CHAPTER 5.5 Noise

Project construction will temporarily increase noise levels in the project vicinity; however, WSDOT has incorporated measures to minimize construction noise. During project operation, the noise walls and lids that are part of the project design will substantially reduce traffic noise throughout the SR 520 corridor.

Please refer to the Noise Technical Memorandum in Appendix O for additional information about the noise analysis.

Sound is a fundamental component of daily life. When sounds are perceived as desired, beneficial, or otherwise pleasing, they are typically considered as having a positive effect on daily life. When sound is perceived as unpleasant, unwanted, or disturbingly loud, it is considered noise.

This chapter addresses noise issues in the project vicinity. WSDOT considered this project's effects on noise to help understand the potential effect of traffic and construction noise on public health and welfare.

Environmental noise may interfere with a broad range of human activities in a way that degrades public health and welfare. Examples include situations where noise adversely affects a person's hearing, mental state (for example, annoyance), or the ability to engage in important activities such as sleeping or communicating.

The project team worked with local agencies and the public to evaluate and address traffic noise, ultimately lessening noise effects from the freeway.

Why is noise considered in this EA?

Understanding the adverse effects of traffic and construction noise is an integral part of this EA. Federal, state, and local governments provide guidance on acceptable noise levels to ensure the public's health and well being, both now and in the future. Traffic and construction noise analyses are required by law for federally funded projects and by State of Washington policy for other funded projects that (1) involve construction of a new highway, (2) substantially change the horizontal or vertical alignment, or (3) increase the number of through-traffic lanes on an existing highway. State policy also requires the review and consideration of noise abatement on projects

that substantially alter the ground contours surrounding a state highway.

How did WSDOT evaluate noise levels for this project?

Typical outdoor systems used for long-term noise monitoring

What are the Noise Abatement Criteria (NAC)?

For residential and public use buildings or outdoor recreational areas, FHWA defines the NAC at 67 A-weighted decibels (dBA). WSDOT has adopted the NAC and states its own criteria at 66 dBA so that noise levels do not approach, meet, or exceed the NAC. If the NAC is approached, met, or exceeded, noise mitigation must be evaluated.

WSDOT used the FHWA Traffic Noise Model Version 2.5 computer model to predict future noise levels. To validate the model, the project team measured noise levels at 43 locations in the study area between Evergreen Point Road and Bellevue Way NE. These included 4 long-term (24-hour or greater) and 39 short-term (15 to 30 minutes) monitoring locations. These measurements also help describe the existing noise levels, identify major noise sources in the study area, and characterize weekday background noise levels.

The Traffic Noise Model was used to estimate operational noise levels at 168 locations in the project corridor. Modeling was performed to determine what locations in the study area exceeded the FHWA and Washington State noise abatement criteria (NAC). Therefore, peak-hour traffic noise levels were calculated for existing conditions using current traffic volumes and for the Build Alternative and No Build Alternative using predicted 2030 traffic volumes, with and without noise mitigation measures.

In places where noise levels were modeled as approaching, meeting, or exceeding the NAC, noise specialists evaluated whether mitigation measures could reduce traffic noise substantially enough to warrant the cost of barrier construction. This evaluation was based on WSDOT's feasibility and reasonableness criteria. See Appendix O, Noise Technical Memorandum, for additional detail about these criteria and the decision making process related to noise wall construction.

Construction noise was considered using U.S. Environmental Protection Agency (USEPA) reference levels. The analysis was based on noise levels from equipment typically used for roadway construction. Noise levels were reviewed at various distances from the proposed area of construction.

What is the study area for the noise analysis?

A detailed reconnaissance of the study area was performed to identify all noise-sensitive properties that are, or could be, directly affected by the project. All noise-sensitive properties included in this analysis are located on the north and south sides of the project corridor, as listed below.

- Medina and Hunts Point North — North of SR 520 between Evergreen Point Road and 84th Avenue NE.
- Medina and Hunts Point South — South of SR 520 between Evergreen Point Road and 84th Avenue NE.
- Hunts Point, Clyde Hill, Yarrow Point and Kirkland — North of SR 520 between 84th Avenue NE and Bellevue Way NE.
- Hunts Point, Clyde Hill, Yarrow Point and Bellevue — South of SR 520 between 84th Avenue NE and Bellevue Way NE.

How was the study area defined?

As defined in the WSDOT Policy and Procedures Manual and in 23 CFR 772, the study area should include all lands within 500 feet of the edge of pavement. At the request of community leaders, some study locations were farther away than the 500-foot study area required by WSDOT.

East of 108th Avenue NE, the project will only restripe the highway with no change to the vertical or horizontal alignment. In accordance with Federal guidance and WSDOT noise policy, a project with two distinct parts, to be constructed in separate contracts, where one part requires a noise analysis and the other part clearly does not, may be evaluated independently for noise. Therefore, no noise analysis is required east of 108th Avenue NE.

How noisy is the study area?

From the measurements and modeling described above, WSDOT concluded that current noise levels in the study area range between 48 and 72 A-weighted decibels (dBA). The baseline conditions in the study area include traffic on SR 520 and local arterials such as Bellevue Way NE, 84th Avenue NE, NE 28th Street, Points Drive NE, 92nd Avenue NE, and Evergreen Point Road. Under these conditions, some study area locations already approach, meet, or exceed the NAC. There are approximately 128 residences in the study area that meet or exceed the Washington state NAC of 66 dBA.

How is Sound Measured?

Sound is measured both in terms of loudness and frequency. The unit used in this EA to measure sound is called an A-weighted decibel (dBA). Sounds expressed in terms of dBA provide a single number measure of a sound's loudness based on the ear's sensitivity to different frequencies.

For a sense of perspective, normal human conversation ranges between 44 and 65 dBA. Very slight changes in noise levels, up or down, are generally not detectable by the human ear. The smallest change in noise level that a human ear can perceive is about 3 dBA, while increases of 5 dBA or more are clearly noticeable.

How will construction activities affect noise levels?

Several different construction stages will be required to complete the project, which will be constructed under both daytime and nighttime conditions (nighttime construction will not occur at the same location for the entire construction period). To provide the public with a general understanding of how loud construction might be, the team performed an analysis that assumed worst case noise levels based on expected construction activities. Typical construction stages and activities for the project are shown in Exhibit 5-20.

Exhibit 5-20. Noise Levels for Typical Construction Stages

Scenario	Equipment	Maximum Noise Levels (dBA)[1]
Construction preparation	Air compressors, backhoe, concrete pumps, crane, excavator, forklifts, haul trucks, loader, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	82-86
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	92-94
Miscellaneous activities, including striping, lighting and signs	Air compressors, backhoe, crane, forklifts, haul trucks, loader, pumps, service trucks, tractor trailers, utility trucks, welders	80
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	82-92

[1] Corresponding maximum noise level as measured at 50 to 100 feet from closest receiver under normal use.

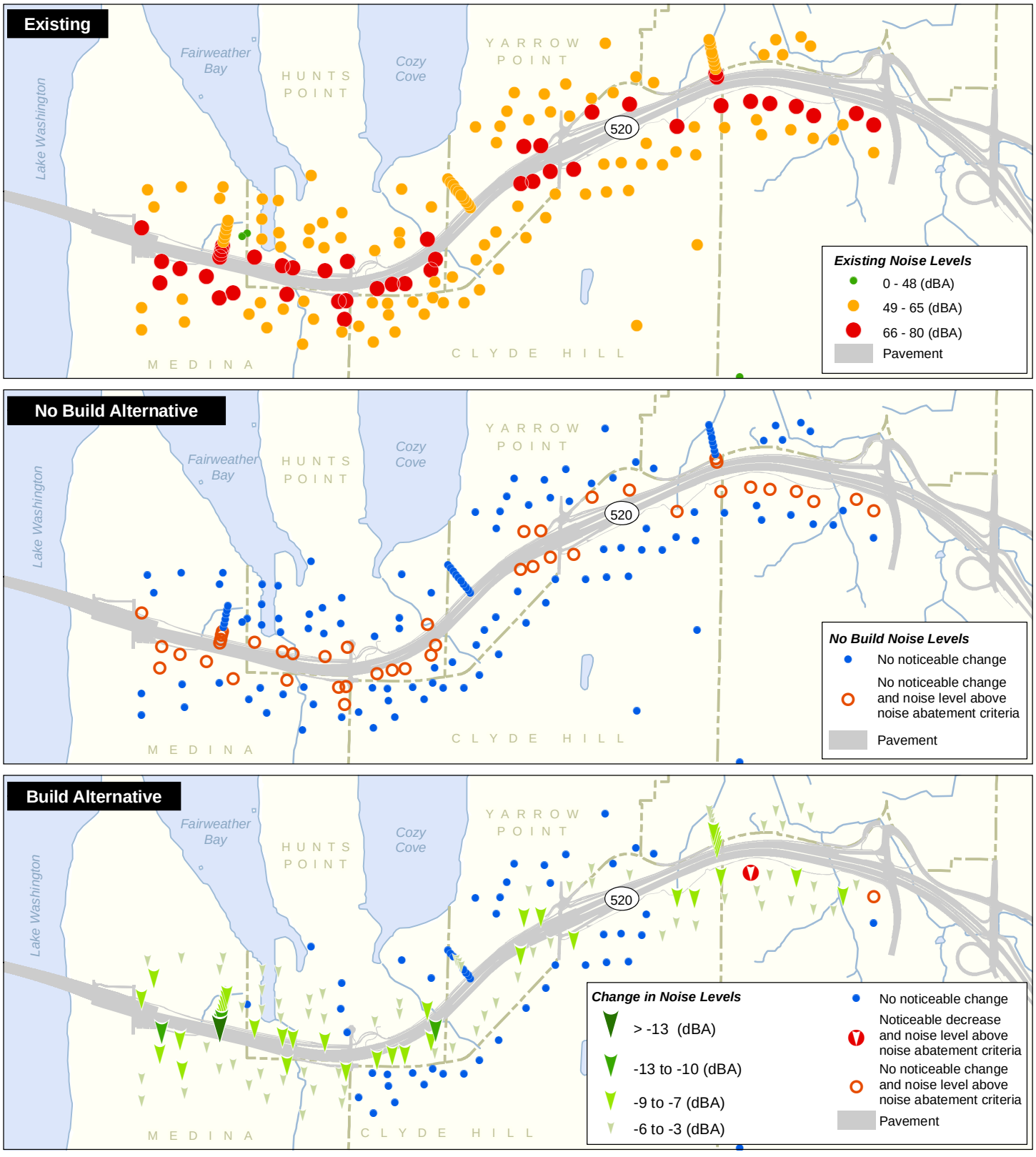
The noise levels described above will be temporary, occurring only during the construction period. Measures to minimize construction noise effects have been incorporated into the project and are described in Chapter 6.

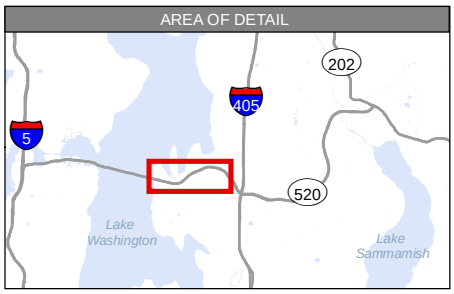
How will noise levels change after the project is completed?

WSDOT compared future traffic noise levels to the NAC to estimate traffic noise effects for the proposed project. For all locations that exceeded the FHWA criteria, the effectiveness of noise walls to reduce noise was evaluated. Exhibit 5-21 shows a comparison of existing noise levels versus noise levels for the Build Alternative and No Build Alternative.

The Build Alternative peak-hour traffic noise levels were modeled for the same 168 locations in the study area as existing peak-hour traffic conditions. Compared with today's and the projected 2030 No Build Alternative noise levels, the proposed Build Alternative, which includes noise walls and lids at the three overpasses, will reduce the noise levels substantially throughout the SR 520 project corridor. Overall, the Build Alternative will lower the number of residences where noise levels exceed the NAC from 128 today to 20. All of the remaining 20 properties exceeding the NAC do so because of noise from arterial roads, such as Bellevue Way NE, 92nd Avenue NE, and 84th Avenue NE, or because area topography limits the effectiveness of noise walls. The Build Alternative with the proposed noise walls will not cause any substantial (more than 10 dBA) increases in noise.

Noise walls are proposed for the Build Alternative from the Evergreen Point Road lid to just west of Bellevue Way NE. The noise walls will be virtually continuous through the entire area except for breaks at 84th Avenue NE and 92nd Avenue NE, where the noise walls will be integrated with the lids. The overall project corridor noise walls will be 18,000 feet long with heights varying from 8 feet to 26 feet. The taller noise walls will be necessary in areas where residents are located uphill from the project corridor. For the purpose of evaluating the noise walls under WSDOT cost criteria, the proposed noise walls on the north and south side of SR 520 were considered one complete noise wall system with breaks for the 84th Avenue NE and 92nd Avenue NE lids. Exhibit 5-22 shows the locations of the proposed noise walls.





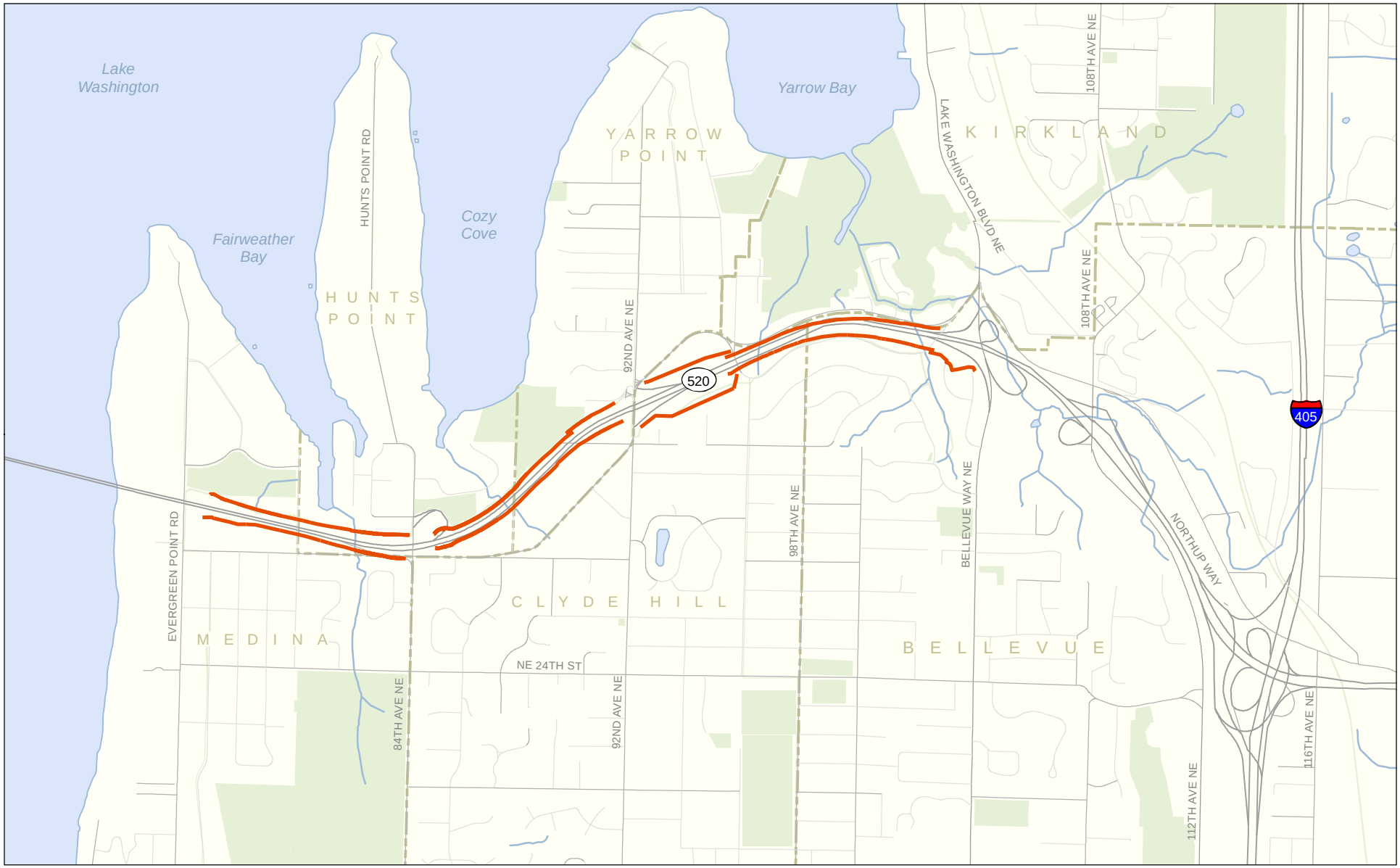
N

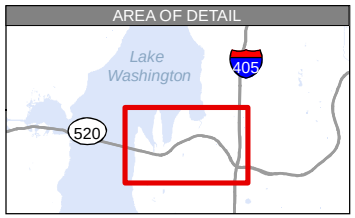
0 1,000 2,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Exhibit 5-21. **Noise Levels Changes in the Study Area**

Medina to SR 202: Eastside Transit and HOV Project





Proposed Noise Wall

Park

City Limits

N

0 500 1,000 2,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Exhibit 5-22. **Noise Wall Locations**

Medina to SR 202: Eastside Transit and HOV Project

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WSDOT has developed a method of assigning a "**residential equivalents**" value to noise-sensitive areas such as parks. Residential equivalents values were calculated for the parks along SR 520, Points Loop Trail, and the SR 520 bike and pedestrian path.

A total of 464 residential equivalents (55 with noise levels of 70 dBA or higher) will benefit from construction of the proposed noise walls under the Build Alternative. Because the Build Alternative includes construction of proposed noise walls in the analysis, the number of residential equivalents experiencing traffic noise effects under this alternative will be reduced compared with existing conditions. On average, the Build Alternative will meet noise abatement objectives by providing an average of 7 to 10 dBA noise reduction.

The proposed noise walls along the north and south sides of SR 520 meet the WSDOT cost criteria.

The proposed noise walls described in this EA are based on current design drawings. As the project design proceeds and is refined, it is possible that changes could occur in the vertical and horizontal alignment of the noise walls. During the design-build process, the location and height of the walls will be verified once the roadway design reaches a level where the noise walls can be finalized. During this process, it is possible that the height and placement of the walls could change. It is also possible that some walls may not be constructed as part of the project.

If a noise wall described in the EA is not constructed as part of the project, it will normally be due to one of three issues: the noise reduction of the noise wall is insufficient and does not meet WSDOT noise reduction requirements; the cost of the wall exceeds the allowable amount; or there are constructability issues such as unstable ground. Once the noise wall locations and heights are finalized, coordination with residents adjacent to the noise walls will be performed. If a simple majority of residents want the noise walls, then the walls will be included in the project.

Please refer to the Noise Technical Memorandum in Appendix O for additional information about the noise monitoring locations, walls, and analysis described in this chapter.

The Build Alternative also includes lidded highway sections that are very effective at reducing noise levels above and near the lids. The lids will be integrated with the noise walls and retaining walls. Each lid will be approximately 500 feet long, which is short enough to not require ventilation but long enough to help reconnect the communities along SR 520. The

locations of the three lids are at Evergreen Point Drive, 84th Avenue NE, and 92nd Avenue NE. Exhibit 5-23 shows an example of a depressed roadway with a lid and demonstrates how vehicle noise is contained.

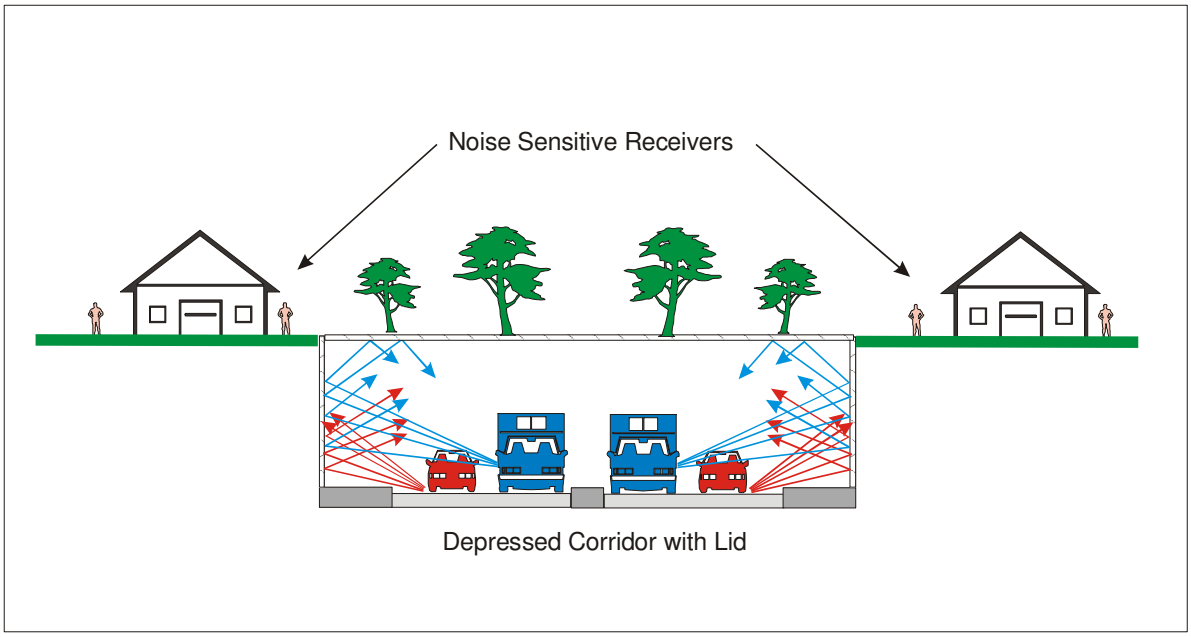

Exhibit 5-23. Example of a Depressed Roadway with a Lid

What will happen to noise levels if WSDOT does not build this project?

Under the No Build Alternative, there are approximately 146 residences in the study area where the state traffic NAC of 66 dBA would be met or exceeded. Under the No Build Alternative, noise levels are projected to increase in 2030 by only 1 to 2 dBA in most locations, an amount that is not normally noticeable to people with average hearing. However, with this increase, noise levels would exceed the NAC at an additional 18 residences, bringing the total to 146 from the current estimate of 128 residences.