## 3.10 Noise

This chapter describes how implementation of the action alternatives could affect noise in the study areas of the Alternative 1 and Alternative 2 sites, compared with the No Action Alternative. This section is based on the NERTS Noise Assessment provided in Appendix E. The Noise Assessment provides additional detail on noise regulations and the assessment's methodology, including the construction noise and vibration evaluation and operations sound modeling.

The environmental review determined that Alternatives 1A and 1B would likely have a significant, but temporary, construction noise impact on the closest neighbors to the Alternative 1 site; Alternative 2 would have a moderate, but temporary construction noise impact on the closest neighbors to the Alternative 2 site. No other significant noise impacts requiring mitigation are identified in the study areas during operation of the alternatives.

### 3.10.1 Fundamentals of Acoustics and Vibration

An understanding of how noise is defined and measured provides useful background for this assessment. Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. There are several different ways to measure noise, depending on the source of the noise, the receiver, and the reason for the noise measurement. Table 3.10-1 summarizes the acoustical terms used in this section.

Table 3.10-1. Definitions of Acoustical Terms.

| Term | Definition |
|---|---|
| Ambient noise level | The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient noise level is typically defined by the equivalent noise ($L_{eq}$) level. |
| Sound pressure (noise) level in decibels (dB) | A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter). |
| A-weighted sound pressure (noise) level (dBA) | The sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound (noise) levels in this report are A-weighted. |
| Equivalent noise level ($L_{eq}$) | The average A-weighted noise level, on an equal energy basis, during the measurement period. |
| Statistical noise level ($L_n$) | The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (1-4 e.g., $L_{50}$ is the level exceeded 50 percent of the time). |

Table 3.10-2 depicts the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

Table 3.10-2. Typical A-weighted Sound Levels.

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | — 110 — | Rock band |
| Jet fly-over at 1,000 feet | | |
| | — 100 — | |
| Gas lawn mower at 3 feet | | |
| | — 90 — | |
| Diesel truck at 50 feet at 50 mph | | Food blender at 3 feet |
| | — 80 — | Garbage disposal at 3 feet |
| Noisy urban area, daytime | | |
| Gas lawn mower at 100 feet | — 70 — | Vacuum cleaner at 10 feet |
| Commercial area | | Normal speech at 3 feet |
| Heavy traffic at 300 feet | — 60 — | |
| | | Large business office |
| Quiet urban daytime | — 50 — | Dishwasher next room |
| | | |
| Quiet urban nighttime | — 40 — | Theater, large conference room (background) |
| Quiet suburban nighttime | | |
| | — 30 — | Library |
| Quiet rural nighttime | | Bedroom at night, concert hall (background) |
| | — 20 — | |
| | | Broadcast/recording studio |
| | — 10 — | |
| | | |
| Lowest threshold of human hearing | — 0 — | Lowest threshold of human hearing |

Source: Caltrans 2013; dBA = A-weighted decibel(s)

The effects of noise on people can be listed in three broad categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startling and hearing loss

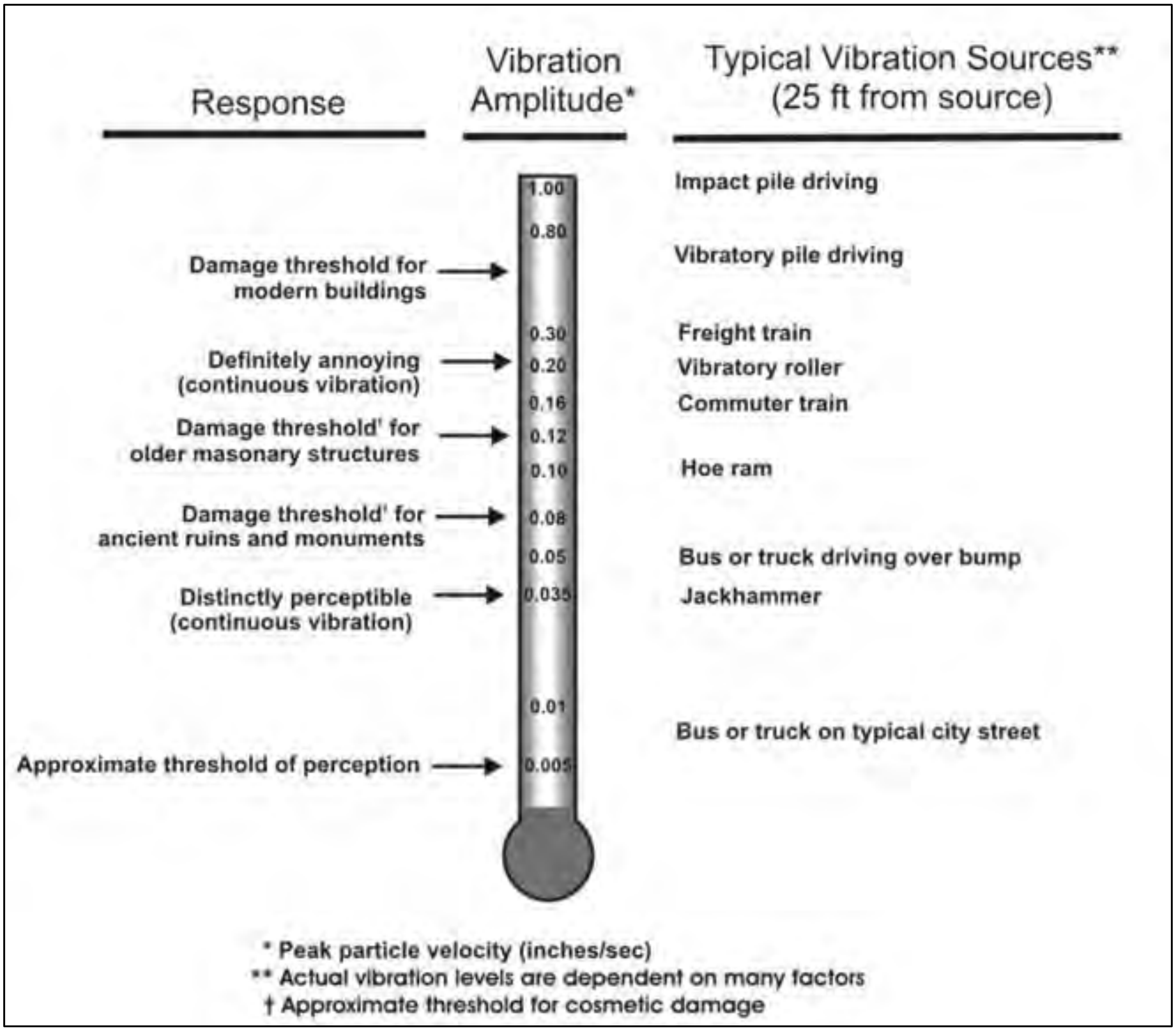
In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial projects may experience noise effects in the last category. There is no completely satisfactory way to measure the subjective effects of noise, nor to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily attributable to the wide variation in individual thresholds of annoyance and habituation to noise.

Decibels (dB) cannot be directly added arithmetically (e.g., 50 dBA plus 50 dBA does not equal 100 dBA). When two sources of equal level are added together, the result will always be 3 dB greater (e.g., 50 dBA plus 50 dBA equals 53 dBA, and 70 dBA plus 70 dBA equals 73 dBA). If the difference between the two sources is 10 dBA, the level (when rounded to the nearest whole dB) will not increase (e.g., 40 dBA plus 50 dBA equals 50 dBA, and 60 dBA plus 70 dBA equals 70 dBA) (Caltrans 2013).

The decrease in sound level caused by distance from any single sound source normally follows the inverse square law; that is, the sound pressure level changes in inverse proportion to the square of the distance from the sound source. In a large open area with no obstructive or reflective surfaces, it is a general rule that at distances greater than approximately the largest dimension of the noise-emitting surface, the sound pressure level from a single source of sound drops off at a rate of 6 dB with each doubling of the distance from the source. Sound energy is absorbed in the air as a function of temperature, humidity, and the frequency of the sound. This attenuation can be up to 2 dB over 1,000 feet. The drop-off rate will also vary based on terrain conditions and the presence of obstructions in the sound's propagation path. These factors are considered in the development of the acoustical model.

Vibration is the periodic oscillation of a medium or object, which may be directly felt or in some cases heard if the vibration induces rattling. Sources of ground-borne vibrations include natural phenomena such as earthquakes, volcanic eruptions, sea waves, landslides, or human-made sources such as explosions, machinery, traffic, trains, and construction equipment. Figure 3.10-1. illustrates common ground-borne vibration peak particle velocity sources as well as the human and structural response.

Figure 3.10-1. Typical Levels of Ground-borne Vibration.




Source: Wilson, Ihrig & Associates et al. 2012

Regulations at the federal, state, regional, and local levels are described in the following sections.

## 3.10.2 Regulatory Context

Under the action alternatives, development that has potential to affect noise levels would require compliance with federal, state, and local regulations. The applicable regulations related to noise are described in the following sections.

### *3.10.2.1Federal Regulations*

There are no applicable federal regulations that limit off-site environmental sound or vibration levels.

The Federal Transit Administration (FTA) manual establishes guidelines for vibration. Construction damage criteria are expressed in terms of peak particle velocity (PPV). These criteria are presented in Table 3.10-3 and range from a threshold of 0.12 inches per second for "buildings extremely susceptible to vibration damage" to 0.5 inches per second for "reinforced concrete, steel or timber (no plaster)" (FTA 2018).

Table 3.10-3. Federal Transit Administration Construction Vibration Damage Criteria.

| Building Category | PPV (inches per second) | Single Event PPV (inches per second) |
|---|---|---|
| Reinforced concrete, steel, or timber (no plaster) (buildings in steel or reinforced concrete, such as factories, retaining walls, bridges, steel towers, open channels, underground chambers, and tunnels with and without concrete alignment) | 0.5 | 1.2 |
| Engineered concrete and masonry (no plaster) (buildings with foundation walls and floors in concrete, walls in concrete or masonry, stone masonry retaining walls, underground chambers and tunnels with masonry alignments, and conduits in loose material) | 0.3 | 0.7 |
| Nonengineered timber and masonry buildings (buildings as mentioned previously but with wooden ceilings and walls in masonry) | 0.2 | 0.5 |
| Buildings extremely susceptible to vibration damage (construction very sensitive to vibration; objects of historic interest) | 0.12 | 0.3 |

Vibration damage risk thresholds to assess potential for damage from construction are based on criteria from *Effects of Vibration on Construction* (Swiss Consultants 1992). There are no state or local ordinances concerning construction vibration limits. The Swiss criteria provide additional details regarding the building category and provide a single event limit.

#### *3.10.2.2State Regulations*

WAC Title 173, Chapter 173-60, provides the applicable Maximum Environmental Noise Levels for Washington state. These levels are based on the environmental designation for noise abatement (EDNA), which is defined as "an area or zone (environment) within which maximum permissible levels are established" (WAC 173-60). There are three EDNA designations (WAC 173-60-030), which roughly correspond to residential, commercial/recreational, and industrial/agricultural uses:

- Class A: Lands where people reside and sleep (such as residential)
- Class B: Lands requiring protection against noise interference with speech (such as commercial/recreational)
- Class C: Lands where economic activities are of such a nature that higher noise levels are anticipated (such as industrial/agricultural)

Table 3.10-4 summarizes the maximum permissible levels applicable to sound received at residential areas (Class A EDNA) and at industrial/agricultural areas (Class C EDNA) from an industrial facility (Class C EDNA).

Table 3.10-4. State of Washington Maximum Permissible Environmental Noise Levels.

| Statistical Descriptor | Maximum Permissible Sound Levels (dBA) from a Class C EDNA Source | | |
|---|---|---|---|
| | Class A EDNA Receiver | | Class C EDNA Receiver |
| | Daytime (7 a.m. -10 p.m.) | Nighttime (10 p.m.–- 7 a.m.) | Anytime |
| $L_{eq}$ | 60 | 50 | 70 |
| $L_{25}$ | 65 | 55 | 75 |
| $L_{8.3}$ | 70 | 60 | 80 |
| $L_{2.5}$ | 75 | 65 | 85 |

Source: WAC 173-60-040
$L_{25}$: 15 minutes in any one-hour period
$L_{8.3}$: 5 minutes in any one-hour period
$L_{2.5}$: 1.5 minutes in any one-hour period

The following are exempted from the limits presented in Table 3.10-1 (according to WAC 173-60-050):

- Construction noise (including blasting) between the hours of 7:00 a.m. and 10:00 p.m.
- Motor vehicles when regulated by WAC 173-62 (Motor Vehicle Noise Performance Standards for vehicles operated on public highways)
- Motor vehicles operated off public highways, except when such noise affects residential receivers.

WAC 173-60-050(6) states that "nothing in these exemptions is intended to preclude the [Washington State] Department [of Ecology] from requiring installation of the best available noise abatement technology consistent with economic feasibility." WAC 173-62, Motor Vehicle Noise Performance Standards, regulates noise generated by vehicles traveling on public roads.

### *3.10.2.3Local Laws, Plans, and Policies*

King County has promulgated independent state-approved noise standards pursuant to WAC 173-60 Section 110. The City of Kirkland and City of Woodinville also have separate noise regulations.

#### 3.10.2.3.1 King County

The 2016 King County Comprehensive Plan (King County 2016a) discusses goals specific to unincorporated areas of the County. While the project is not within the unincorporated area of King County, this discussion is provided for informational purposes. The following excerpts from the 2016 King County Comprehensive Plan provide examples of the value placed on minimizing noise impacts by the residents of King County:

*12.86.110 Environmental sound levels – maximum permissible sound levels.*

A. *For purposes of this subsection, sound levels shall be measured by a Type 1 or Type 2 sound level meter. Sound level measurements shall be based on the equivalent sound level ($L_{eq}$)*

*during the measurement interval, using a minimum measurement interval of one minute for a constant sound source or a thirty-minute measurement for a noncontinuous sound source.*

For sound sources located within unincorporated King County, the maximum permissible sound levels are provided in Table 3.10-5.

Table 3.10-5. Maximum Permissible Sound Levels by Source and Receiving Property Districts.

| | Receiving Property District | | | |
|---|---|---|---|---|
| Sound Source District | Rural Day/Night dBA | Residential Day/Night dBA | Commercial dBA | Industrial dBA |
| Rural | 49/39 | 52/42 | 55 | 57 |
| Residential | 52/42 | 55/45 | 57 | 60 |
| Commercial | 55/45 | 57/47 | 60 | 65 |
| Industrial | 57/47 | 60/50 | 65 | 70 |

During a measurement interval, the maximum sound level (Lmax) may exceed the sound level limits of this section by no more than 15 dBA. For the purposes of this subsection, "Lmax" means the maximum sound over a measurement interval determined by using a sound level meter set to "fast" response time.

Additional information from the 2016 King County Comprehensive Plan pertaining to potential modifications and exemptions (including construction) to maximum permissible sound levels can be found in the NERTS Noise Assessment, Appendix E.

#### 3.10.2.3.2 City of Kirkland

The City of Kirkland addresses noise in Chapter 115 of the Kirkland Zoning Code (Miscellaneous Use Development and Performance Standards). In Section 115.95 of the code, the City of Kirkland adopted the State standards for maximum environmental noise levels (WAC 173-60) described in Section 3.10.2.2, above. The code addresses public nuisance noise as follows:

*Any noise which injures; endangers the comfort, repose, health or safety of persons; or in any way renders persons insecure in life, or in the use of property, is a violation of this code. The operation of power equipment, including but not limited to leaf blowers, shall be deemed a public nuisance if such operation occurs during the following hours: before 8:00 a.m. or after 8:00 p.m. Monday through Friday, or before 9:00 a.m. or after 6:00 p.m. Saturday, Sunday, or the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.*

Section 115.25 of the Kirkland Zoning Code addresses requirements related to development activity – construction work that requires a permit. Limitations on construction noise are related to the timing of construction activity:

*It is a violation of this code to engage in any development activity before 7:00 a.m. or after 8:00 p.m., Monday through Friday, or before 9:00 a.m. or after 6:00 p.m. Saturday. No development activity may* *occur on Sundays or on the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.*

Additional information from the Kirkland Municipal Code pertaining to potential modifications to code requirements can be found in the NERTS Noise Assessment, Appendix E.

##### 3.10.2.3.3 City of Woodinville

The City of Woodinville established noise regulations in Chapter 8.08 of the Woodinville Municipal Code (WMC). Section 8.08.040 of the code adopts the State maximum permissible noise levels (WAC 173-60) presented in Section 3.10.2.2, above. Likewise, exemptions from the state maximum permissible noise levels from WAC 173-60-050 are adopted by reference. Section 8.08.060 prohibits public nuisance and disturbance noises, including the following:

*Any sound made by the construction, excavation, repair, demolition, destruction, or alteration of any building or property or upon any building site anytime on Sundays and holidays and outside the hours of 7:00 a.m. through 7:00 p.m., Monday through Friday and 9:00 a.m. through 5:00 p.m. on Saturday, or, from Memorial Day to Labor Day, anytime on Sundays and holidays and outside the hours of 7:00 a.m. through 9:00 p.m., Monday through Friday and 9:00 a.m. through 5:00 p.m. on Saturday, excepting:*

*Nothing herein shall be construed to limit or prohibit different or more restrictive hours for any work authorized under a development permit issued under any chapter of this code as may be specified in any determining or decision issued under this code.*

WMC Section 8.08.090 provides an option to obtain a variance from the maximum environmental noise levels:

*Variances may be granted to any person from any requirement of WMC 8.08.040, if findings are made by the Planning Director or his/her designee that immediate compliance with such requirement cannot be achieved because of special circumstances rendering immediate compliance unreasonable in light of economic or physical factors, encroachment upon an existing noise source, or because of nonavailability of feasible technology or control methods. Variances shall not be granted for any requirement of WMC 8.08.060.*

*Any such variance, or renewal thereof, shall be granted only for the minimum time period found to be necessary under the facts and circumstances.*

### 3.10.3 Affected Environment

#### *3.10.3.1Study Area*

The study areas for evaluation of potential noise impacts encompasses areas where construction or operational noise from the proposed project would have the potential to affect nearby noise-sensitive land uses. The study areas extend approximately 2,500 feet beyond each action alternative site boundary as compliance with applicable thresholds is reasonably expected within this distance.

### *3.10.3.2No Action Alternative and Alternative 1*

The existing Houghton RTS is located at 11724 NE 60th Street in Kirkland on parcel 1759701890. The site is bordered to the east and west by single-family homes. Directly south of the site is NE 60th Street and directly south of NE 60th Street is Bridle Trails State Park. The existing RTS site is 8.4 acres. Access to the site is from NE 60th Street. Under the No Action Alternative, KCSWD would not site a new NERTS facility and would continue to operate the existing Houghton RTS.

The affected environment and community that could be impacted by noise and vibration due to continued operation of the Houghton RTS or implementation Alternative 1 would be residents of the neighborhoods surrounding the existing and proposed Alternative 1 site. The existing Houghton RTS is not enclosed. The primary sources of noise at the No Action Alternative and Alternative 1 site are waste collection and transfer vehicles. Waste unloading and loading, including consolidation of waste on site, may be heard off site. In addition, back-up safety alarms on vehicles and machinery may be heard at times off site. Potential sources of vibration at the No Action Alternative and Alternative 1 site are primarily from site operations: tipping of trailers and moving waste.

The sources of potential noise and vibration for Action Alternative 1 would be construction of the new NERTS facility, and future operational equipment and vehicles. Noise sources under Alternative 1 during construction could include pile drivers, bulldozers, drilling, jackhammers, and trucks. The primary sources of noise at the Alternative 1 site during operation would be similar to the existing noise sources for the existing Houghton RTS. NERTS under Alternative 1 would operate within an enclosed transfer building and an enclosed recycling area constructed with noise dampening materials and systems, and add a compactor, which would also be enclosed. Potential sources of vibration at the site under Alternative 1 would also be similar to existing sources but enclosed.

#### 3.10.3.2.1 Land Uses

Land uses in the noise study area for the No Action Alternative and Alternative 1 include the existing Houghton RTS, the closed Houghton landfill (which is operated as Taylor Fields baseball fields and recreation area), single-family residential uses to the east and west, I-405 further to the west, Bridle Trails State Park to the south, and local and arterial transportation uses. The nearest residences are located approximately 55 feet west on the opposite side of an existing six- to12-foot sound wall, and approximately 90 feet east of the Alternative 1 potential site development footprint. This study area is currently largely developed and the RTS site and closed landfill parcels are zoned P-Park/Open Space (Kirkland Parcel Viewer). Existing sources of noise include the existing transfer station and associated traffic, I-405, and other nearby construction.

As a general rule, noise levels tend to be higher in industrial and commercial areas and near transportation facilities (roadways and railroads), and lower in rural and open space areas. Table 3.10-6 contains typical A-weighted noise levels for residential areas during day and night. Table 3.10-7 shows a summary of existing average daytime and nighttime sounds levels near the No Action Alternative and Alternative 1 site.

Table 3.10-6. Typical Residential Noise Levels.

| Residential Land Use Category | Typical Day dBA | Typical Night, dBA |
|---|---|---|
| Very noisy urban | 66 | 58 |
| Noisy urban | 61 | 54 |
| Urban and noisy suburban | 55 | 49 |
| Quiet urban and normal suburban | 50 | 44 |
| Quiet suburban | 45 | 39 |
| Very quiet suburban and rural | 40 | 34 |

Source: ANSI/ASA 2013.

#### 3.10.3.2.2 Ambient Sound Survey

Ambient sound monitoring was conducted adjacent to the Alternative 1 site at locations depicted on Figure 3.10-2. Monitoring was conducted using an American National Standards Institute (ANSI) S1.4 Type 1 (precision) data logging sound level meter for seven days, from May 17 to 24, 2023. The hourly results are tabulated in the NERTS Noise Assessment, Appendix E, and summary results are presented in Table 3.10-7, compared with maximum permissible levels allowed.

Table 3.10-7. Summary of Existing Average Daytime and Nighttime Sound Levels (dBA) for Action Alternatives 1A and 1B.

| | Metric | | | |
|---|---|---|---|---|
| | $L_{2.5}$ | $L_{8.33}$ | $L_{25}$ | $L_{eq}$ |
| WAC Class A Daytime Limits | 75 | 65 | 70 | 60 |
| WAC Class A Nighttime Limits | 65 | 60 | 55 | 50 |
| WAC Class C Limits (Anytime) | 85 | 80 | 75 | 70 |
| | Measured Average Levels for Alternatives 1A and 1B | | | |
| M1 (Day) | 62 | 58 | 55 | 56 |
| M1 (Night) | 54 | 52 | 50 | 50 |
| M2 (Day) | 60 | 58 | 55 | 55 |
| M2 (Night) | 51 | 49 | 47 | 47 |

Notes: Given the proposed operational hours, daytime is considered to start at 6:00 a.m. on weekdays and 8:00 a.m. on weekends, and to end at 6:00 p.m. While nighttime operations are not anticipated, existing nighttime sound levels are provided for completeness and considered to occur between 10:00 p.m. and 6:00 a.m. on any day. Measurements at M4 and M5 were collected for one hour during the daytime hours.

L2.5: 1.5 minutes in any one-hour period

L8.3: 5 minutes in any one-hour period

L25: 15 minutes in any one-hour period

Leq: hourly energy average

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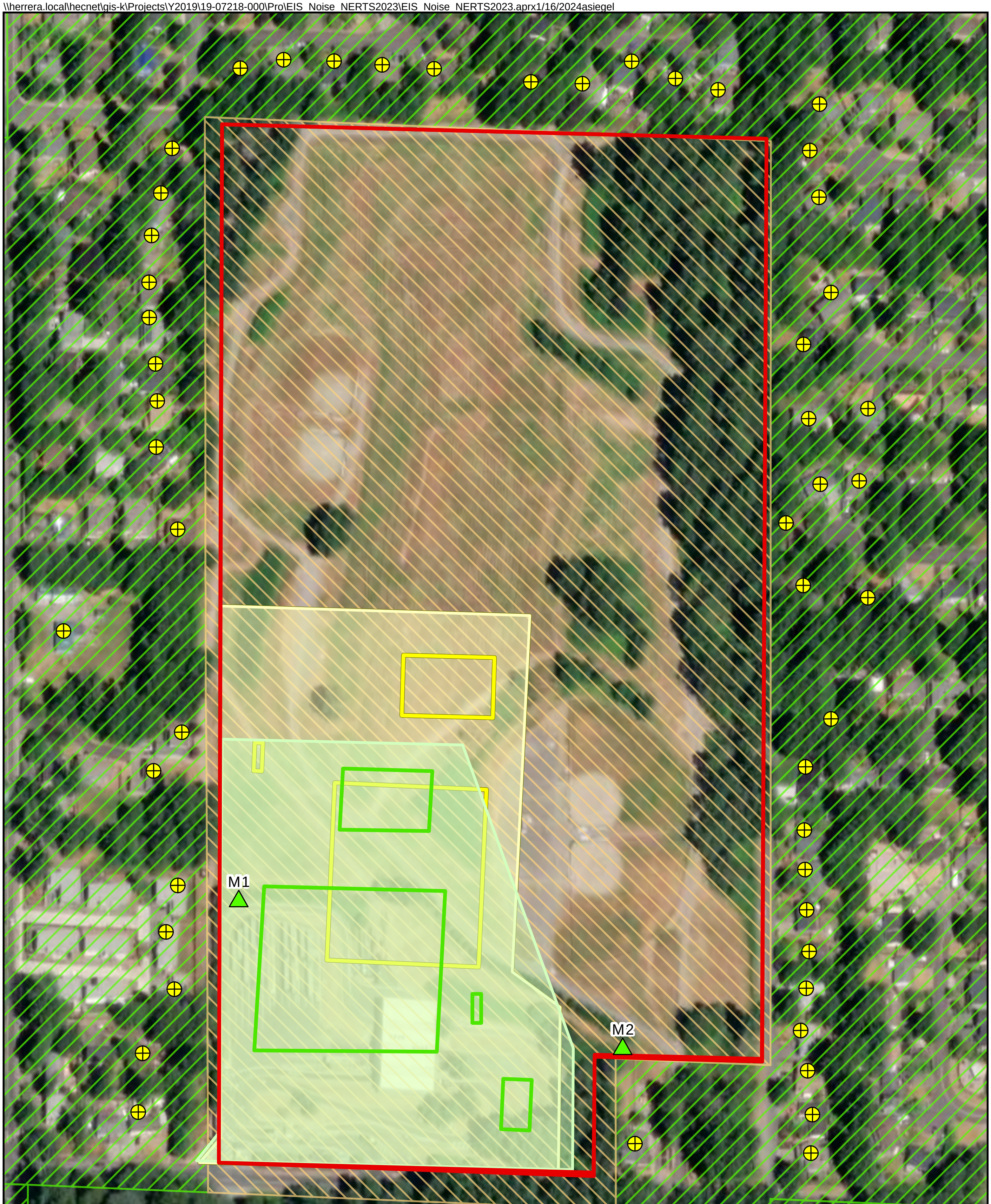


LEGEND

Monitoring Point

Alternative Location

Alternative 1A

Future Development Area

Potential Site Development Area

Alternative 1B

Future Development Area

Potential Site Development Area

Zoning

Low Density Residential

Park/Open Space

Receptor Location

Residence

**Figure 3.10-2. Noise Monitoring Locations for Action Alternatives 1A and 1B.**

N

PLAN

**SCALE: 1" = 350'-0"**

0 175 350

Feet

King County

#### *3.10.3.3 Alternative 2*

The affected environment and community that could be impacted by noise and vibration due to implementation of Alternative 2 would be residents of the neighborhoods surrounding the Alternative 2 site. The sources of potential noise and vibration would be construction of the new NERTS facility, and future operational equipment and vehicles. Noise sources under Alternative 2 during construction could include pile drivers, bulldozers, drilling, jackhammers, and trucks. The primary sources of noise at the Alternative 2 site during operation are similar to the sources stated for Alternative 1 including waste collection and transfer vehicles, waste unloading and loading, compactor, and back-up safety alarms on vehicles and machinery. Potential sources of vibration at the Alternative 2 site are primarily from site operations including tipping of trailers and moving waste.

##### 3.10.3.3.1 Land Uses

Under Alternative 2, KCSWD would site a new station in Woodinville (Figure 3.10-3). The Alternative 2 site is 12.9 acres, with an area of at least seven acres with additional area potentially available dependent on compliance with federal, state, and local environmental regulations (Figure 3.10-3).

Land uses in the noise study area for Alternative 2 include commercial and industrial parcels. The site is bordered to the north and south by commercial and light industrial uses. To the east is Woodinville-Redmond Road NE and further east are commercial and light industrial uses. To the west is a sloped green space, abandoned BNSF rail line, and residential properties. Southwest of the site and approximately 720 feet upslope from the conceptual building footprints, and west of the site and approximately 1,325 feet upslope from the conceptual building footprints are the closest single-family residential land uses. Across Woodinville-Redmond Road NE and approximately 300 feet east from the conceptual building footprint and 190-feet from the roadway center is the Chrysalis School. Access to the Alternative 2 site is from Woodinville-Redmond Road NE. The site is currently used for commercial uses including construction, portable toilet rental, manufacturing, and automotive businesses, which would relocate. A portion of the site is vacant and undeveloped. Existing sources of noise include existing commercial and manufacturing businesses and associated trucking, nearby traffic, and other nearby construction.

As a general rule, noise levels tend to be higher in industrial and commercial areas and near transportation facilities (roadways and railroads), and lower in rural and open space areas. Typical noise levels for Alternative 2 would follow a similar pattern as shown for Alternative 1 in Table 3.10-7.

##### 3.10.3.3.2 Ambient Sound Survey

Ambient sound monitoring was conducted adjacent to the proposed Alternative 2 site at locations depicted on Figure 3.10-3. Monitoring was conducted using an ANSI S1.4 Type 1 (precision) data logging sound level meter for seven days, from May 17 to 24, 2023. The hourly results are tabulated in the NERTS Noise Assessment, Appendix E, and summary results are presented in Table 3.10-8, compared with maximum permissible levels.

Table 3.10-8. Summary of Existing Average Daytime and Nighttime Sound Levels (dBA) for Action Alternative 2.

| | Metric | | | |
|---|---|---|---|---|
| | $L_{2.5}$ | $L_{8.33}$ | $L_{25}$ | $L_{eq}$ |
| WAC Class A Daytime Limits | 75 | 65 | 70 | 60 |
| WAC Class A Nighttime Limits | 65 | 60 | 55 | 50 |
| WAC Class C Limits (Anytime) | 85 | 80 | 75 | 70 |
| | Measured Average Levels for Alternative 2 | | | |
| M3 (Day) | 56 | 52 | 49 | 50 |
| M3 (Night) | 50 | 47 | 45 | 46 |
| M4 (Day) | 58 | 55 | 52 | 52 |
| M5 (Day) | 53 | 52 | 50 | 50 |

Notes: Given the proposed operational hours, daytime is considered to start at 6:00 a.m. on weekdays and 8:00 a.m. on weekends, and to end at 6:00 p.m. While nighttime operations are not anticipated, existing nighttime sound levels are provided for completeness and considered to occur between 10:00 p.m. and 6:00 a.m. on any day. Measurements at M4 and M5 were collected for one-hour during the daytime hours.

$L_{2.5}$: 1.5 minutes in any one-hour period

$L_{8.3}$: 5 minutes in any one-hour period

$L_{25}$: 15 minutes in any one-hour period

$L_{eq}$: hourly energy average

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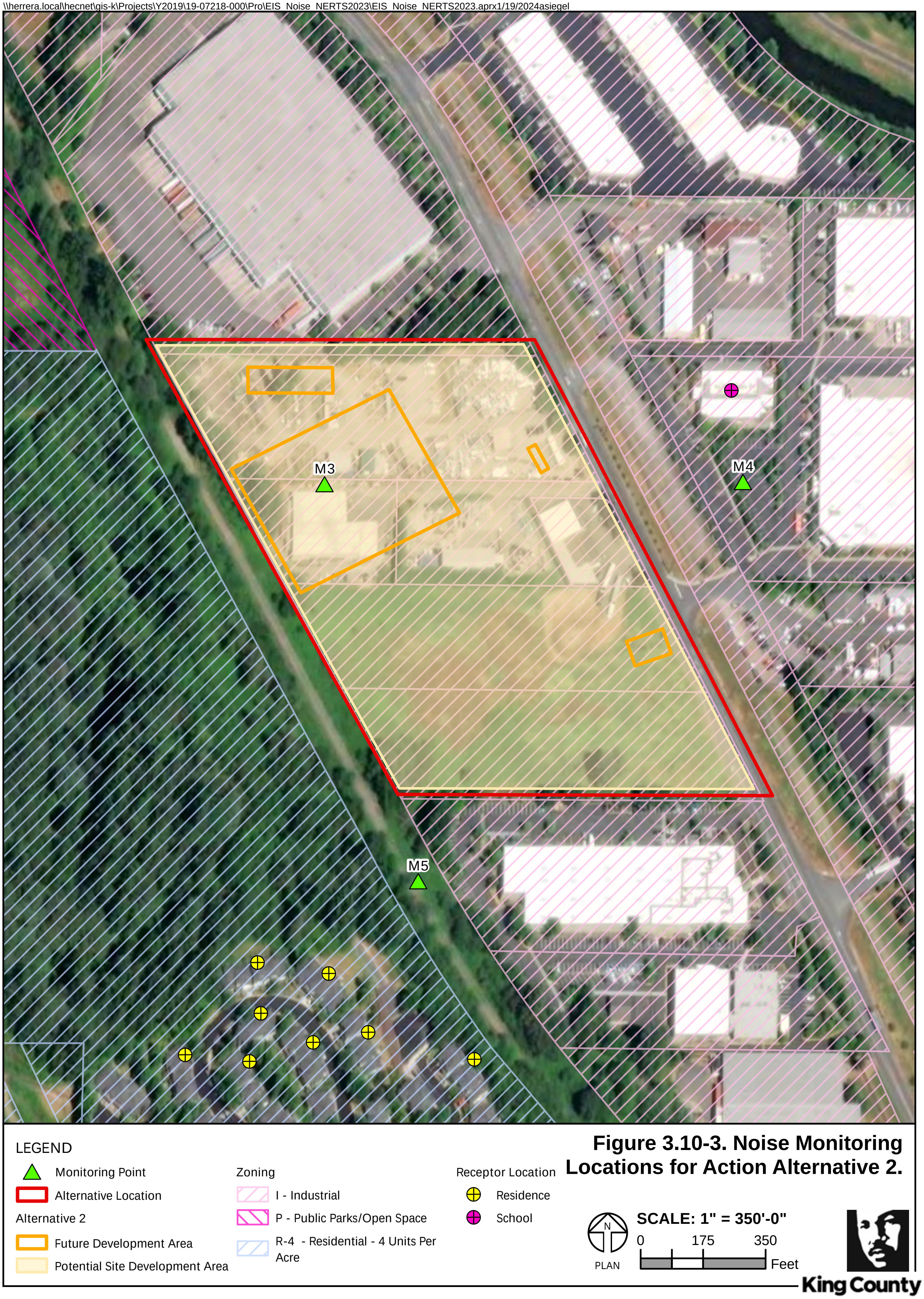



**Figure 3.10-3. Noise Monitoring Locations for Action Alternative 2.**

## 3.10.4 Environmental Impacts

### *3.10.4.1No Action Alternative*

Under the No Action Alternative, KCSWD would continue to the operate the existing Houghton RTS and noise levels would remain as they are or could increase over time as population and waste disposal operations in the region grow. The facility would not be enclosed to control noise. Waste would continue to not be compacted, which could result in an unchanged growth in transfer truck traffic as population increases. Under the No Action Alternative, groups affected by noise would include the existing Houghton RTS visitors, staff, and neighbors.

No changes would be made to the Alternative 2 site and would continue to emit noise typical of the existing businesses on the site. Background noise for each of the alternative sites would continue as-is under existing conditions.

The revised NERTS Noise Assessment in Appendix E presents a comparative analysis of potential noise levels from vehicle traffic associated with the project alternatives under consideration, including details on methodology, assumptions, and results. Vehicle trips by vehicle type were those used in the NERTS Transportation Assessment (see Appendix H), and routes were identified as the most likely to carry traffic to and from each of the proposed NERTS sites. Vehicle noise emissions were estimated using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM). The TNM was developed to predict hourly equivalent continuous sound levels, or Leq values, for free-flowing traffic conditions and is accurate within ± 3 decibels (dBA). Typically, 3 dBA is considered the threshold of a perceivable sound, 5 dBA is considered a clearly noticeable sound, and 10 dBA is considered a doubling in sound. The TNM calculated sound levels for the roads of interest on 50-foot offsets, up to 500 feet, from the edge of pavement on each side of the road (e.g., north and south) for each of the roads included in this screening. The TNM modeling includes the range of conditions that could exist under five-day waste hauling operations.

For TNM modeling under the No Action Alternative, the No Action and Alternative 1 site shows a range of noise levels along roadways near the site: for 116th Avenue NE: between I-405 ramps and NE 60th Street, the maximum noise level is 63 dBA and a minimum of 45 dBA; and for NE 60th Street: between 116th Avenue NE and 122nd Avenue NE, the maximum noise level is 60 dBA and a minimum of 44 dBA.

For TNM modeling under the No Action Alternative, the Alternative 2 site also shows a range of noise levels along roadways near the site: for Woodinville-Redmond Road: between NE 145th Street and NE 175th Street, the maximum noise level is 62 dBA and a minimum of 43 dBA; for NE 145th Street: between Woodinville-Redmond Road and NE 148th Street, the maximum noise level is 63 dBA and a minimum of 43 dBA; for Woodinville-Redmond Road: between NE 124th Street and NE 145th Street, the maximum noise level is 65 dBA and a minimum of 46 dBA; and for NE 175th Street: between Woodinville-Redmond Road and NE 131st Street, the maximum noise level is 66 dBA and a minimum of 46 dBA.

Additional detail on the breakdown of noise levels for specific roadway segments is provided in Appendix E.

### *3.10.4.2 Impacts Common to All Action Alternatives*

If an action alternative is selected, it is anticipated to open for business in 2029 following a construction period of approximately 30 months. A summary of building features common to all action alternatives and elements of operation can be found in Chapter 2, Alternatives, and in the NERTS Noise Assessment, Appendix E.

#### 3.10.4.2.1 Impacts from Construction

##### *3.10.4.2.1.1. Direct Impacts*

Construction is anticipated to last approximately 30 months. Permits for construction would be required by the local jurisdiction. Construction activities are expected to be limited to the hours allowed. Work outside these hours would require additional approvals.

Heavy equipment will be used during material deliveries, grading, excavation, paving, and building erection. This equipment typically generates 80 to 90 dBA at 50 feet. A model of multiple pieces of heavy equipment operating simultaneously is estimated to result in 62 to 67 dBA at 800 to 1,600 feet, respectively. The range of sound levels reflects the fact that the work is highly variable given the dynamics of construction.

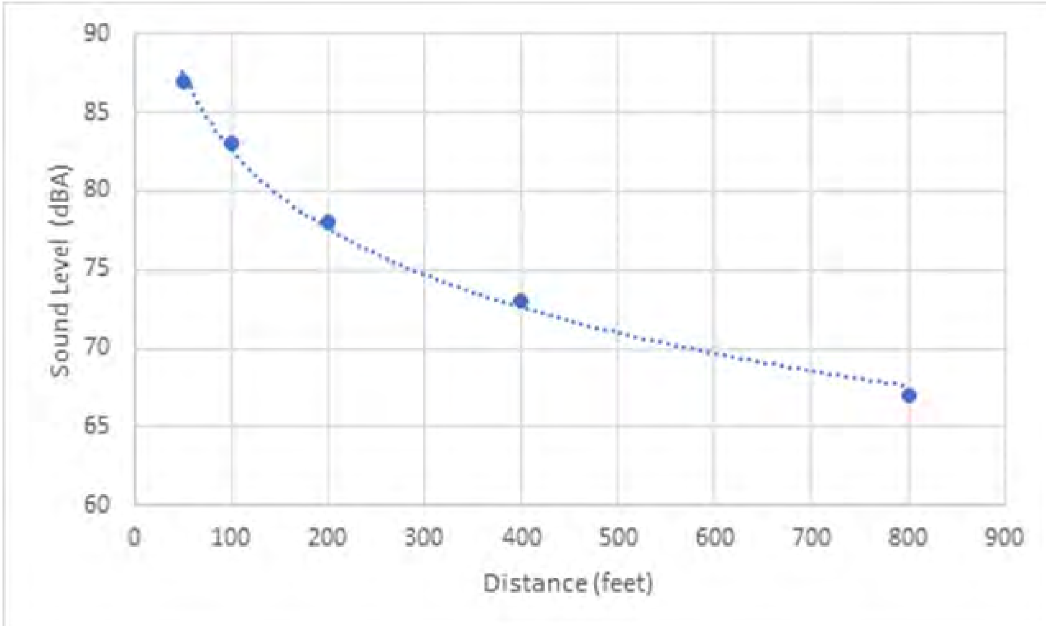
Pile driving is a unique construction activity that would be limited to a portion of the construction period, if used, and conducted during daytime hours. Sound levels from pile driving may vary and range between an average of 88 and 94 dBA at a distance of 50 feet, decreasing with increasing distance. Vibrations from pile driving activities also decrease with increasing distance.

*General Construction Noise Evaluation*

Sound levels from construction activities were estimated based on data from the FTA's Transit Noise and Vibration Impact Assessment Manual (FTA 2018). This manual represents the most recent and comprehensive tabulation of sound from common pieces of construction equipment that are typically used on a variety of construction projects. Representative sound levels of construction equipment from the FTA manual can be found in the NERTS Noise Assessment.

The loudest equipment generally emits noise in the range of 80 to 90 dBA at 50 feet. Noise at any specific receptor is dominated by the closest and loudest equipment. The types, numbers, and duration of equipment anticipated to be used near any specific receptor location will vary over time. Therefore, a typical noise estimate was developed in the NERTS Noise Assessment based on the general assumption of multiple pieces of loud equipment operating near each other with the exception of impact pile driving, which is addressed separately. Specifically, the scenario evaluated uses five pieces of general construction equipment working near each other. The highest average equipment noise level anticipated would be 87 dBA at 50 feet. Figure 3.10-4 shows a plot of sound level versus distance.

Figure 3.10-4. Sound Level Versus Distance.




Average pile driving sound levels are expected to yield sound levels of up to 94 dBA when evaluated at 50 feet and will decrease with increasing distance as detailed in the NERTS Noise Assessment. Pile driving is a short-term activity and if required would be scheduled to occur during daytime hours.

These predicted sound levels during construction would be short term (limited to the predicted 30 months of construction) and could be significant for some nearby receptors. The types, numbers, and duration of equipment anticipated to be used near any specific receptor location will vary over time, and impacts would be dependent on the acoustical characteristics of the specific sound sources, and the distance between the noise sources on site and the receptors. All construction activities will comply with applicable codes.

Because roadway noise is exempted from compliance under WAC 173-60-050 and the adopted codes for City of Kirkland and City of Woodinville, potential noise levels from construction vehicle traffic was not modeled. However, all construction vehicles on public roadways would meet all applicable federal, state, and local requirements and performance standards.

*General Construction Vibration Evaluation*

Construction activities have the potential to result in varying degrees of temporary ground-borne vibration, depending on the specific equipment used and operations involved. Vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. A summary of vibration levels for typical construction equipment can be found in the NERTS Noise Assessment, but the largest vibration source is an impact pile driver. According to FTA, vibration levels associated with the upper range of an impact pile driver are 1.518 inches per second PPV at 25 feet. Trucks generate lower vibration levels of 0.076 inch per second PPV at 25 feet.

An analysis of the impact of vibration levels on buildings in the NERTS Noise Assessment found that for all building categories, general construction equipment must be less than 25 feet from the existing structure to cause damage. Given that construction noise and vibration levels are anticipated to be short term, the impact is unlikely to be significant due the distance between the source of noise and the receptors.

Pile driving is a unique construction activity. If pile-driving is used with the action alternatives, it would be limited to a portion of the construction period and conducted during daytime hours. Sound levels from pile driving may vary and are predicted to range between an average of 88 and 94 dBA at a distance of 50 feet, decreasing with increasing distance. Vibrations from pile driving activities also decrease with increasing distance. For residential structures, the distance at which pile driving may damage residential buildings varies between less than 25 and 100 feet depending on the type and upper range of impact (see NERTS Noise Assessment, Appendix E).

##### *3.10.4.2.1.2. Indirect Impacts*

Heavy truck traffic to/from the project area through the surrounding residential neighborhoods has potential to annoy residents farther away from the construction site. These potential indirect effects would not be significant because the construction management plan would identify a truck route that minimizes or eliminates traffic on residential streets to reduce noise impacts from trucks, thus no significant indirect impacts are anticipated.

#### 3.10.4.2.2 Impacts from Operation

##### *3.10.4.2.2.1. Direct Impacts*

Sound sources related to operation of a new NERTS facility would include collection trucks, front-end loaders, compactors, transfer trucks, back-up alarms, material handling activities and building ventilation systems.

*Operation Sound Modeling Methodology*

The following primary sources of operational noise are associated with the action alternatives:

- Operations on the tipping floor (trucks dumping, front-end loaders pushing the waste to the compactor chute, recyclables getting moved around)
- Operation of two compactors in the lower floor, below the tipping floor
- Operation of HVAC systems located on the roofs of each of the buildings
- Tractor trailers hauling full trash trailers off site
- Repositioning of empty trailers and containers
- Management of recyclables in the public recycling areas, including managing metals, plastic, and glass, baling of materials, and the loading of recyclables into transfer containers
- Potential hard vertical surfaces, such as retaining walls, which can reflect noise

Standard acoustical engineering methods were used in the noise analysis. The sophisticated noise model, CADNA/A (DataKustik 2023), enables one to fully model complex industrial plants. The sound propagation factors used in the model have been adopted from International Organization for Standardization (ISO) 9613-2, Acoustics—Sound Attenuation During Propagation Outdoors (ISO 1996). Atmospheric absorption was estimated for conditions of 10 degrees Celsius and 70 percent relative humidity (conditions that favor propagation) and computed in accordance with ISO 9613-1.

A conceptual acoustical model was developed for the study area of each alternative. This model consists of a standard uninsulated 20-gage metal building with multiple large doors that are modeled as being open. The average sound level throughout the interior was derived from measurements of approximately 84 dBA at the King County Factoria RTS tipping floor (commercial collection trucks dumping, front-end loader operations, compactors, back-up alarms, King County waste transfer trucks, material handling activities, building ventilation systems, and non-commercial unloading activities) (HDR 2012). This sound level was modeled at the inside of all wall surfaces and throughout any modeled opening. While numerous acoustical minimization measures are available to be considered during detailed design, to be conservative no such measures were incorporated into this conceptual model. Because the facility will not operate during the nighttime hours, the analysis focused on the daytime operations and criteria (NERTS Noise Assessment).

Site layout and noise-attenuating design features can achieve substantial noise reduction. Noise reduction measures that could be incorporated into the project design to reduce operational noise and noise impacts at receiving properties include:

- Incorporate sound-attenuating design features for the compactor hydraulic power unit and radiator to reduce off-site sound emissions.
- Enclose the transfer station.
- Utilize wing walls near transfer station building openings, where needed.
- Incorporate sound-attenuating design features for vertical hard surfaces to reduce off-site sound emissions. As design progresses, updated modeling of the final design can be conducted that incorporates site specific grading and considers absorptive treatments of hard surfaces.
- Design on-site traffic routes to reduce the need for trucks to use back-up alarms.
- Ensure all on-site equipment is fitted with adequate exhaust-muffling devices.
- Minimize idle duration of on-site operations vehicles.
- Install ambient-sensing broadband back-up alarms on all equipment that remains on site, such as goat trucks (small diesel trucks used to move trailers around the site) and loaders.

Noise reduction measures incorporated into the final project design would depend on the geometry of the site developed during final design. Potential noise impacts will vary depending on the relative distance between dominant noise sources on the site, nearest point of regulatory compliance (i.e., property line), and the location of the noise sensitive receptor.

The noise-attenuating design features mentioned above would limit propagation of noise, resulting in less than significant impacts related to operational noise.

As discussed in Section 3.10.4.1, potential noise levels from vehicle traffic associated with the project alternatives under consideration were estimated using the FHWA TNM. Modeling results show that in 2029 and 2040, all action alternatives increase traffic noise compared to the No Action Alternative in each year by minor amounts and would be considered less than the typical threshold of perceptible difference (3 dBA). An estimate and comparison of operations related traffic noise emissions is included with the discussions of impacts unique to each alternative.

###### *3.10.4.2.2.2. Indirect Impacts*

No indirect noise impacts are anticipated during project operations as a result of the action alternatives because noise emissions from the only operational noise source, the transfer station, would be localized and controlled.

##### 3.10.4.2.3 Cumulative Impacts

An acoustically designed, built, and well-maintained transfer station should not induce any adverse noise impacts under the action alternatives. Therefore, when the action alternatives are considered with past, present, and reasonably foreseeable future actions, no adverse cumulative noise impacts are anticipated from the action alternatives. Since all action alternatives include enclosing the transfer station along with other design features that limit noise, cumulative noise impacts should be less than noise impacts under the No Action Alternative.

#### *3.10.4.3Alternative 1A*

This section describes impacts unique to Alternative 1A, along with applicable mitigation measures. Alternative 1A would construct the new NERTS facility at the Houghton RTS property at 11724 NE 60th Street in Kirkland after the existing transfer station building is closed and deconstructed or demolished.

##### 3.10.4.3.1 Impacts from Construction

###### *3.10.4.3.1.1. Direct Impacts*

The site for Alternative 1 is bordered to the north, east, and west by single-family homes. For Alternative 1A, the closest residences are 120 feet from conceptual building footprints. The average sound level during construction at this distance as determined by the methodology described in Section 3.10.3 would be approximately 81 dBA. While noise is exempted from state and City of Kirkland maximum permissible limits, construction activities would start and end at times that meet construction operating time-of-day requirements. In addition, KCSWD would implement construction practices to reduce noise impacts. These include the range of common construction minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS.

All construction impacts related to noise under Alternative 1A should be similar to those described in Section 3.10.4.2.1. With implementation of noise minimization measures, the noise impacts of Alternative 1A are anticipated to be short term (limited to the predicted 30 months of construction) and insignificant for most receptors based on the results of noise and vibration evaluations conducted under the NERTS Noise Assessment. The predicted sound levels during construction of Alternative 1A would be short term and could be significant for nearby residential and daycare/preschool receptors. All construction activities will comply with applicable codes and employ the range of noise minimization measures to reduce construction noise.

###### *3.10.4.3.1.2. Indirect Impacts*

Heavy truck traffic to/from the project area through the surrounding residential neighborhoods has potential to annoy residents farther away from the construction site. These potential indirect effects would not be significant because the construction management plan would identify a truck route that minimizes or eliminates traffic on residential streets to reduce noise impacts from trucks, thus no significant indirect impacts are anticipated.

##### 3.10.4.3.2 Impacts from Operation

###### *3.10.4.3.2.1. Direct Impacts*

A conceptual model for Alternative 1A was developed for facility-related noise. The resulting sound contours are presented on Figure 3.10-5. As shown on Figure 3.10-5, the residential daytime sound is expected to be compliant with the regulatory limit of 60 dBA during operations. At about 50-55 dBA at the nearby daycare (see Figure 3.10-5), noise sound levels would comply with the regulatory limit of 60 dBA during operations. Sound levels are predicted to be even lower toward Benjamin Franklin Elementary School and lower still toward the Rose Hill schools. As discussed under Section 3.10.4.2.2.1, project design will include features to reduce noise impacts during operation of the new facilities, including enclosing the transfer station. Noise reduction measures such as site layout and noise walls would be evaluated during project design to achieve optimum noise reduction and meet regulatory requirements. Potential noise impacts would vary depending on the relative distance between dominant noise sources on the site, nearest point of regulatory compliance (i.e. property line), and the location of the noise sensitive receptor, but noise impacts under Alternative 1A are anticipated to be lower than those under the No Action Alternative because of implementation of noise reducing design features and the range of common operational minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS. Alternative 1A will be designed to comply with applicable noise code requirements.

A conceptual model also was developed for project related traffic-related noise. Table 3.2-9 below summarizes estimated noise levels under the 2029 and 2040 No Action Alternative compared with the 2029 and 2040 Alternative 1A. Full details are provided in Appendix E.

Table 3.10-9. Noise Level Results, 2029 and 2040 No Action Alternative and Alternative 1A

| Receiver | 2029 No Action Alternative (dBA) | 2029 Action Alternative 1A (dBA) | Difference (Action and No Action) (dBA) | 2040 No Action Alternative (dBA) | 2040 Action Alternative 1A (dBA) | Difference (Action and No Action) (dBA) |
|---|---|---|---|---|---|---|
| 116th Avenue NE: between I-405 ramps and NE 60th Street | | | | | | |
| NB 50 | 63 | 63 | 0 | 64 | 64 | 0 |
| NB 250 | 51 | 51 | 0 | 51 | 51 | 0 |
| NB 500 | 45 | 45 | 0 | 46 | 46 | 0 |
| SB 50 | 63 | 63 | 0 | 63 | 63 | 0 |
| SB 250 | 51 | 51 | 0 | 51 | 51 | 0 |
| SB 500 | 45 | 45 | 0 | 46 | 46 | 0 |
| NE 60th Street: between 116th Avenue NE and 122nd Avenue NE | | | | | | |
| EB 50 | 60 | 60 | 0 | 60 | 60 | 0 |
| EB 250 | 49 | 49 | 0 | 50 | 50 | 0 |
| EB 500 | 44 | 44 | 0 | 45 | 45 | 0 |
| WB 50 | 60 | 60 | 0 | 60 | 60 | 0 |
| WB 250 | 49 | 49 | 0 | 49 | 49 | 0 |
| WB 500 | 44 | 44 | 0 | 44 | 44 | 0 |

For Alternative 1A, the action levels are the same as the No Action levels. Based on TNM model output, the difference in noise levels between 2029 conditions and 2040 are negligible. Table 3.10-9 shows the level of noise is higher closer to the road (e.g., 50 feet), where the truck traffic is located, and then declines farther away from the road (e.g., 500 feet), as the noise has to travel farther and it is attenuated. Based on Table 3.10-9 above, the residences along 116th Avenue NE between I-405 ramps and NE 60th Street would experience traffic noise at no more than 64 dBA. Traffic from the proposed NERTS facility under Alternative 1A does not add perceptible noise to the predicted noise levels. While higher than the maximum permissible level in the City of Kirkland for Class A EDNA Receivers, roadway noise is exempted from compliance under WAC 173-60-050 and the adopted Kirkland Code. The analysis also shows that at about 45 feet from the roadway (the approximate distance of the Nanny's Kare Daycare/Preschool and other residences along NE 60th) roadway noise levels would be less than 60 dBA, the regulatory limit for residential uses. The revised assessment also shows at about 400 feet from the roadway (the approximate distance of the Benjamin Franklin Elementary School) roadway noise levels would be no more than 46 dBA, below regulatory limit for residential uses.

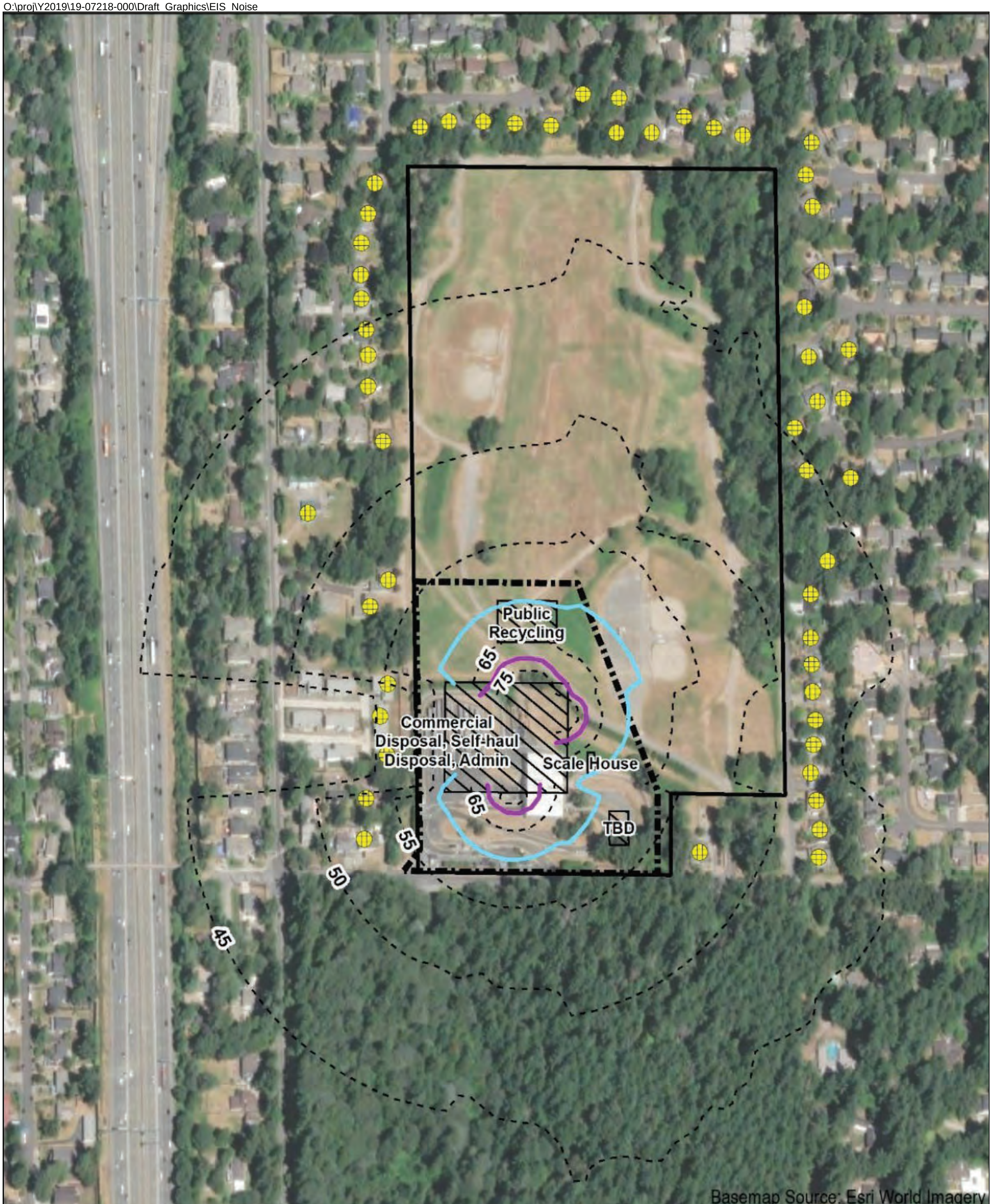
Based on the facility and traffic noise modeling, noise impacts from operation of Alternative 1A are expected to be minor and not significant.

#### *3.10.4.3.2.2. Indirect Impacts*

Heavy truck traffic to/from the project area through the surrounding residential neighborhoods has the potential to annoy residents farther away from the construction site. These potential indirect effects would not be significant because operational BMPs would identify a truck route that minimizes or eliminates traffic on residential streets to reduce noise impacts from trucks, and noise attenuation reduces noise farther from the street to below appropriate thresholds, thus no significant indirect impacts are anticipated.

#### 3.10.4.3.3 Cumulative Impacts

All cumulative impacts related to noise under Alternative 1A should be similar to those described in Section 3.10.4.2.3.




**Legend**

**Predicted Sound Level (dBA)**

- Maximum Permissible Sound Level for Industrial Property (70 dBA)
- Residential Daytime Sound Limit (60 dBA)
- 5 dBA Contour Interval
- Future Development Area
- Potential Site Development
- Site Boundary
- Receptor Location

N
PLAN

0 125 250 500
Feet

King County

Figure 3.10-5. Predicted Sound Levels for Operations at Alternative 1A.

#### *3.10.4.4Alternative 1B*

This section describes impacts unique to Alternative 1B, along with applicable mitigation measures. Alternative 1B would involve constructing the new NERTS facility at the existing Houghton RTS property at 11724 NE 60th Street in Kirkland while the existing transfer station building is open and operating. The old transfer station building would then be closed and repurposed or replaced after the new station is open.

##### 3.10.4.4.1 Impacts from Construction

###### *3.10.4.4.1.1. Direct Impacts*

The site for Alternative 1B is bordered to the north, east, and west by single-family homes. For Alternative 1B, the closest residences are about 120 feet from conceptual building footprints. The sound level at this distance as determined by the methodology described in Section 3.10.3 would be approximately 81 dBA, about the same as for Alternative 1A. While noise is exempted from state and City of Kirkland maximum permissible limits, construction activities would start and end at times that meet construction operating time-of-day requirements. In addition, KCSWD would implement construction practices to reduce noise impacts. These include the range of common construction minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS.

All construction impacts related to noise under Alternative 1B should be similar to those described in Section 3.10.4.2.1. The predicted sound levels during construction of Alternative 1B would be short term (limited to the predicted 30 months of construction) and could be significant for nearby residential and daycare/preschool receptors. All construction activities will comply with applicable codes and employ the range of noise minimization measures to reduce construction noise.

With implementation of noise minimization measures, the noise impacts of Alternative 1B are anticipated to be short term and insignificant based on the results of noise and vibration evaluations conducted under the NERTS Noise Assessment.

###### *3.10.4.4.1.2. Indirect Impacts*

Heavy truck traffic to/from the project area through the surrounding residential neighborhoods has the potential to annoy residents farther away from the construction site. These potential indirect effects would not be significant because the construction management plan would identify a truck route that minimizes or eliminates traffic on residential streets to reduce noise impacts from trucks, thus no significant indirect impacts are anticipated.

##### 3.10.4.4.2 Impacts from Operation

###### *3.10.4.4.2.1. Direct Impacts*

A conceptual model for Alternative 1B was developed for facility-related noise. The resulting sound contours are presented on Figure 3.10-6. As shown on Figure 3.10-6, the residential daytime sound is expected to be in compliance with the regulatory limit of 60 dBA during operations. As discussed under Section 3.10.4.2.2.1, project design will include features to reduce noise impacts during operation of the new facilities, including enclosing the transfer station. Noise reduction measures such as site layout and noise walls would be evaluated during project design to achieve optimum noise reduction and meet regulatory requirements. Potential noise impacts would vary depending on the relative distance between dominant noise sources on the site, nearest point of regulatory compliance (i.e. property line), and the location of the noise sensitive receptor, but noise impacts under Alternative 1B are anticipated to be lower than those under the No Action Alternative and similar to those under Alternative 1A, because of implementation of noise reducing design features and the range of common operational minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS. Alternative 1B will be designed to comply with applicable noise code requirements.

Modeled traffic noise for Alternative 1B is the same as the results for Alternative 1A, discussed in Section 3.10.4.3.2.1.

###### *3.10.4.4.2.2. Indirect Impacts*

No indirect noise impacts are anticipated during project operations as a result of the action alternatives because noise emissions from the only operational noise source, the transfer station, would be localized and controlled.

##### 3.10.4.4.3 Cumulative Impacts

All cumulative impacts related to noise under Alternative 1B should be similar to those described in Section 3.10.4.2.3.

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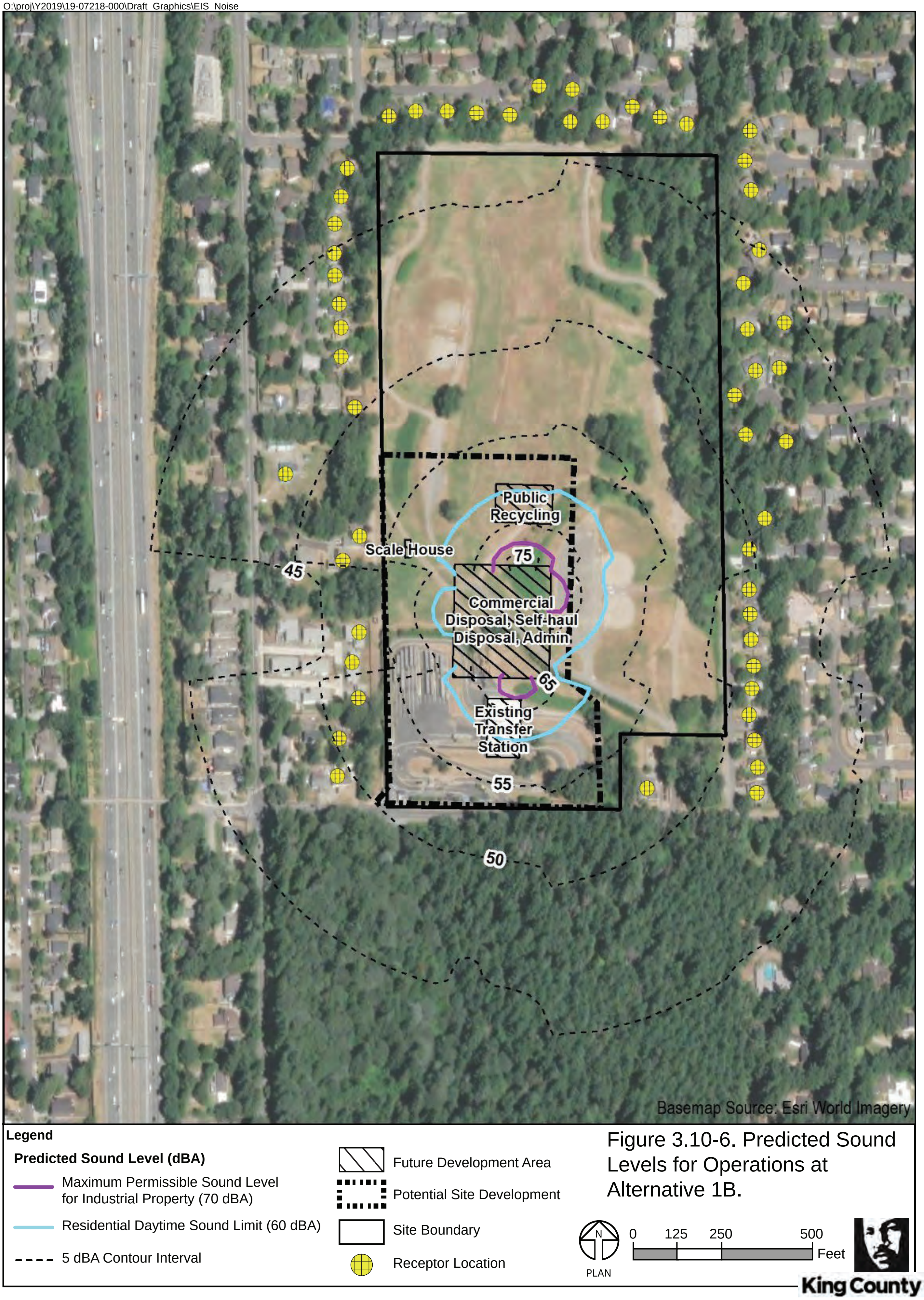


Figure 3.10-6. Predicted Sound Levels for Operations at Alternative 1B.

#### *3.10.4.5Alternative 2*

This section describes impacts unique to Alternative 2, along with applicable mitigation measures. Alternative 2 would construct the new NERTS facility on six tax parcels in the 15000 block of Woodinville-Redmond Road NE in Woodinville.

##### 3.10.4.5.1 Impacts from Construction

###### *3.10.4.5.1.1. Direct Impacts*

The closest noise receptors to Alternative 2 are the Chrysalis school approximately 300 feet from the conceptual building footprints and a neighborhood with residences approximately 720 feet from the conceptual building footprints. General construction noise is modeled to be 74 dBA at the school and 68 dBA at the residences. Typical construction equipment would need to be operated closer than 25 feet of existing structures to present a vibration risk. While noise is exempted from state and City of Woodinville maximum permissible limits, construction activities would start and end at times that meet construction operating time-of-day requirements. In addition, KCSWD would implement construction practices to reduce noise impacts. These include the range of common construction minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS.

All construction impacts related to noise under Alternative 2 should be similar to those described in Section 3.10.4.2.1. With implementation of noise minimization measures, the noise impacts of Alternative 2 are anticipated to be short term and insignificant based on the results of noise and vibration evaluations conducted under the NERTS Noise Assessment.

###### *3.10.4.5.1.2. Indirect Impacts*

Heavy truck traffic to/from the project area through the surrounding residential neighborhoods has the potential to annoy residents farther away from the construction site. These potential indirect effects would not be significant because the construction management plan would identify a truck route that minimizes or eliminates traffic on residential streets to reduce noise impacts from trucks, thus no significant indirect impacts are anticipated.

##### 3.10.4.5.2 Impacts from Operation

###### *3.10.4.5.2.1. Direct Impacts*

A conceptual model for Alternative 2 also was developed for facility-related noise. The resulting sound contours are presented on Figure 3.10-7. As shown on Figure 3.10-7, the residential daytime sound is expected to comply with the regulatory limit of 60 dBA during operations. As discussed under Section 3.10.4.2.2.1, the project design will include features to reduce noise impacts during operation of the new facilities, including enclosing the transfer station. Noise reduction measures such as site layout and noise walls would be evaluated during project design to achieve optimum noise reduction and meet regulatory requirements. Potential noise impacts would vary depending on the relative distance between dominant noise sources on the site, nearest point of regulatory compliance (i.e. property line), and the location of the noise sensitive receptor, but noise impacts under Alternative 2 are anticipated to be lower than those under the No Action Alternative at that site, and potentially lower than Alternative 1, because of distance to closest receptors, implementation of noise reducing design features, and the range of common operational minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E and summarized in Section 3.10.5 of this EIS. Alternative 2 will be designed to be compliant with applicable noise code requirements.

A conceptual model also was developed for project related traffic-related noise. Table 3.2-10 below summarizes estimated noise levels under the 2029 and 2040 No Action Alternative compared with the 2029 and 2040 Alternative 2. Full details are provided in Appendix E.

Table 3.10-10. Noise Level Results, 2029 and 2040 No Action Alternative and Alternative 2

| Receiver | 2029 No Action Alternative (dBA) | 2029 Action Alternative 2 (dBA) | Difference (Action and No Action) (dBA) | 2040 No Action Alternative (dBA) | 2040 Action Alternative 2 (dBA) | Difference (Action and No Action) (dBA) |
|---|---|---|---|---|---|---|
| Woodinville-Redmond Road: between NE 145th Street and NE 175th Street | | | | | | |
| NB 50 | 62 | 63 | 1 | 63 | 64 | 1 |
| NB 250 | 49 | 51 | 2 | 50 | 52 | 2 |
| NB 500 | 43 | 45 | 2 | 44 | 46 | 2 |
| SB 50 | 62 | 64 | 2 | 63 | 64 | 1 |
| SB 250 | 49 | 51 | 2 | 49 | 51 | 2 |
| SB 500 | 43 | 45 | 2 | 43 | 45 | 2 |
| NE 145th Street: between Woodinville-Redmond Road and NE 148th Street | | | | | | |
| WB 50 | 63 | 64 | 1 | 64 | 65 | 1 |
| WB 250 | 50 | 51 | 1 | 50 | 51 | 1 |
| WB 500 | 43 | 44 | 1 | 44 | 45 | 1 |
| EB 50 | 63 | 64 | 1 | 64 | 65 | 1 |
| EB 250 | 50 | 51 | 1 | 50 | 51 | 1 |
| EB 500 | 43 | 44 | 1 | 44 | 45 | 1 |
| Woodinville-Redmond Road: between NE 124th Street and NE 145th Street | | | | | | |
| NB 50 | 65 | 65 | 0 | 66 | 66 | 0 |
| NB 250 | 52 | 52 | 0 | 53 | 53 | 0 |
| NB 500 | 46 | 46 | 0 | 47 | 47 | 0 |
| SB 50 | 64 | 64 | 0 | 65 | 65 | 0 |
| SB 250 | 51 | 51 | 0 | 52 | 52 | 0 |
| SB 500 | 46 | 47 | 1 | 46 | 46 | 0 |
| NE 175th Street: between Woodinville-Redmond Road and NE 131st Street | | | | | | |
| WB 50 | 66 | 67 | 1 | 67 | 68 | 1 |
| WB 250 | 53 | 54 | 1 | 54 | 55 | 1 |
| WB 500 | 47 | 48 | 1 | 47 | 48 | 1 |
| EB 50 | 66 | 67 | 1 | 66 | 67 | 1 |

Table 3.10-10. Noise Level Results, 2029 and 2040 No Action Alternative and Alternative 2

| Receiver | 2029 No Action Alternative (dBA) | 2029 Action Alternative 2 (dBA) | Difference (Action and No Action) (dBA) | 2040 No Action Alternative (dBA) | 2040 Action Alternative 2 (dBA) | Difference (Action and No Action) (dBA) |
|---|---|---|---|---|---|---|
| EB 250 | 52 | 53 | 1 | 53 | 54 | 1 |
| EB 500 | 46 | 47 | 1 | 47 | 48 | 1 |

For Alternative 2, the action levels are slightly higher than the No Action levels whereas with Alternative 1 they are the same. As with Alternative 1, Table 3.10-10 shows the level of noise is higher closer to the road (e.g., 50 feet), where the truck traffic is located, and then declines farther away from the road (e.g., 500 feet), as the noise has to travel farther, and it is attenuated.

Based on TNM model output, the difference in noise levels between 2029 action and no action conditions and between 2040 action and no action conditions would be so small that the sound levels would not be perceptible. The largest difference between the Action Alternative and the No Action Alternative is 2 dBA, which is barely perceptible to the human ear.

Based on the facility and traffic noise modeling, noise impacts from operation of Alternative 2 are expected to be minor and not significant.

To compare the alternatives on an equal basis, the average modeled noise sound levels at each 50-foot offset were taken from each of the roads included in this screening, for each alternative. The difference was then calculated between the average 2029 and 2040 No Action sound levels at each offset and the average 2029 and 2040 action alternative sound levels at each offset. Results are shown in Table 3.10-11, below.

Table 3.10-11. Average Increase in dBA at Roadway Offsets from Project Traffic for 2029 and 2040 Action Alternatives Compared to 2029 and 2040 No Action Alternative

| | No Action | | Alternative 1 | | Alternative 2 | |
|---|---|---|---|---|---|---|
| Offset From Roadway (feet) | 2029 No Action | 2040 No Action | 2029 Action | 2040 Action | 2029 Action | 2040 Action |
| | Avg.(dBA) | Avg.(dBA) | Avg.(dBA) | Avg.(dBA) | Avg.(dBA) | Avg.(dBA) |
| 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.88 | 0.75 |
| 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.88 | 0.75 |
| 150 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.88 |
| 200 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| 250 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| 300 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| 350 | 0.00 | 0.00 | 0.00 | 0.00 | 1.13 | 1.00 |
| 400 | 0.00 | 0.00 | 0.00 | 0.00 | 1.13 | 1.00 |
| 450 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| 500 | 0.00 | 0.00 | 0.00 | 0.00 | 1.13 | 1.00 |

Based on TNM model output, Alternative 2 has a greater increase in average noise sound levels from project traffic compared to the No Action Alternative at each offset along the modeled roadway segment, than Alternative 1. However, as discussed above, the increase would be so small that the sound levels would not be perceptible.

###### *3.10.4.5.2.2. Indirect Impacts*

No indirect noise impacts are anticipated during project operations as a result of the action alternatives because noise emissions from the only operational noise source, the transfer station, would be localized and controlled.

##### 3.10.4.5.3 Cumulative Impacts

The proposed NERTS facility is a new noise source in the Alternative 2 study area. However, with the design features and noise minimization measures, the facility is not anticipated to create noise that exceeds regulatory thresholds. When Alternative 2 is considered with past, present, and reasonably foreseeable future actions in the vicinity of the site, no adverse cumulative noise impacts are anticipated from Alternative 2. All cumulative impacts related to noise under Alternative 2 should be similar to those described in Section 3.10.4.2.3.

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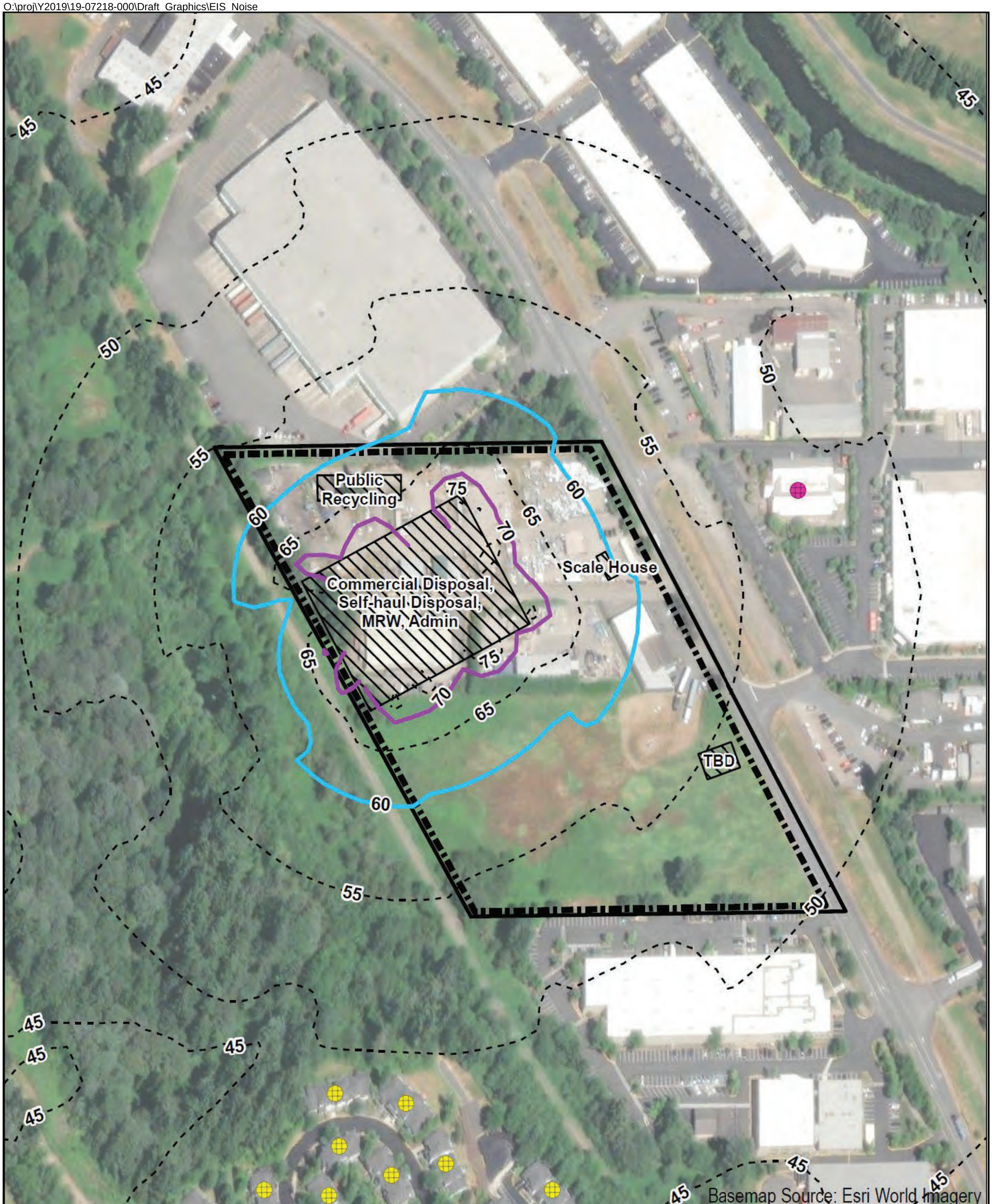


**Legend**

**Predicted Sound Level (dBA)**

- Maximum Permissible Sound Level for Industrial Property (70 dBA)
- Residential Daytime Sound Limit (60 dBA)
- 5 dBA Contour Interval
- Future Development Area
- Potential Site Development Area
- Site Boundary
- Residence
- School

Figure 3.10-7. Predicted Sound Levels for Operations at Alternative 2.

PLAN

0 90 180 360 Feet

King County

## 3.10.5 Mitigation Measures

### 3.10.5.1.1 During Construction

Please see the range of common construction minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E.

Temporary noise barriers could reduce construction noise and provide the greatest benefit to areas immediately behind these barriers. Temporary construction noise barriers could be erected using a variety of materials and approaches. For example, temporary chain-link fencing (commonly 10 feet tall) could be erected, with acoustical quilted mats attached to the fencing. Products used for this application usually have a layer of mass-loaded vinyl (a sheet of vinyl impregnated with material that increases its weight per square foot) inside the quilting. The quilting consists of fiberglass insulation enclosed in a weather-resistant material that forms the outer layer of the quilt. Often these materials have grommets along the edges, which allows the quilted product to be attached to the temporary fence. Another potential option would be to install a row of cargo boxes to form a solid barrier that blocks construction noise.

There would also be opportunities to reduce construction noise at the administrative level, at the noise source, and in the noise propagation path. Scheduling is an administrative approach to managing construction noise. For example, construction noise levels could be minimized if the loudest equipment and activities did not occur simultaneously at the same location. Limiting construction activities to daytime hours is another administrative control. Construction equipment should be maintained in a state of good repair. Items with internal combustion engines should have mufflers with performance that is as good or better than the original equipment manufacturer's performance.

Impact pile driving would be one of the noisiest construction activities. If proposed to occur close to residences and parcels with other noise-sensitive land uses, limiting the duration of impact pile-driving is one way to manage this noise. It would also be possible to install a shroud around the impact hammer, which would reduce overall noise levels from impact pile-driving. Quieter pile-driving options also exist, such as sonic pile-driving.

Construction vehicles could be equipped with broadband backup alarms, which are a recent technology that offers an alternative to traditional tonal alarms. Reversing vehicles pose a safety risk at construction sites. Backup alarms are meant to prevent injury or death by alerting people near vehicles when they are moving backward. Broadband alarms produce a hissing noise, and the sound is directional so pedestrians can identify the source of the alarm. The hissing sound of the broadband alarms blends into the ambient soundscape more than a traditional backup beeper. The hissing sound of a broadband backup alarm is not as distinctly perceivable at farther distances as a traditional backup beeper, which can be distinctly heard at distances beyond the immediate vicinity where they are used. These audible warning systems allow people to determine which direction the sound is coming from and immediately decide if they are in the danger zone.

##### 3.10.5.1.2 During Operation

Please see the range of common construction minimization measures outlined in Section 5.2.2 of the NERTS Noise Assessment, Appendix E.

In addition, under each action alternative, the transfer station would be designed, built, and operated in a manner to maintain compliance with the applicable standards at the surrounding land uses. Examples of noise minimization measures also could include the following:

- To control noise generation inside the transfer station building, locate the compactor hydraulics in an acoustically designed room or enclosure.
- Reflected noise inside the building could be reduced by using an acoustical cement block product that has slits or notches cut into the side that faces inside the room. Those openings would allow sound to enter the interior cavity of the concrete block. There would be a piece of compressed fiberglass inside the interior cavity. Functionally, sound would enter the inside of the concrete block and interact with the fiberglass, where the kinetic sound pressure energy would be converted to minute amounts of heat and absorbed. The concrete material would have enough mass to minimize sound transmission through it and into adjoining spaces.
- Reflected noise outside the building on vertical hard surfaces could be reduced by using absorptive materials. As design progresses, updated modeling of the final design can be conducted that incorporates site specific grading and considers absorptive treatments of hard surfaces where appropriate.
- Transfer stations also have ventilation systems for thermal maintenance and to provide fresh air. Sometimes transfer station ventilation systems are part of odor control systems. Noise exiting through ventilation intake and exhaust ducting could be controlled with silencers or acoustically lined ducts and acoustical louvers at the outlets. Ventilation ducts could also be lined with acoustically absorptive materials. Fans could be specified to minimize noise emissions, and parapets (protective walls) could be built around outdoor fans to reduce fan noise off-site.

### 3.10.6 Significant Unavoidable Adverse Impacts

The environmental review determined that Alternatives 1A and 1B would likely have a significant, but temporary, construction noise impact on the closest neighbors to the Alternative 1 site. No other significant unavoidable adverse noise impacts requiring mitigation are identified in the study areas during construction or operation of the alternatives.