[a] NAC is the WSDOT Noise Abatement Criteria level.

[b] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[c] Bold numbers indicate noise levels exceeding the NAC.

[d] Estimated number of residences with noise levels exceeding the NAC.

Exhibit 1D-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MS-1	4	66	**74**	**74**	**71**	-3
MS-2	4	66	**74**	**74**	**71**	-3
MS-3	6	66	**74**	**74**	**71**	-3
MS-4	3	66	**72**	**73**	**72**	-1
MS-5	5	66	**70**	**71**	**70**	-1
MS-6	4	66	59	61	60	-1
MS-7	4	66	59	60	60	0
MS-8	3	66	61	63	63	0
MS-9	2	66	62	63	62	-1
MS-10	4	66	**67**	**67**	**67**	0
MS-11	2	66	60	61	61	0
MS-12	4	66	56	58	58	0
MS-13	4	66	58	59	58	-1
MS-14	4	66	60	60	60	0
MS-15	6	66	56	58	57	-1
MS-16	4	66	62	62	62	0
MS-17	2	66	**73**	**73**	**73**	0
MS-18	4	66	65	**67**	**66**	-1
MS-19	4	66	**66**	**67**	65	-2
MS-20	3	66	**66**	65	61	-4
MS-21	0	66	**70**	**66**	59	-7
MS-22	0	66	**69**	**67**	61	-6
MS-23	0	66	**66**	65	61	-4
MS-24	2	66	63	63	58	-5
MS-25	2	66	63	63	57	-6
MS-26	4	66	63	62	57	-5
MS-27	3	66	65	65	59	-6
MS-28	4	66	64	64	60	-4
MS-29	4	66	63	64	62	-2
MS-30	4	66	64	65	64	-1
MS-31	6	66	58	59	58	-1

Exhibit 1D-4. 4-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	4-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MS-32	4	66	61	61	61	0
MS-33	5	66	64	64	64	0

[a] Leq noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA Leq.

Exhibit 1D-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	6-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MS-1	4	66	**74**	**72**	**71**	-1
MS-2	4	66	**74**	**74**	**71**	-3
MS-3	6	66	**74**	**74**	**71**	-3
MS-4	3	66	**72**	**74**	**71**	-3
MS-5	5	66	**70**	**71**	**70**	-1
MS-6	4	66	59	61	60	-1
MS-7	4	66	59	60	60	0
MS-8	3	66	61	62	62	0
MS-9	2	66	62	63	62	-1
MS-10	4	66	**67**	**67**	**66**	-1
MS-11	2	66	60	60	60	0
MS-12	4	66	56	58	58	0
MS-13	4	66	58	59	59	0
MS-14	4	66	60	61	61	0
MS-15	6	66	56	58	57	-1
MS-16	4	66	62	62	62	0
MS-17	2	66	**73**	**73**	**73**	0
MS-18	4	66	65	65	64	-1
MS-19	4	66	**66**	65	63	-2
MS-20	3	66	**66**	64	60	-4
MS-21	0	66	**70**	**66**	58	-8
MS-22	0	66	**69**	**67**	59	-8
MS-23	0	66	**66**	**66**	58	-8
MS-24	2	66	63	63	56	-7
MS-25	2	66	63	63	56	-7
MS-26	4	66	63	63	56	-7
MS-27	3	66	65	64	58	-6
MS-28	4	66	64	63	59	-4
MS-29	4	66	63	63	60	-3
MS-30	4	66	64	64	62	-2
MS-31	6	66	58	59	59	0

Exhibit 1D-5. 6-Lane Alternative Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	Residential Structures	NAC	Existing[a,b]	6-Lane Alternative		Sound Wall Reduction[a]
				No Wall[a]	w/ Wall[a]	
MS-32	4	66	61	62	61	-1
MS-33	5	66	64	65	65	0

[a] L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.

Exhibit 1D-6. Comparison of Future Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

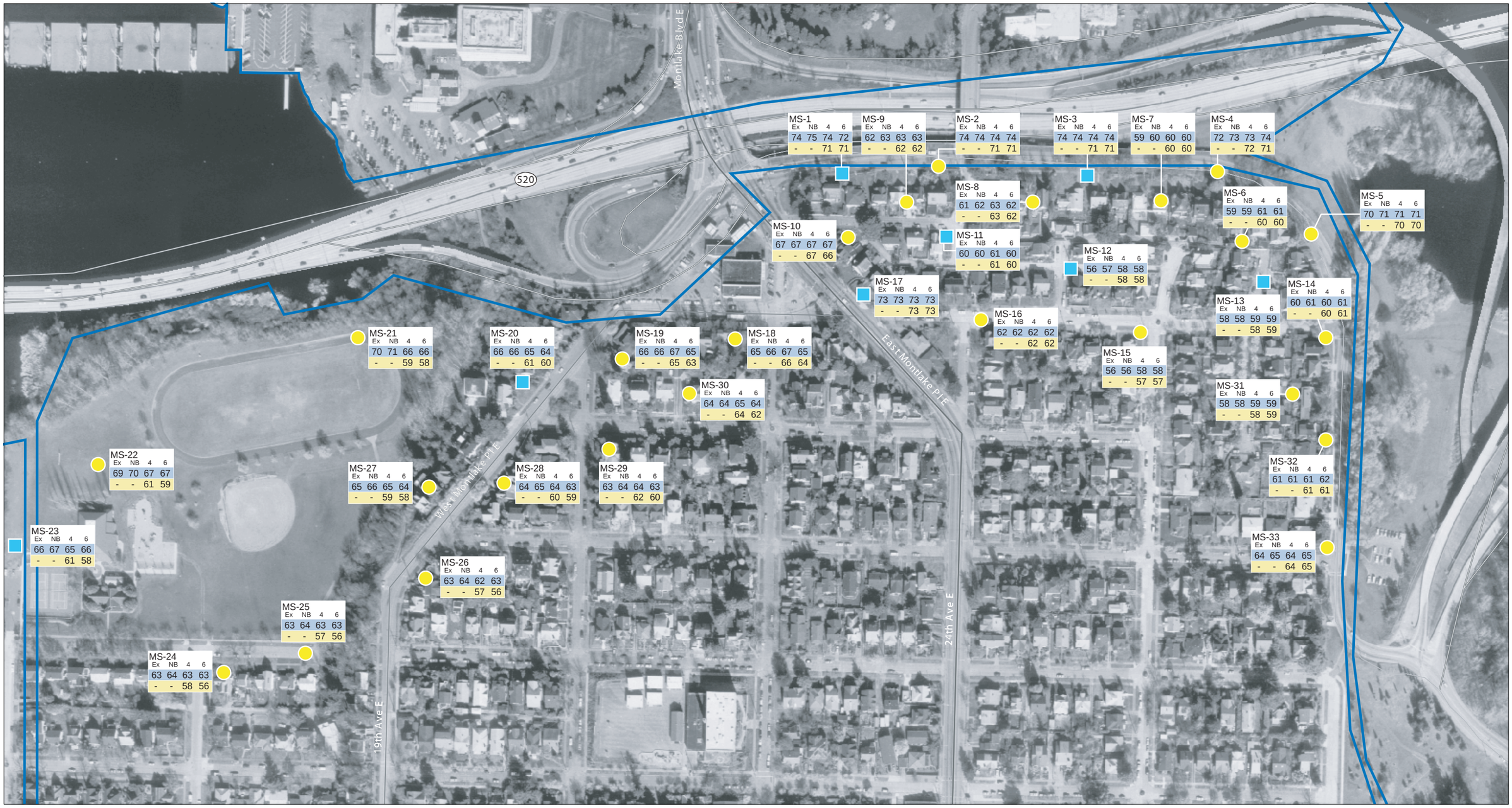
Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane	6-Lane
MS-1	**74**	**75**	**71**	**71**	1	-3	-3
MS-2	**74**	**74**	**71**	**71**	0	-3	-3
MS-3	**74**	**74**	**71**	**71**	0	-3	-3
MS-4	**72**	**73**	**72**	**71**	1	0	-1
MS-5	**70**	**71**	**70**	**70**	1	0	0
MS-6	59	59	60	60	0	1	1
MS-7	59	60	60	60	1	1	1
MS-8	61	62	63	62	1	2	1
MS-9	62	63	62	62	1	0	0
MS-10	**67**	**67**	**67**	**66**	0	0	-1
MS-11	60	60	61	60	0	1	0
MS-12	56	57	58	58	1	2	2
MS-13	58	58	58	59	0	0	1
MS-14	60	61	60	61	1	0	1
MS-15	56	56	57	57	0	1	1
MS-16	62	62	62	62	0	0	0
MS-17	**73**	**73**	**73**	**73**	0	0	0
MS-18	65	**66**	**66**	64	1	1	-1
MS-19	**66**	**66**	65	63	0	-1	-3
MS-20	**66**	**66**	61	60	0	-5	-6
MS-21	**70**	**71**	59	58	1	-11	-12
MS-22	**69**	**70**	61	59	1	-8	-10
MS-23	**66**	**67**	61	58	1	-5	-8
MS-24	63	64	58	56	1	-5	-7
MS-25	63	64	57	56	1	-6	-7
MS-26	63	64	57	56	1	-6	-7
MS-27	65	**66**	59	58	1	-6	-7
MS-28	64	65	60	59	1	-4	-5
MS-29	63	64	62	60	1	-1	-3
MS-30	64	64	64	62	0	0	-2

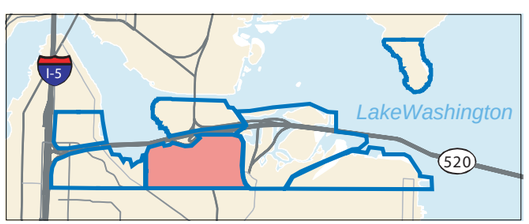
Exhibit 1D-6. Comparison of Future Peak-Hour Traffic Noise Levels for Montlake Neighborhood South of SR 520

Receiver Number	Existing[a,b]	Future 2030 Noise Levels[a,b]			Change from Existing		
		No Build	4-Lane	6-Lane	No Build	4-Lane	6-Lane
MS-31	58	58	58	59	0	0	1
MS-32	61	61	61	61	0	0	0
MS-33	64	65	64	65	1	0	1

[a] Modeled L_{eq} noise levels in decibels with A-weighting (dBA).

[b] Bold numbers indicate noise levels exceeding the NAC, 66 dBA L_{eq}.





Location map showing noise analysis area

Modeling location

Monitoring and modeling location

Noise analysis area

MS-19 Ex NB 4 6 64 65 63 63 - - 61 62

Modeling number

Alternatives (Existing, No Build, 4-Lane, 6-Lane)

Noise level in decibels without wall

Noise level in decibels with wall

N

0 100 200 Feet

Exhibit 1D-7. **Noise Modeling Locations, Montlake South of SR 520**

SR 520 Bridge Replacement and HOV Project

1E: Washington Park Arboretum