

3.11 NOISE

This section characterizes existing noise levels in the site area. Potential impacts to noise conditions from the Proposed Action, Alternative 1 and the No Action Alternative are evaluated. This section is based on the January 2006 Noise Analysis, prepared by Landau Associates (see **Appendix K**)

3.11.1 Affected Environment

Noise Level Terminology and Human Hearing

The human response to sound depends on the magnitude of a sound, and also on its frequency and time pattern. Sound magnitude is typically expressed as decibels (dB). Because environmental noise is composed of many frequencies, environmental sound is commonly expressed in terms of “A-weighted” decibels, or dBA. The dBA sound level descriptor estimates how an average person hears a combination of sounds by “weighting” sounds of various frequencies.

Because the range of human hearing from the faintest to the loudest sounds is large, the decibel scale is logarithmic. This means that doubling the number of noise sources increases noise levels by 3 dBA. For example, a noise source emitting a level of 60 dBA combined with another noise source of 60 dBA results in a combined noise level of 63 dBA, not 120 dBA. It also follows that doubling the volume of traffic that produces a certain amount of noise will result in a 3 dBA increase. This increase in the noise level is generally considered an insignificant change and is not audible by most people. However, a tenfold increase in the number of noise sources will add 10 dBA, which is perceived as twice as loud (USDOT 1980).

Table 3.11-1 shows noise levels of representative sounds. The levels listed in **Table 3.11-1** provide an instantaneous look at representative noise sources. Each of these sources however, will generate varying noise levels during each activity. **Table 3.11-2** shows how most people perceive a given change in sound pressure level.

Noise levels decrease with distance from the noise source. For a roadway, noise levels will decrease 3 dBA over hard ground (concrete or pavement) or 4.5 dBA over soft ground (grass) for every doubled distance between the source and the receiver. For a point source, such as stationary construction equipment or environmental noise generated by the operation of store equipment, noise levels will decrease 6 dBA over hard ground or 7.5 dBA over soft ground for every doubling of the distance.

Another descriptor for environmental noise is the equivalent sound level (Leq). Traffic noise levels described within the noise analysis for this EIS are Leq(h) levels. Leq is defined as a sum of energy-averaged noise levels over a specific period of time; therefore, Leq is a measure of total noise during a given time period. As such, it places more emphasis on occasional high noise levels than accompanying general background noise levels. The Leq can be measured or predicted for a specific time period; the hourly Leq or Leq(h) is recommended by the FHWA for highway noise analyses.

**Table 3.11-1
NOISE LEVELS OF REPRESENTATIVE SOUNDS**

Noise Source (distance)	Decibels (dB)	Description
Jet takeoff (nearby)	150	
Pneumatic riveter	130	
Jet takeoff (60 meters)	120	Pain threshold
Construction noise (3 meters)	110	
Subway train	100	
Heavy truck (15 meters)	90	Constant exposure above this level endangers hearing
Average factory	80	
Busy traffic	70	
Normal conversation (1 meter)	60	
Quiet office	50	Quiet
Library	40	
Soft whisper (5 meters)	30	Very quiet
Rustling leaves	20	
Normal breathing	10	Barely audible
Hearing threshold	0	

Source: Tipler 1976

**Table 3.11-2
PERCEIVED CHANGES IN LOUDNESS RELATIVE TO A CHANGE IN SOUND PRESSURE**

Sound Level Change	Perceived Change in Loudness
-10 dBA	Half as loud
0 dBA	Reference
3 dBA	Barely noticeable increase, generally considered insignificant
5 dBA	Noticeable increase
10 dBA	Twice as loud
20 dBA	Four times as loud

Source: Landau Associates, 2005.

Noise Regulations

The Federal Highway Administration (FHWA) provides policies and guidance to state highway agencies. According to FHWA guidance, traffic noise impacts “occur when the predicted traffic noise levels approach or exceed the noise abatement criteria” shown in **Table 3.11-3**, or “when the predicted traffic noise levels substantially exceed the existing noise levels” (23 CFR §772.5[g]). The FHWA noise abatement criteria are based on the sound level and the nature of the receptor land use (see **Table 3.11-3**). FHWA allows state agencies to define “substantially exceed” and “approach and exceed,” provided that the definition is at least 1 dBA less than the noise abatement criteria values. The FHWA requires that if impacts occur, noise mitigation measures must give primary consideration to exterior areas having frequent human use. FHWA regulations apply to highway traffic noise and transportation projects, not to development projects such as the Proposed Action; however, they are used here as guidelines.

**Table 3.11-3
FHWA AND WSDOT NOISE ABATEMENT CRITERIA**

Activity Category	L_{eq} in dBA	Description of Activity Category (Frequent Human Use Areas)
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A or B above
D	-	Undeveloped lands
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

Source: 23 CFR Part 772.

The Washington State Department of Ecology (Ecology) has established noise level limits at residential, commercial and industrial property lines of neighboring properties (Washington Administrative Code 173-60). The maximum permissible noise levels depend on the land uses of both the noise source property and receiving property. The land use categories or Environmental Designations for Noise Abatement (EDNA) specified in Ecology’s regulations correspond to residential, commercial, and industrial zoning classifications used within the City of Tumwater (TMC 18.40). Ecology environmental noise regulations are limited to noise sources such as concerts, generators, manufacturing plants and commercial/industrial operational activities. Vehicular traffic noise is exempt from Ecology noise limitations.

The WAC outlines the EDNAs, within which maximum permissible noise levels are established. The site is considered a Class B noise source. The surrounding properties are a mix of Class A (residential) and Class B (commercial) noise sources. Maximum permissible noise levels are established for each class of property. These noise levels are shown in Table 4 in **Appendix K**.

As outlined in the WAC, the maximum permissible noise level that can be transmitted to the receiving property for Class A and Class B environments is 57 and 60 dBA, respectively. Between the hours of 10:00 PM and 7:00 AM, the noise limitations shown in Table 4 in **Appendix K** are reduced by 10dBA for Class A receiving properties, resulting in a maximum noise level of 47 dBA received at residential properties. However, at any hour of the day the applicable noise limitations may be exceeded by no more than one of the following:

- 5 dBA for a total of 15 minutes in any 1-hour period
- 10 dBA for a total of 5 minutes in any 1-hour period
- 15 dBA for a total of 1.5 minutes in any 1-hour period.

These EDNA noise levels were used for the evaluation of any onsite operational equipment impacts, such as generators, HVAC units, compressors, and condensers in the noise analysis for this EIS.

Neither the City nor Thurston County has a specific noise ordinance that provides jurisdictional direction for the evaluation of traffic noise levels. Because of this, the FHWA criteria shown in **Table 3.11-3** are used by WSDOT for highway traffic noise and other federally or state funded transportation related projects. The proposed project would be exempt from traffic noise-related impacts and would not fall within the jurisdiction of WSDOT or other state or federally funded programs. The WSDOT criteria were also used as a framework for comparison in the noise analysis for this EIS. WSDOT defines an impact, per FHWA guidelines, as when the predicted traffic noise levels are 1dBA less than the noise abatement criteria shown in **Table 3.11-3**, or when resulting noise levels would be 10dBA or more over existing conditions, provided that the noise level in the year that the proposed project is to open is at least 50 dBA Leq(h). **Table 3.11-3** displays the noise abatement criteria which are noise levels averaged over an hour period (Leq), whereas **Table 3.11-1** shows representative noise levels at an instantaneous measurement (dBA).

The Tumwater Municipal Code defines construction hours as between 7 AM and 8 PM on weekdays and 9 AM and 8 PM on Saturday, and prohibits construction activities that produce noise clearly audible at any dwelling units outside of these hours (TMC 8.08).

Existing Noise Levels

Land uses surrounding the site include commercial/retail development and residential in the central and south end of the site vicinity (the site vicinity for the EIS noise analysis is defined as along Littlerock Road generally from south of Trospen Road to Glenwood Drive SW). To the west and southwest of the site are a middle school, two cemeteries, and numerous residential homes. In addition, a mobile home park is located between two commercial establishments to the northwest of the site. The terrain in the site vicinity is generally flat with residential areas and commercial establishments essentially at the same elevation as the road surface. Ground cover is primarily grass lawns and pavement throughout the site vicinity. The dominant noise source in the site vicinity is vehicular traffic on Littlerock Road; however, other roadways in the area (I-5 to the east, Israel Road SW to the south, and Trospen Road to the north) also generate background noise in the site vicinity. Traffic noise at any specific location can become intermittent, varying with the timing of the signals and the traffic volume. Background noise is a term used to classify the total of all noise in a system or situation, excluding the roadway or other noise source being evaluated (23 CFR 772).

The existing noise environment was characterized by measuring mid-day noise levels at four locations within the site vicinity. These locations were chosen based on their proximity to the site and designated land use, such as residential dwellings or commercial establishments. **Figure 3.11-1** shows the four noise measurement locations. Existing noise levels in the site vicinity range from a low of 60 dBA near Tumwater Middle School to a high of 63 dBA at an apartment complex located 0.3 mile south of the site along Littlerock Road.

In addition to measurements taken in the site vicinity, operational noise levels were measured at a similar, existing Wal-Mart superstore in Marysville, Washington. These measurements are intended to represent operational conditions subsequent to store development at the site in the future, and included noise from unloading merchandise and grocery trucks, as well as the noise generated from the operation of the store's compressor and HVAC units. Merchandise unloading was found to remain relatively quiet (45-55 dBA), with short bursts of noise ranging from 65-70 dBA and occasionally reaching 78 dBA at 70 feet. When the compressor is operating, a consistent noise level of 68 dBA was emitted through the partially screened wall surrounding the compressor.

The noise generated by moving traffic includes sounds from engines, tires, and exhaust. Traffic sound levels are dependent on the number of vehicles, the vehicle speeds, and the percentage of trucks that make up the traffic. Traffic noise levels for the PM peak hour traffic period were modeled for 2005 based on vehicle counts, and assuming that the percentage of trucks on the roadways within the study area ranges from 1 to 2 percent per hour (see **Appendix I**). The modeling was conducted for seven representative receiver locations, as shown in **Figure 3.11-1**. The seven locations represent groupings of sensitive receivers, relative to the proposed project, which share common characteristics, such as proximity, elevation, or use (residential or commercial). The modeling was conducted with the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) computer program, Version 2.2 (see **Appendix K** for discussion of noise modeling software, model calibration, and modeling assumptions).

Table 3.11-4 includes a description of each of the seven representative receiver locations and shows modeled existing noise levels under existing conditions (based on 2005 traffic counts), as well as and future conditions with and without the project at each location (based on 2007 traffic predictions; see below).

Baseline Noise Levels in 2007

Traffic noise modeling was conducted to predict baseline noise levels in 2007 without the proposal. Modeling for the 2007 horizon year was based on the 2005 vehicle counts, growth projections, and the assumption that the percentage of trucks on the roadways within the study area would continue to range from 1 to 2 percent per hour (see **Section 3.9, Transportation and Appendix I** for details). These levels are shown for the seven representative receiver locations in **Table 3.11-4**. Compared with 2005 predicted existing conditions noise levels, baseline noise levels in 2007 (without the proposal) would increase by a maximum of 1 dBA over existing conditions at the representative receivers analyzed. This increase in noise levels is predicted with an estimated 3 percent growth in background traffic volumes (without the proposed project) per year from 2005 through 2007. The highest noise levels would be expected in the residential area represented by Receiver 5, which is predicted to have a noise level of 64 dBA, due to the close proximity of Littlerock Road. As discussed previously, a 1 dBA increase is expected to go unnoticed by the homeowners in this area (noise changes of less than 3 dBA are generally imperceptible; see **Table 3.11-2**).

**Figure 3.11-1
Noise Modeling Locations**

**Table 3.11-4
PREDICTED NOISE LEVELS (in hourly Leq DBA)**

Representative Receiver Number	Description of Location	FHWA / WSDOT Traffic Noise Criteria	2005 Existing Conditions	2007 Baseline Condition/ No Action	2007 Proposed Action	2007 Alternative 1
1	Gas station at north end of site vicinity	72	58	59	65	66
2	Located within mobile home park community in the northern site vicinity	67	61	62	65	65
3	Commercial strip mall	72	62	62	65	65
4	Located at the cemetery, central site vicinity, on the west side of Littlerock Road	67	60	61	64	61
5	Located in a residential area on the eastern side of Littlerock Road, south of the proposed retail store	67	63	64	64	64
6	Located in front of Tumwater Middle School courtyard	67	62	63	63	63
7	Located in a residential area along Littlerock Road in the southern portion of the site vicinity	67	61	62	62	62

Source: Landau Associates, 2005.

3.11.2 Impacts

Proposed Action

Construction

Construction noise levels are difficult to predict. Actual noise levels at any receiver would depend on what type of equipment is being used, the number of pieces of equipment, how often the equipment operates, location within the construction area, and distance to a particular receiver. The primary source of noise is typically heavy equipment, such as heavy trucks. Secondary noise sources include stationary equipment, such as generators and compressors. At times, these secondary sources can be more intrusive to residences, because they operate continuously. Future construction noise is described based on the documented noise levels of typical construction equipment published by the U.S. Environmental Protection Agency (EPA), as shown in **Table 3.11-5**.

**Table 3.11-5
CONSTRUCTION EQUIPMENT NOISE RANGES**

Equipment	Examples	Noise Level (dBA) at 50 ft
Earth Moving	Compactors, loaders, backhoes, tractors, graders, pavers	73 to 96
Materials Handling	Concrete mixers and pumps, cranes, derricks	74 to 88
Stationary	Pumps, compressors, generators	69 to 87
Hauling	Trucks	83 to 94
Impact Equipment	Pile drivers	95 to 106
Impact Tools	Jackhammers, rock drills, pneumatic wrenches	81 to 98

Source: EPA 1971

Depending on the activity, peak noise levels from equipment would most likely range from 69 to 106 dBA at 50 feet from the source; however, noise would decrease with distance from the source at a rate of approximately 6 to 7.5 dBA per doubled distance, and noise levels received further from construction activities would be lower than those listed in **Table 3.11-5**. At 200 feet from the noise source, noise levels from construction equipment would range from 57 to 94 dBA. The closest receivers in the site vicinity are a commercial property and a cemetery located approximately 500 to 600 feet from the proposed retail store; the nearest residences are located approximately 800 feet from the proposed construction area. Noise levels from construction equipment would range from 49 dBA to 68 dBA at a distance of 560 feet and would be lower at 650 feet. Further, construction activities generally are short-term and occur during daylight hours when occasional loud noises are more tolerable. During daylight hours, such noises are exempt from local, state, and federal regulations. Construction would comply with the City's noise regulations prohibiting construction activities that produce noise clearly audible at any dwelling units during nighttime hours (TMC 8.08).

Operational Traffic Noise

The operation of the proposed retail store would contribute to increased noise levels in the site vicinity. The primary source of noise associated with operation of the proposed retail store would be noise from traffic associated with the project, including truck traffic. Traffic noise would be associated with increases in traffic volumes, and, to a lesser extent, the additional flow control improvement (roundabout) planned as part of the proposed City improvements to Littlerock Road (not associated with the proposal) and a traffic signal at the Littlerock Road and Costco/Albany Access intersection proposed by the applicant, because these improvements would require vehicles to accelerate and decelerate more frequently in the site vicinity, thereby contributing to the noise increase (see **Section 3.9**, Transportation).

The Federal Highway Administration (FHWA) Traffic Noise Model (TNM) computer program, Version 2.5, was used to predict traffic noise levels at sensitive receivers in 2007 under the Proposed Action. Modeling for the 2007 horizon year with the project was based on the 2005 vehicle counts, growth projections, and the assumption that the percentage of trucks on the roadways within the study area would continue to range from 1 to 2 percent per hour, including trucks from the proposed project. On average, it is anticipated that fewer than 10 trucks per day would initially deliver merchandise and groceries to the proposed store (see **Section 3.9**,

Transportation and **Appendix I** for details). The results of the analysis were compared to existing conditions (2005) and future baseline (2007) noise levels without the project (see Section 3.11.1, Affected Environment). The results were also compared to established Federal and State noise regulations for the evaluation of potential noise impacts. (See **Appendix K** for further information on traffic noise modeling.) **Table 3.11-4** shows modeled traffic noise levels under the Proposed Action in 2007. Compared to baseline conditions in 2007, noise levels at representative receiver locations under the Proposed Action would be expected to increase by an average of approximately 2 dBA (see **Table 3.11-4**). The Proposed Action is predicted to result in an increase of 4 dBA to 7 dBA over existing noise levels at receivers locations 1, 2, 3, and 4 (see **Figure 3.11-1**). These receivers are located in the area along Littlerock Road, between the southern edge of the cemeteries north to Trosper Road. The maximum noise level predicted is 65 dBA at receiver locations 1, 2 and 3; this represents an increase of 6 dBA at receiver location 1, and 3 dBA at receiver locations 2 through 4, over the 2007 baseline condition. Receiver location 1 represents a commercial area with retail stores; receiver location 2 represents residential uses; locations 3 and 4 represent a commercial strip mall and the cemeteries, respectively. Noise levels at receiver locations 5 through 7 (see **Figure 3.11-1**) would not be predicted to increase over the 2007 baseline condition, because traffic volumes and lane configurations on Littlerock Road would be similar, and distances to the receivers would be great enough that any differences in noise levels would not be perceptible. The predicted noise increase under the Proposed Action, as compared to existing conditions, would generally be 1dBA higher than the noise increase over the 2007 baseline condition. None of the predicted noise levels would approach or exceed the WSDOT noise abatement criteria of 67 dBA for residential areas and 72 dBA for commercial areas, and no significant noise impacts would be expected.

Vibration is a motion that can be felt or heard, or both depending on the speed and the force which causes that motion (Vibration Diagnosis School 2005). For the proposed retail store, vibration may be associated with delivery trucks traveling to and from the site, depending on the surface the trucks are traveling on and the distance of the receivers to the passing truck traffic. The vibration emitted from the delivery trucks would be typical of other commercial trucks in the area and would not significantly impact residences or businesses within the area.

Other Operational Noise Impacts- Based on the noise measurements collected at a similar retail facility, significant store operational noise impacts would not result from the use of compressors or HVAC units, loading or unloading of trucks, or the use of garbage compactors at the site. These facilities would be positioned on the east and south walls of the proposed building. Given the close proximity of I-5 to the east and the distance of the nearest residential sensitive receiver (over 600 feet in any direction), significant impacts to residential receivers would not result, even during nighttime hours. The brief frequency of these noise levels would be within the noise limitations for Class A and Class B EDNA's for daytime noise, would be below background noise levels, and would occur for periods that would be less than Ecology provisions during the nighttime hours. (See **Appendix K** for further information on operational noise modeling methodology.)

Alternative 1

Construction

Construction noise impacts under Alternative 1 would be similar to those described for the Proposed Action; however, construction associated with the relocation of Kingswood Drive would be closer to residential receivers to the south. As under the Proposed Action, construction noise impacts would generally be short-term and occur during daylight hours.

Operational Traffic Noise

Traffic noise levels under Alternative 1 are forecast to be within 1 dBA of noise levels under the Proposed Action; however, noise levels in the area of receiver location 4, which represents the closest receiver location (see **Table 3.11-4**), would be on average 3 dBA lower than under the Proposed Action, based on the location of the Littlerock Road/Kingswood Drive intersection further south (see **Figure 2-7**). The maximum noise level increase over the 2007 baseline condition would be 7 dBA and would occur at receiver location 1, as compared to an increase of 6 dBA at this location under the Proposed Action. As under the Proposed Action, noise levels would not approach or exceed FHWA/WSDOT noise abatement criteria, and no significant noise impacts would be expected. The impacts of vibration would be similar to under the Proposed Action, and would not be expected to be significant.

Under Alternative 1 the proposed retail store and Kingswood Drive would be situated further south than under the Proposed Action. However, results of the noise modeling indicated that this change in store location would not significantly change the predicted noise levels between the Proposed Action and Alternative 1, because under both development alternatives the traffic volumes and lane configurations on Littlerock Road would be similar, and distances to the receiver locations would be great enough that any differences in noise levels would not be perceptible.

Other Operational Noise Impacts- The facility-related equipment and unloading zones would remain in the same locations under Alternative 1 as under the Proposed Action. Therefore, store operational noise impacts would be the same as under the Proposed Action.

No Action Alternative

Noise conditions under the No Action Alternative would be the same as those described for the baseline condition in 2007. While other development on the site could be proposed in the future, future noise conditions resulting from such development would likely be similar to those described for the Proposed Action and Alternative 1. No significant noise impacts would be expected.

3.11.3 Mitigation Measures

Construction

To reduce construction noise at nearby receivers, construction-industry best management practices would be incorporated into construction plans and contractor specifications, including:

- Limiting noisier construction activities to 7 AM to 8 PM during weekdays and 9 AM to 8 PM on Saturday to comply with the Tumwater Municipal Code noise regulations (TMC 8.08) and reduce construction noise impacts during sensitive nighttime hours.
- Equipping engines of construction equipment with adequate mufflers, intake silencers, or engine enclosures that would reduce their noise by 5 to 10 dBA.
- Turning off construction equipment when not in use for long periods of time to eliminate noise from construction equipment during those time periods.
- Requiring contractors to maintain all equipment and training their equipment operators to reduce noise levels and increase efficiency of operation.
- Locating stationary equipment away from receiving properties to decrease noise, as feasible.

Operation

- No mitigation measures related to operation of the proposed retail store or associated traffic would be required. However, best available mitigation alternatives could be implemented to limit operational noise (see **Appendix K**, Section 9 for further information on mitigation measures.)

3.11.4 Significant Unavoidable Adverse Impacts

None would be expected.