

Noise Analysis Report Tumwater Retail Tumwater, Washington

January 5, 2006

Prepared for

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1.0 INTRODUCTION

Wal-Mart Corporation is proposing to construct a 207,700-square-foot (ft²) retail store on an approximately 21-acre site within the City of Tumwater (City), Washington (Figure 1). The proposed retail shopping area will be a one-story building approximately 30 ft in height and will include associated parking areas. Loading docks for supply trucks will be located along the east side of the building facing Interstate 5 (I-5). A lease lot will be located at the north end of the site for the future establishment of a gasoline service station.

This report evaluates both potential traffic noise and environmental noise impacts resulting from the proposed project. The report evaluates these two noise sources separately because they are regulated by different local, state, and federal agencies and have different noise impact criteria. The noise generated by moving traffic is complex and depends on the number of vehicles, vehicle speeds, and the percentage of trucks traveling on the roadway. Environmental noise includes noise sources other than traffic, such as generators, construction equipment, commercial/industrial store operation, and concerts.

This report includes a discussion of the characteristics of noise, a review of traffic-related and environmental noise regulations, a description of the analysis methods, and identification of any potential traffic-related or environmental noise impacts from the retail store. Construction and mitigation methods are also presented.

1.1 DESCRIPTION OF ALTERNATIVES

Two development alternatives are proposed for the project, the Proposed Action and Alternative 1. Under both development alternatives, the proposed retail store will be located in the eastern portion of the 21-acre lot. A signalized intersection will be installed to ease traffic congestion at the intersection of Littlerock Road and the Costco/Albany access.

Under the Proposed Action, Kingswood Drive would divide the parking lot of the proposed retail store into two separate parking areas (Figure 2), leaving parking available on either side of this roadway. Access points on Kingswood Drive will allow vehicles to enter either parking lot. A vehicle roundabout at the intersection of Kingswood Drive and Littlerock Road is included as part of the City's planned improvements to Littlerock Road and is included in the design of this alternative. The purpose of this roundabout is to slow vehicle speeds in the project area and keep a constant flow of traffic along Littlerock Road.

Alternative 1 would realign Kingswood Drive at the southern end of the site (Figure 3); this roadway would not divide the parking lot into two areas and create a crossing hazard. Several access

points from the proposed retail store's parking lot will connect to Kingswood Drive to allow vehicles to enter and exit the lot.

1.2 METHOD OF ANALYSIS

This noise study evaluates impacts and mitigation needs related to the two development alternatives described above. The existing noise environment was characterized by measuring noise levels at representative receiver locations within the study area. Construction noise is described based on the documented noise levels of typical construction equipment published by the U.S. Environmental Protection Agency (EPA).

The Federal Highway Administration (FHWA) Traffic Noise Model (TNM) computer program, version 2.5, was used in this analysis to predict traffic noise levels at sensitive receivers for current roadway use (2005 existing conditions), a 2007 no action (no build) alternative, and the 2007 year of building opening (Proposed Action and Alternative 1). Modeled results of the no action and two development alternatives were compared to established federal and state noise regulations to evaluate potential noise impacts resulting from the proposed project. The analysis of traffic noise impacts and mitigation is consistent with FHWA and Washington State Department of Transportation (WSDOT) guidance and criteria. Additional information on the modeling methods is presented in Section 4.0.

2.0 CHARACTERISTICS OF NOISE

2.1 NATURE OF SOUND

Sound is created when objects vibrate, resulting in a variation in surrounding atmospheric pressure called sound pressure. The human response to sound depends on the magnitude of a sound as a function of its frequency and time pattern (EPA 1974). Magnitude describes the physical size of sound waves in the air. The range of magnitude from the faintest to the loudest sound humans can hear is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). Loudness, compared to physical sound measurement, refers to how people subjectively judge a sound. This varies from person to person. Table 1 shows typical decibel levels of representative sounds measured over a few seconds.

**TABLE 1
NOISE LEVELS OF REPRESENTATIVE SOUNDS**

Noise Source (distance)	Decibels (dBA)	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

Humans also respond to a sound's frequency or pitch. Environmental noise is composed of many frequencies, each occurring simultaneously at its own sound pressure level. As measured by an electronic sound level meter, frequency "weighting" combines the overall sound frequency into one sound level. The commonly used frequency weighting for environmental noise is A-weighting (dBA), which estimates how an average person hears sounds [U.S. Department of Transportation (USDOT) 1980].

Because of the logarithmic nature of the decibel scale, doubling the number of noise sources increases noise levels by 3 dBA. Thus, 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. This example illustrates that doubling the number of noise sources, such as doubling the traffic volume, will result in a 3 dBA increase. This increase in the noise level is generally considered an insignificant change and is not audible to 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 2 indicates how most people perceive a given change in sound pressure level.

**TABLE 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

2.2 DESCRIPTION OF NOISE

A descriptor for noise is the equivalent sound level (L_{eq}). L_{eq} is defined as a sum of energy-averaged noise levels over a specific period of time. It is a measurement of total noise or a summation of all sounds during a time period. As such, it places more emphasis on occasional high noise levels than accompanying general background noise levels. The L_{eq} measured or predicted for a 1-hour period is the hourly L_{eq} or $L_{eq}(h)$, and is recommended by the FHWA for highway traffic noise analyses. Similarly, noise level results within this report are assumed to be $L_{eq}(h)$.

Noise levels decrease with distance from the noise source. For a traffic-related noise, noise levels will decrease 3 dB over hard ground (concrete or pavement) or 4.5 dB 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.

3.0 FEDERAL, STATE, AND LOCAL REGULATIONS AND POLICIES

3.1 TRAFFIC-RELATED NOISE REGULATIONS

3.1.1 FEDERAL REGULATIONS

Responding to the problem of traffic noise, the FHWA provides policies and guidance to state highway agencies in the U.S. Code of Federal Regulations (CFR) *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 CFR 772).

FHWA guidance indicates that traffic noise impacts “occur when the predicted traffic noise levels approach or exceed the noise abatement criteria” as shown in Table 3, or “when the predicted traffic noise levels substantially exceed the existing noise levels” [23 CFR §772.5(g)].

The regulations set forth by the FHWA attempt to establish a balance between reasonable levels of noise and the feasibility of obtaining those levels. The 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. According to the FHWA regulations, if impacts occur, noise mitigation measures must be evaluated with primary consideration given to exterior areas having frequent human use.

**TABLE 3
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.

Under normal circumstances, FHWA does not require any modeling or detailed analysis for construction traffic noise due to the temporary nature of the noise. Most projects will fall under this general provision provided that construction is scheduled for daylight hours and the construction period will be short term or phased to provide noise-related relief to nearby sensitive receivers. Impacts from construction noise are generally not serious; however, FHWA does require that potential impacts be generally identified and a reasonable effort made to include abatement measures into the project plans and specifications (23 CFR §772.19).

3.1.2 STATE AND LOCAL REGULATIONS

Both the City and Thurston County do not have a specific noise ordinance that provides jurisdictional direction for the evaluation of traffic noise. The City and County have adopted the Washington State Department of Ecology (Ecology) noise regulations as defined in Washington Administrative Code (WAC) 173-60; however, these regulations do not apply to traffic-related noise. Additional information regarding WAC 173-60 is discussed in Section 3.2 below.

The guidance and evaluation methods of WSDOT have been used to predict traffic-related noise levels within the project area. WSDOT's noise abatement criteria (Table 3) are used for highway traffic noise and other state and federally funded transportation-related projects. Because the onsite roadway development associated with the proposed retail store will not be completed with any federal or state funds, this local retail development project is not required to perform a traffic-related noise impact evaluation and does not fall within the jurisdiction of WSDOT or federal programs. However, the WSDOT noise criteria were used in this report to provide a technical framework for comparison purposes to state-approved criteria.

As discussed in Section 3.1.1, WSDOT defines FHWA's terms "approach or exceed" as 1 dBA less than the noise abatement criteria (Table 3) and "substantially exceed" as a 10 dBA increase over existing conditions, provided that the design year (year that the proposed project is to open) noise level is at least 50 dBA $L_{eq}(h)$ (WSDOT 1997).

The FHWA and WSDOT noise abatement criteria are noise standards that specify exterior noise levels for various land activity categories where frequent human use occurs, as presented in Table 3. Table 3 displays the noise abatement criteria, which are noise levels averaged over a 1-hour period (L_{eq}), whereas Table 1 shows representative noise levels measured over a few seconds. For residences, parks, schools, churches, and similar areas, the noise abatement criterion is 67 dBA. Because approach is defined to be within 1 dBA, traffic noise impacts at these receivers would occur if predicted noise levels are 66 dBA or higher. Similarly, for commercial establishments, the noise abatement criterion is 72 dBA, and traffic noise impacts at these locations would occur if predicted noise levels are 71 dBA or higher.

WSDOT has adopted FHWA policies on construction noise, which is discussed in Sections 7.1 and 8.0. Construction hours are defined in the Tumwater Municipal Code (TMC), which outlines construction windows between the hours of 7 a.m. and 8 p.m. on weekdays and 9 a.m. and 8 p.m. on Saturday, with construction prohibited on Sunday (TMC 8.08).

3.2 ENVIRONMENTAL NOISE REGULATIONS

3.2.1 STATE AND LOCAL REGULATIONS

Both the City (TMC 18.40.30) and Thurston County (Thurston County Code 21.57.030) have adopted Ecology's environmental noise regulations (WAC 173-60). Ecology regulates only environmental noise, which is limited to noise sources such as concerts, generators, manufacturing plants, and other commercial/industrial operational activities. Vehicular traffic noise is exempt from Ecology's noise limitations.

Ecology is responsible for establishing maximum noise levels allowed in an area or environment and, in particular, limitations of noise at property lines (WAC 173-60). The land use categories or Environmental Designations for Noise Abatement (EDNAs) specified in Ecology's regulations correspond to residential, commercial, and industrial zoning classifications determined by the City. The maximum noise level allowed at a property boundary depends on the current land use (EDNA) of both the noise source and receiving property (property where the noise is audible). The WAC outlines the EDNAs, which establish maximum permissible noise levels at property boundaries. Various properties are grouped as followed:

- **Class A:** Often classified by local governments as residential. Lands where human beings reside and sleep: residences, multiple family living accommodations, recreational and entertainment properties (camps, parks, and camping facilities), and community services (hospitals, health and correctional facilities).
- **Class B:** Often classified by local governments as commercial. Lands involving uses that require protection against noise interference with speech: retail services, recreation and entertainment not used for habitation (schools, churches, cultural facilities), and commercial living/dining establishments (hotels/motels, restaurants).
- **Class C:** Often classified by local governments as industrial. Lands involving economic activities of such a nature that higher than average noise levels are to be anticipated: storage and warehouse facilities, property used for production of crops, and wood products or livestock.

The proposed retail store is considered a Class B noise source. The surrounding land uses (receiving property) are a mix of Class A (residential) and Class B (commercial) environments. Maximum permissible noise levels are established for each class of property. These noise levels are outlined in Table 4.

**TABLE 4
MAXIMUM PERMISSIBLE ENVIRONMENTAL NOISE LEVELS (IN DBA)**

EDNA Noise Source	EDNA Receiving Property		
	Class A	Class B	Class C
Class A	55	57	60
Class B	57	60	65
Class C	60	65	70

Source: WAC 173-60

As outlined in the WAC, the maximum permissible noise levels that can be transmitted to the receiving property for Class A and Class B environments are 57 and 60 dBA, respectively. Between the hours of 10 p.m. and 7 a.m., the noise limitations outlined in Table 4 are reduced by 10 dBA 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 in this report to evaluate any onsite operational equipment impacts from the proposed project, such as noise from generators, HVAC units, compressors, and condensers.

4.0 ANALYSIS METHOD

4.1 FIELD DATA

Noise in the project area was measured in accordance with WSDOT and FHWA policies. A Type II sound level meter with microphone located 5 ft aboveground was used to measure the noise at specific points within the project area.

4.1.1 TRAFFIC NOISE LEVEL DATA

Noise levels were measured at four locations surrounding the proposed retail store in the project area to establish accurate noise measurements of the existing environment. Figure 4 shows the four locations (represented in yellow) where field noise measurements were taken. These locations were chosen based on their proximity to the proposed site location and designated land use, such as residential dwellings or commercial establishments. The results of these measurements indicate that existing noise levels in the study area range from a low of 60 dBA near Tumwater Middle School to a high of 63 dBA at an apartment complex south of the project area along Littlerock Road.

Sound levels were collected over time periods ranging from 10 to 15 minutes to ensure statistically accurate estimates. These measurements were collected during mid-day and were used to calibrate the noise model. Measurements are best collected during times when traffic is not congested, as during peak traffic hours. The movement of the vehicles through the project area allows for accurate collection of noise measurements and associated traffic counts.

4.1.2 ENVIRONMENTAL NOISE LEVEL DATA

Additional noise levels were measured at a Wal-Mart retail facility that is similar to the facility proposed for the Tumwater area. These store-related noise levels were collected at the Wal-Mart retail facility in Marysville, Washington. These measurements included the unloading of merchandise and grocery trucks as well as the noise generated from the operation of the compressor. Measurements were taken from a distance of 70 ft from the noise source for periods of 5 to 15 minutes. Merchandise unloading was found to be relatively quiet (45-55 dBA) with short bursts (1-3 seconds) of noise ranging from 65 to 70 dBA and occasionally reaching 78 dBA. Noise levels were also collected from operation of the compressor at a distance of 70 ft. When operated, a consistent noise level of 68 dBA was emitted through the partially screened wall surrounding the compressor.

4.2 TRANSPORTATION DATA

Vehicular travel patterns for the evening rush hour (PM peak hour) traffic period are estimated for the existing year and predicted for 2007 both with and without the project. Existing and future peak hour traffic volumes from the proposed retail store are based on vehicle counts and growth projections. The projected traffic volumes for the project are specified in the *Transportation Impact Analysis* (The Transpo Group 2005) and have been used in this noise analysis.

The TNM divides all vehicles into automobiles, medium trucks, heavy trucks, buses, and motorcycles. Medium trucks are defined as cargo vehicles with two axles and six wheels, and heavy trucks as cargo vehicles having three or more axles. According to vehicle classification data outlined in the *Transportation Impact Analysis*, the percentage of trucks on the roadways within the study area ranges from 1 to 2 percent, which includes both medium and heavy trucks. Future truck traffic related to the proposed retail store is included in the 2 percent heavy trucks predicted along Littlerock Road. This provides a “worst-case” approach. The *Transportation Impact Analysis* (The Transpo Group 2005) suggests that on average fewer than 10 trucks per day will be needed initially for merchandise or grocery delivery.

Several roadways surround the proposed project site. Littlerock Road is one of the roadways classified as a minor arterial that provides a north-south connection between Trosper Road and Israel Road SW. This roadway will provide the main access to the proposed site. Littlerock Road varies between two and five lanes closer to the Trosper Road intersection.

4.3 TRAFFIC NOISE MODELING

A traffic noise analysis was performed for 2005 existing conditions, 2007 no action, and 2007 year of opening with both the Proposed Action and an Alternative 1. Computer models were the primary tool for determining traffic noise levels with and without the proposed project.

The FHWA TNM computer program, version 2.5, was used to predict traffic noise levels at multiple locations for each of the analyses mentioned above. The software allows for a variety of modeling elements to be included, such as traffic lanes, flow control devices (stop signs or signals), ground cover, changes in topography, intervening barriers (fences, buildings, or natural elements), and traffic volume and speed information. Each of these elements affects the noise level at any given location.

4.3.1 TRAFFIC MODEL CALIBRATION

Each project area has its own unique terrain, topography, vehicle distribution, man-made and natural barriers, and flow control devices. The TNM is capable of modeling many elements of a project area. Computer models must be calibrated with the field measurements made specifically at each unique project site. With this method, confidence in predicted noise levels is achieved.

Model calibration is performed by creating a base model of the project area and comparing the results of the predicted noise levels with the field-measured noise levels. If base model results fall within 2 dBA of the field-measured data, the base model is considered valid and the project-related models (action and no action models) are developed using the calibrated base model. If the base model results do not fall within 2 dBA, model elements are edited until the model is accurately calibrated. Table 5 presents the successful model calibration results.

**TABLE 5
MODEL CALIBRATION RESULTS**

Field Measurement Location	Measured Noise Level (dBA)	TNM Predicted Noise Level (dBA)	Difference between TNM and Actual Noise Levels (dBA)
1	60	62	+2
2	62	62	0
3	62	64	+2
4	63	63	0

4.3.2 TRAFFIC MODEL ASSUMPTIONS

Model assumptions for the TNM included “worst-case” assumptions to predict conservative noise level results for existing conditions and both the no action and action alternatives. This “worst-case” approach includes conservative selection of model inputs, such as ground surface, traffic volumes, vehicle type, and weather. Key assumptions used for the TNM include:

- TNM default values of 50 percent relative humidity, 20°C temperature, and average pavement type were used.
- The height above ground for all receivers was 1.5 meters (approximately 5 ft), which corresponds to ear height.
- The ground surface for the overall study area was assumed to be pavement, providing a “worst-case” sound level result.
- The highest PM peak hour traffic volumes were used on roadways in the project area to predict conservative, “worst-case” results.
- The percentage of trucks on the roadways within the project area ranges from 1 to 2 percent, which includes both medium and heavy trucks. Other than automobiles, heavy trucks were

the only other vehicle modeled in TNM. 2 percent was used for all TNM models, which provides conservative results or a “worst-case” scenario.

Based on the use of “worst-case” model inputs in the TNM, actual noise levels are expected to be lower than predicted levels during off peak hours.

5.0 AFFECTED ENVIRONMENT

5.1 LAND USES

The proposed project site is located along the east side of Littlerock Road in the City of Tumwater (Figure 1). Land uses surrounding the proposed site include commercial/retail development located predominately in the north end of the project area and transitioning to residential in the central and south end of the project area. The proximity of these land uses to surrounding roadways, I-5 to the east, Littlerock Road immediately to the west, Israel Road SW to the south, and Trospen Road to the north of the site, generate a steady flow of traffic in the project area. These arterials service the majority of the traffic in the area.

The proposed site is bounded by two large commercial establishments, one is Costco to the north and the other is Home Depot to the south. Also, several restaurants, gasoline stations, strip malls, an automobile auction and junk yard, and a few office buildings are located within the site vicinity along Littlerock Road. To the west and southwest of the proposed site are a middle school, two cemeteries, and numerous residences. In addition, a mobile home park is present between two commercial establishments to the northwest of the project site.

5.2 TERRAIN

The terrain in the site vicinity is generally flat with residential areas and commercial establishments at the same elevation as the road surface. Ground cover is primarily manicured lawns and pavement throughout the project area.

5.3 EXISTING CONDITIONS

The dominant noise source in the study area is vehicular traffic on Littlerock Road; however, other roadways surrounding the project area I-5 to the east, Israel Road SW to the south, and Trospen Road to the north—also generate background noise in the project area. Background noise is a term used to classify the total of all noise in a system or situation excluding the roadway being evaluated (23 CFR 772), in this case Littlerock Road.

Littlerock Road is one of the roadways classified as a minor arterial that provides a north-south connection between Trospen Road and Israel Road SW. This roadway will provide the main access to the project site and is a major contributor to existing vehicle noise. The roadway varies between two and five lanes.

Existing nearby commercial businesses, residences, and offices produce minor noise levels compared to existing traffic noise. Due to the positioning of traffic signals surrounding the study area and multiple lanes that run in each direction of Littlerock Road, traffic noise at any specific location can become intermittent, varying with the timing of the signals and the traffic volume.

For comparison purposes, Table 6 shows the seven representative receiver locations within the study area for the existing 2005 noise levels versus the WSDOT/FHWA traffic impact criteria. Determination of the existing conditions year (in this case 2005) was based on data generated by The Transpo Group and presented in the *Transportation Impact Analysis* (The Transpo Group 2005). Representative receivers were selected based on their location to represent a grouping of sensitive receivers, which share common characteristics such as the same elevation, location in the project area, or similar activity type (residential or commercial property). Each representative receiver location is identified on Figure 4 and in Table 6. As shown in Table 6, all receivers currently experience noise levels below the FHWA/WSDOT noise impact criteria.

**TABLE 6
PREDICTED EXISTING TRAFFIC NOISE LEVELS (IN DBA)**

Representative Receiver Number	Description of Location	FHWA / WSDOT Traffic Noise Criteria	2005 Existing Conditions
1	Retail store at north end of project area	72	58
2	Located within mobile home park community in the northern project area	67	61
3	Commercial strip mall	72	62
4	Located at the cemetery, central project area, on the west side of Littlerock Road	67	60
5	Located in a residential area on the western side of Littlerock Road, south of the proposed retail store	67	63
6	Located in front of Tumwater Middle School courtyard	67	62
7	Located in a residential area along Littlerock Road south of the project area	67	61

6.0 TRAFFIC NOISE LEVELS

6.1 NO ACTION ALTERNATIVE

Compared with 2005 existing conditions noise levels, the no action alternative will increase noise in the project area by a maximum of 1 dBA at the representative receivers analyzed. This increase in noise level is predicted with an estimated 3 percent growth in traffic volumes (The Transpo Group 2005) per year from 2005 through 2007 without the proposed retail store being built. The highest noise levels can be expected in the residential area represented by Representative Receiver 5, which is predicted to have a noise level of 64 dBA (Table 7). This is due to the proximity of Littlerock Road to the residences in that area. As discussed in Section 2.1, a 3 dBA increase is generally not perceivable; this 1 dBA increase is expected to go unnoticed by the homeowners at this location.

**TABLE 7
PREDICTED TRAFFIC NOISE LEVELS (IN DBA)**

Representative Receiver Number	Description of Location	FHWA / WSDOT Traffic Noise Criteria	2005 Existing Conditions	2007 No Action	2007 Proposed Action	2007 Alternative 1
1	Retail store at north end of project area	72	58	59	65	66
2	Located within mobile home park community in the northern project area	67	61	62	65	65
3	Commercial strip mall	72	62	62	65	65
4	Located at the cemetery, central project area, on the west side of Littlerock Road	67	60	61	64	61
5	Located in a residential area on the western 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 south of the project area	67	61	62	62	62

6.2 OPERATIONAL IMPACTS OF ALTERNATIVES: TRAFFIC

The operation of the proposed retail store will contribute to increased noise levels in this area due to the increase in traffic volumes. Compared to 2005 existing conditions, noise levels at representative receiver locations are expected to increase on average 3 dBA for both the Proposed Action and Alternative 1. Comparing both development alternatives in 2007, noise levels are expected to increase by a maximum of 8 dBA at Representative Receiver 1 under Alternative 1. Another contributing element for

increased noise levels, although minor, is an additional flow control device (roundabout) planned as part of the proposed City improvements to Littlerock Road. These planned improvements, a new traffic signal at the Littlerock Road and Costco/Albany access intersection, and the increased project-related traffic will require vehicles to accelerate and decelerate more frequently in the project area, which would contribute to the noise increase in the project area.

Vibration is a motion that can be felt, heard, or both, depending on the speed and the force that causes the 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 should not adversely affect residences or businesses within the area.

Under the Proposed Action and the Alternative 1 in 2007, the predicted noise levels would be similar. Noise levels would be similar because traffic volumes and roadways (i.e., Littlerock Road) would be similar under both development alternatives.

6.2.1 PROPOSED ACTION

The 2007 Proposed Action for the proposed retail store is predicted to increase traffic noise levels 4 to 7 dBA over existing conditions at Representative Receivers 1, 2, 3, and 4. Four of the seven representative receiver locations are in the area along Littlerock Road between the southern edge of the cemetery and north to Trosper Road (Figure 4, represented in blue). The maximum noise level predicted is 65 dBA, which is an increase of 7 dBA over existing conditions, and will occur at the locations represented by Receiver 1. This receiver represents a commercial area with retail stores. The noise level increase will occur as result of increased traffic volumes and the traffic signal at the intersection of Littlerock Road and Trosper Road. The noise levels predicted in this northern area will not approach or exceed the WSDOT noise abatement criterion of 67 dBA for residential areas and 72 dBA for commercial areas. Mitigation measures will not need to be considered.

Representative Receivers 5 through 7 (Figure 4, represented in blue) are predicted to increase an average of 1 dBA over existing noise levels. These three representative receiver locations are at the southern edge of the cemetery and south to Israel Road SW. This area is expected to experience traffic volume increases by an average of 30 percent; a 50 percent increase in traffic volumes would be required for noise levels to increase by 3 dBA, a noise level change barely noticeable to most humans. In addition, this portion of the roadway lacks traffic signals, so vehicles can travel this stretch with minimal acceleration and deceleration events that contribute to increased noise levels. None of the receivers in

this area will approach or exceed the FHWA/WSDOT noise abatement criterion of 67 dBA for residential areas and will not require consideration of mitigation measures.

Both the Proposed Action and Alternative 1 will provide adequate parking for customers using the retail store. Traffic noise levels were predicted for receivers in the project area, including noise generated from vehicles traveling to and from the retail store but not within the parking lot itself. In a typical parking lot setting, physical constraints do not allow vehicles to reach speeds that would generate noise levels above background noise levels (traffic noise levels within the project area.) Again, traffic noise level predictions generated by the TNM for sensitive receivers surrounding the proposed retail store were modeled with inputs to provide a conservative or “worst-case” scenario. These model inputs include using pavement as a surface layer for 100 percent of the project area, modeling only PM peak hour traffic volumes, and combining all medium and heavy trucks and modeling them as heavy trucks. Trucks associated with the proposed retail store may continue delivery operations during non-peak hours. This specific situation was not modeled in the TNM because the highest volume of vehicles on the roadway, cars and trucks alike, will occur during the PM peak hours. This modeling effort provides a “worst-case” forecast of traffic-related noise expected in the project area because it is the volume of vehicle increase, not just truck traffic alone, that has the greatest effect on increasing noise levels over an averaged hourly period. The noise levels associated with truck traffic during non-peak periods can be expected to fall below the predicted hourly L_{eq} noise levels outlined in Table 7 due to the reduced volume of all vehicles on these roadways during non-peak periods.

6.2.2 ALTERNATIVE 1

In 2007, Alternative 1 is predicted to result in noise levels within 1 dBA of the Proposed Action, with the exception of sensitive receivers represented by Receiver 4 (Table 7). In this area, noise levels decreased on average by 3 dBA. This decrease in noise would result from the Littlerock Road and Kingswood Drive intersection being relocated farther south than the Proposed Action (Figure 4), removing the intersection-associated noise away from these receivers. As mentioned above, the maximum noise level increase of 8 dBA would occur at Representative Receiver 1 under Alternative 1.

The site plan for Alternative 1 has the proposed retail store and Kingswood Drive situated farther south. However, results of the noise modeling indicated that this change in store location will not significantly change the predicted noise levels between the two development alternatives because both plans have similar traffic volumes, lane configurations, and flow control devices. Noise levels for these site plans will not approach or exceed the FHWA/WSDOT noise abatement criteria of 67 dBA for residential areas and 72 dBA for commercial areas. Mitigation measures will not need to be considered.

7.0 ENVIRONMENTAL NOISE LEVELS

7.1 NO ACTION

If the proposed retail facility is not constructed, noise levels in the area will continue to increase from traffic noise within the project area. The expected noise results are the same as those described in Section 6.1.

7.2 OPERATION IMPACTS OF ALTERNATIVES: ENVIRONMENTAL NOISE

7.2.1 PROPOSED ACTION

Based on the noise measurements collected at a similar Wal-Mart retail facility in July 2005, no significant store operational environmental noise impacts will result from compressors, HVAC units, loading or unloading trucks, or garbage compactors at the site. These facilities would be positioned on the east and south walls of the proposed retail store. Given the proximity of I-5 to the east and the nearest sensitive receiver (more than 500 to 600 ft in any direction) even during sensitive nighttime hours, distance alone will prevent the facility-related noise from impacting any residential receivers.

The facility-related noise is a stationary source, like construction noise, and will dissipate 6 to 7.5 dBA for every doubling of distance to the receiver. During the noise collection at a similar facility, the unloading of trucks and an operating compressor measured noise levels between 65 and 70 dBA at a distance of 70 ft. Because the nearest sensitive noise receiver is 500 to 600 ft away, these noise levels will drop to between 44 and 49 dBA at 560 ft from the east and south sides of the retail development, levels that are not expected to be distinguished from other background noise sources in the area. The short instantaneous noise bursts from the stationary truck unloading that were measured at a similar facility up to 78 dBA at 70 ft are expected to drop below 57 dBA at 560 ft from the project site boundary and 51 dBA at 1,000 ft from the project site boundary. Again, at the distance to the nearest receivers (500 to 600 ft), these noise levels will not only be overshadowed by the adjacent traffic from I-5 to the east, but also will be within the noise limitations for Class A and Class B EDNAs for daytime noise. These noise levels also will occur for far shorter periods than the Ecology provisions outlined in Section 3.2.1 during the nighttime hours.

Table 8 displays the distances from the proposed retail store to each representative receiver location and the estimated maximum environmental noise levels generated by operation of the proposed retail facility. Because the main source of noise (background noise) within the project area is traffic,

Table 8 also includes the 2005 existing noise levels calculated for the traffic noise analysis as a comparison.

Noise levels resulting from the operation of the proposed retail store are expected to be at or below the WAC environmental noise regulations and the traffic noise levels or other background noise in the area at all receivers during the daytime and nighttime hours.

7.2.2 ALTERNATIVE 1

The facility-related equipment and unloading zones remain in the same location for the east side of the property under Alternative 1. Results for the store operational noise impacts are the same as described above in Section 7.3.

**TABLE 8
OPERATIONAL NOISE RANGES¹**

Representative Receiver Number	Description of Location	Approximate Distance from Proposed Retail Store (ft)	Ecology Noise Regulations (WAC 173-60) (daytime)	Ecology Noise Regulations (WAC 173-60) (nighttime)	2005 Existing Conditions (Background with traffic)	Estimated Environmental Noise Level (dBA) ²
1	Retail store at north end of project area	1,800	60	NA	58	46
2	Located within mobile home park community in the northern project area	1,000	57	47	61	51
3	Commercial strip mall	560	60	NA	62	57
4	Located at the cemetery, central project area, on the west side of Littlerock Road	560	60	NA	60	57
5	Located in a residential area on the western side of Littlerock Road, south of the proposed retail store	1,600	57	47	63	47
6	Located in front of Tumwater Middle School courtyard	1,800	60	NA	62	46
7	Located in a residential area along Littlerock Road south of the project area	3,000	57	47	61	41

1 Noise levels were estimated for the short instantaneous noise bursts from the stationary truck unloading since it was found to have a higher noise level than operational compressor use. A 7 dBA reduction was used for every doubling of distance to the receiver.

2 Stationary truck noise from operation of the retail store will be below background noise levels and will not be noticeable in these areas.

8.0 CONSTRUCTION IMPACTS

Construction noise levels under both the Proposed Action and Alternative 1 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 residential uses because they operate continuously.

Depending on the activity, peak noise levels from equipment would most likely range from 69 to 106 dBA at 50 ft (EPA 1971). Construction noise at receivers farther away would decrease at a rate of approximately 6 dBA per doubled distance from the source. Because construction equipment would not constantly operate at distances of 50 ft, average L_{eq} noise levels during the day would be less than the noise levels presented in Table 9.

The nearest sensitive receivers to the project site are located approximately 500 to 600 ft away. At this distance, a commercial property is located to the east of the project site and a cemetery is located to the west of the project site. Extrapolating from Table 9, noise levels from construction equipment would range from 49 dBA to 86 dBA at the closest sensitive receiver approximately 560 ft away.

Construction activities generally are short-term and occur during daylight hours when occasional loud noises are more tolerable and exempt from local, state, and federal regulations.

**TABLE 9
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 traveling on roadway	83 to 94
Impact Equipment	Pile drivers	95 to 106
Impact Tools	Jackhammers, rock drills, pneumatic wrenches	81 to 98

Source: EPA 1971

9.0 MITIGATION MEASURES

9.1 OPERATIONAL MITIGATION-TRAFFIC NOISE

Noise can be controlled at three locations: 1) at the source, with mufflers and quieter engines; 2) along the noise path with barriers; and 3) at the receiver with insulation. Noise abatement is necessary only where noise levels exceed the noise abatement criteria (Table 3) and frequent human use occurs (USDOT 1982).

Noise at receivers representing areas of frequent human use (houses and commercial establishments) in the project area would not approach or exceed the traffic noise abatement criteria of 67 dBA for residential areas or 72 dBA for commercial areas. If this project were receiving any state or federal funds, the results would demonstrate, according to WSDOT and FHWA criteria, that mitigation measures do not need to be considered.

9.2 OPERATIONAL MITIGATION-ENVIRONMENTAL NOISE

For equipment related to the operation of the retail store, including truck loading and unloading facilities, noise levels will fall below Ecology's EDNA maximum permissible noise allowances during both the daytime and evening periods at all sensitive receivers in the project area. Additionally, all the equipment required for the operation of the retail store such as truck loading and unloading facilities would be located on the east side of the property with specified containment walls that provide insulation, privacy, and security screens and also some noise mitigation. Noise emitted during non-peak hour delivery will not be noticeable to sensitive receivers in the area because of the above mentioned containment walls, the retail store itself acting as a noise barrier, distance between the retail store and receivers, and because surrounding roadways (I-5) will generate background noise. With these findings for facility operation noise, no mitigation measures are warranted.

Best available mitigation alternatives could consider simple noise control methods. These include restricting the use of trash compactors during nighttime hours and scheduling the delivery of merchandise and grocery trucks to the most reasonable afternoon and evening hours as much as possible. Another noise mitigation feature can include restricting loading trucks from idling while parked. Signs posted onsite can help remind delivery drivers of the noise mitigation efforts. Our findings for both traffic and facility operations suggest that no other noise mitigation measures are warranted.

9.3 CONSTRUCTION MITIGATION

Construction noise could be reduced by providing mufflers on engines, using quieter equipment or construction practices, and turning off equipment when not in use. To reduce construction noise at nearby receivers, construction-industry best management practices would be incorporated into construction plans and contractor specifications. The proposed project would include the following construction noise mitigation measures:

- Limiting noisier construction activities from 7 a.m. to 8 p.m. during weekdays and 9 a.m. to 8 p.m. on Saturday to comply with the Tumwater Municipal Code noise regulations 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 (EPA 1971).
- 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.

10.0 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None would be expected.

12.0 REFERENCES

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