Attachment H

Noise and Vibration Technical Study

Port of Grays Harbor Terminal 4 Expansion and Redevelopment Project

Noise and Vibration Technical Study

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1 Project Overview

The Port of Grays Harbor (Port) is proposing the Terminal 4 (T4) Expansion and Redevelopment Project to increase rail and shipping capacity of dry bulk, breakbulk, and roll-on/roll-off (RORO) cargos at the Port facility located in the cities of Hoquiam and Aberdeen, Washington. The project includes rail upgrades and site improvements; decommissioning the casting basin and relocating the Terminal 4A (T4A) cargo yard to that area; and T4 dock fender and stormwater upgrades. These project elements would be constructed by the Port and are referred to as the *Port Project*. It also includes a new export terminal by Ag Processing, Inc. (AGP), at T4. This project element is referred to as the *AGP Project*. Together, the Port Project and AGP Project are referred to as the *Proposed Project*.

The purpose of this technical study is to describe the affected environment and potential impacts from noise and vibration that results from the construction and operation of the Proposed Project. This technical study will be used to support environmental review of the Proposed Project by the state and federal agencies with a funding, jurisdictional, or permitting authority over the Project. This includes compliance with the Washington State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA). This technical study will also be used as supporting documentation for permitting efforts.

1.1 Location and Setting

Figure 1-1 shows the location and regional setting of the Port. The Port was founded in 1911 and is located on the Pacific coast of Washington state in the cities of Hoquiam and Aberdeen in Grays Harbor County. The Port is located near where the Chehalis River enters Grays Harbor, approximately 15 miles east from the Pacific Ocean. The Port is the westernmost port in Washington. The Pacific Ocean is accessed from the Port via the Grays Harbor deep-draft federal navigation channel within Grays Harbor. Rennie Island is just south of the Port and is within Grays Harbor. Bowerman Airport is approximately 4 miles west-northwest of the Port.

1.2 Project Area

The Project Area consists of the area where the proposed facilities would be located, called the On-Site Project Area, and the existing off-site transportation corridors, called the Off-Site Project Area. The On-Site Project Area includes the area that will be directly affected by construction and operation of the Proposed Project (**Figure 1-2**). All portions of the On-Site Project Area are owned by the Port. The Off-Site Project Area includes Off-Site transportation corridors used for rail and vessel transportation. This includes the Puget Sound and Pacific Railroad (PSAP) line from the Port property to the connection with the BNSF Railway and Union Pacific Railroad mainline in Centralia, Washington, and the Grays Harbor federal navigation channel from the Port property through Grays Harbor to the Pacific Ocean, up to 3 nautical miles offshore from the southern mouth of Grays Harbor.

Figure 1-1: Project Area Location and Regional Setting

2 Proposed Project and Alternatives

Two alternatives are evaluated in this report: the Proposed Project and a No Action Alternative. Additional details about these alternatives are documented in the Project Description Technical Report (Anchor QEA 2023a). The alternatives include the following:

- **Alternative 1 (Proposed Project)**. As noted in Section 1 and as further described in the Project Description Technical Report (Anchor QEA 2023a), the Proposed Project consists of the Port Project and the AGP Project. The Port Project includes the following: 1) rail upgrades and site improvements; 2) T4 dock, fender, and stormwater upgrades; and 3) cargo yard relocation and expansion. In addition to these proposed upgrades at T4, AGP, an existing tenant of the Port, intends to upgrade Terminal 4B (T4B) to include improved rail receiving facilities, a new shiploader, and a soybean meal storage structure (referred to as a surge silo). The primary elements of the Proposed Project are shown in **Figure 2-1** and could be constructed in phases.

Figure 1-2: Existing Conditions

- **No Action Alternative**. The No Action Alternative represents the conditions anticipated without construction and operation of the Proposed Project over the course of the construction analysis period of 2024 to 2025 and the operations analysis period from 2025 to 2045. Although the Port would not complete the proposed infrastructure enhancements or redevelop the T4 cargo yard under the No Action Alternative, it is anticipated that the Port would pursue growth opportunities within the existing Port footprint. It is also assumed that AGP would not complete the proposed infrastructure enhancements at T4B, but AGP would maximize its operations at the existing Terminal 2 facility. However, under the No Action Alternative, the Port would continue to operate and maintain T4 as it exists under existing conditions and would continue to seek out new business. Because activity under the No Action Alternative would be limited to current port infrastructure and terminal capacity limits, the No Action alternative is anticipated to result in operations similar to existing conditions. As such, there would be no foreseeable change to the existing noise environment.

Figure 2-1 Project Elements

3 Fundamentals of Noise and Vibration

3.1 Fundamentals of Noise

Sound is created when a disturbance or vibration induces pressure waves in the air. Sound is characterized by various parameters: the pressure level of a given sound (amplitude), the rate of oscillation (frequency or pitch), and time pattern (variability). When sound is unwanted, it is categorized as noise.

The frequency of a sound is the rate of physical oscillation, measured in cycles per second, or Hertz (Hz). To humans, this manifests as pitch, or the lowness (rumble) or highness (hiss) of a sound. Sound pressure level can vary by over one million times within the range of human hearing. The decibel (dB) scale is a logarithmic loudness scale used to reflect this wide range. Decibels are also well-suited for assessing noise and vibration perception because human senses respond logarithmically to stimuli.

Because the human auditory system does not respond equally to all frequencies of sound, A-weighted sound levels (denoted "dBA") are filtered to reduce the strength of very low and very high-frequency sounds to emulate the human response to sound levels. The A-weighted sound level correlates well with human response. On the dBA scale, the normal range of human hearing extends from 0 dBA to about 140 dBA. Typical sound levels of both transit and non-transit sources are provided in **Figure 3-1**. Under real-world conditions changing a sound by 1 dBA cannot be perceived; a 3-dBA change is considered a perceptible difference, while a 5-dBA change is readily noticeable. A 10-dBA increase in the level of a continuous noise is typically perceived as a doubling of loudness (FTA 2018).

Noise exposure over time is typically expressed in terms of an equivalent steady-state energy level, referred to as L_{eq}, or *equivalent noise level*. This is the steady noise level that has the same amount of acoustical energy as the time-varying noise levels over a specified time period. For all intents and purposes, L_{eq} may be considered the average noise level. Because community receptors are more sensitive to unwanted noise intrusion at night, a 24-hour noise descriptor called the *day-night sound level* (L_{dn}) is often used for environmental studies. This metric adds a 10 dBA penalty to nighttime noise levels from 10 PM to 7 AM to account for the increased sensitivity, and then computes the 24-hour, weighted L_{eq}.

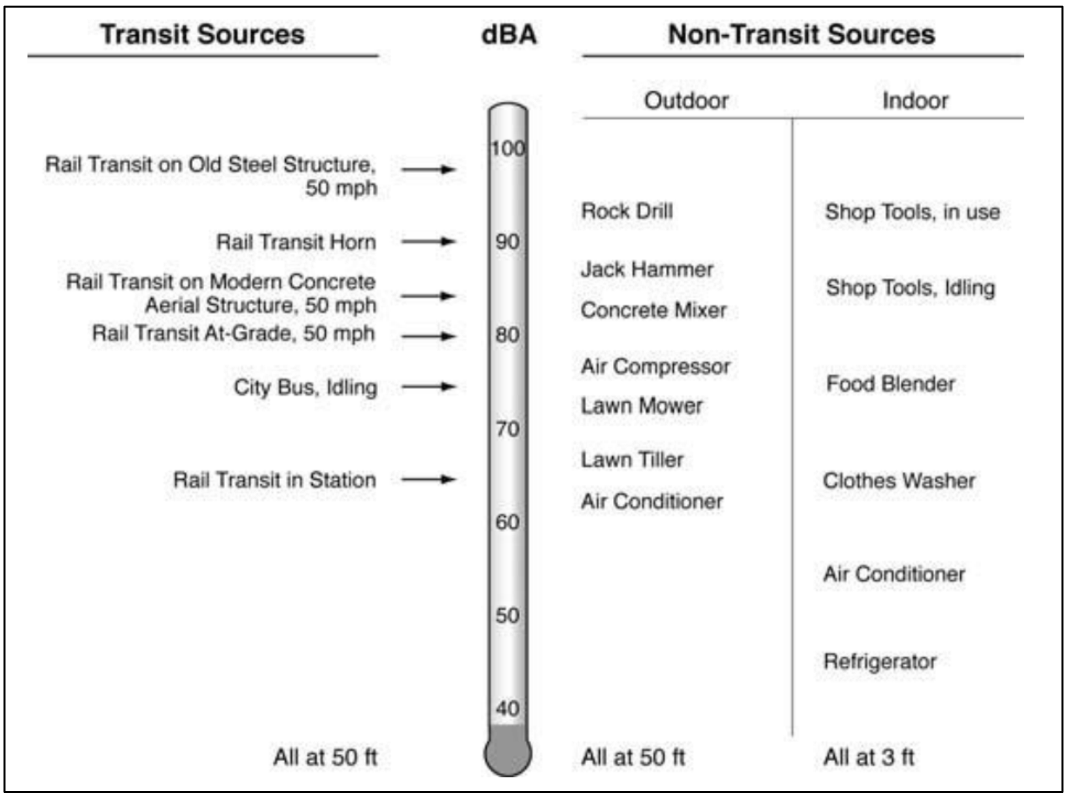

Figure 3-1: Typical Sound Levels of Transit and Non-Transit Noise Sources
Source: FTA 2018

A receptor's distance from a noise source affects how noise levels attenuate (decrease). Transportation noise sources tend to be linear (e.g., roadway, railroad line), and continuous line sources attenuate at a rate of 3.0 dBA to 4.5 dBA per doubling of distance from the source, depending on how the ground conditions absorb sound. Point sources of noise, such as stationary equipment or construction equipment, typically attenuate at a rate of 6.0 dBA to 7.5 dBA per doubling of distance from the source. For example, a point source sound level of 80 dBA at 50 ft will be reduced to 74 dBA at 100 feet and 68 dBA at 200 feet with a 6.0 dBA per doubling of distance rate of attenuation. Noise levels can also be attenuated by "shielding" provided by a barrier, buildings, or other obstructions between the source and the receptor. With respect to interior noise levels, the noise reduction provided by the exterior shell of the building depends on whether windows are closed or open. Based on the United States Environmental Protection Agency (U.S. EPA) national average, closed windows reduce noise levels by approximately 25 dBA, while open windows reduce noise levels by about 15 dBA (U.S. EPA, 1974).

Environmental noise is considered to be a combination of all outdoor noise sources. When combined, sources such as distant traffic, wind in trees, and distant industrial or farming activities often create a low-level background noise in which no particular individual source is identifiable (FTA 2018).

3.2 Fundamentals of Vibration

Vibration is caused by mechanical energy transmitted in waves through the ground.

Broadly speaking, decibels are a measure of power. Originally developed to quantify electrical power transmission, decibels have also proven useful to quantify sound and vibration which, fundamentally, transmit mechanical power through a gas or solid, respectively. The definition of a decibel is ten times the logarithm of a power quantity divided by a reference power quantity. Vibration decibels use a different reference quantity than do sound decibels. Vibration velocity decibels (in the U.S.) use 1 micro-inch/second whereas sound decibels use 20 micro-Pascals (a unit of pressure). To distinguish vibration velocity decibels from sound decibels, the former are designated by "VdB".

Vibration velocity decibels are used in the United States to assess annoyance from train vibration (FTA, 2018). A scale of typical source levels and response levels is provided in **Figure 3-2.** For humans, the response to vibration is also influenced by the number of perceived events.

Vibration generally dissipates with distance from the vibration source due to geometric spreading (a function of distance) and inherent damping in the intervening ground. The vibration transmitted to a receiving person or building is influenced by building construction (if applicable) and duration.

If vibration amplitude is high enough, ground vibration can cause structural damage. To assess the potential for structural damage associated with vibration, the vibratory ground motion in the vicinity of the affected structure is quantified in terms of peak particle velocity (PPV), typically in units of inches per second (in/sec). Minor cosmetic damage to fragile buildings can occur at vibration levels as low as 0.12 in/sec PPV depending on building condition and construction (FTA, 2018).

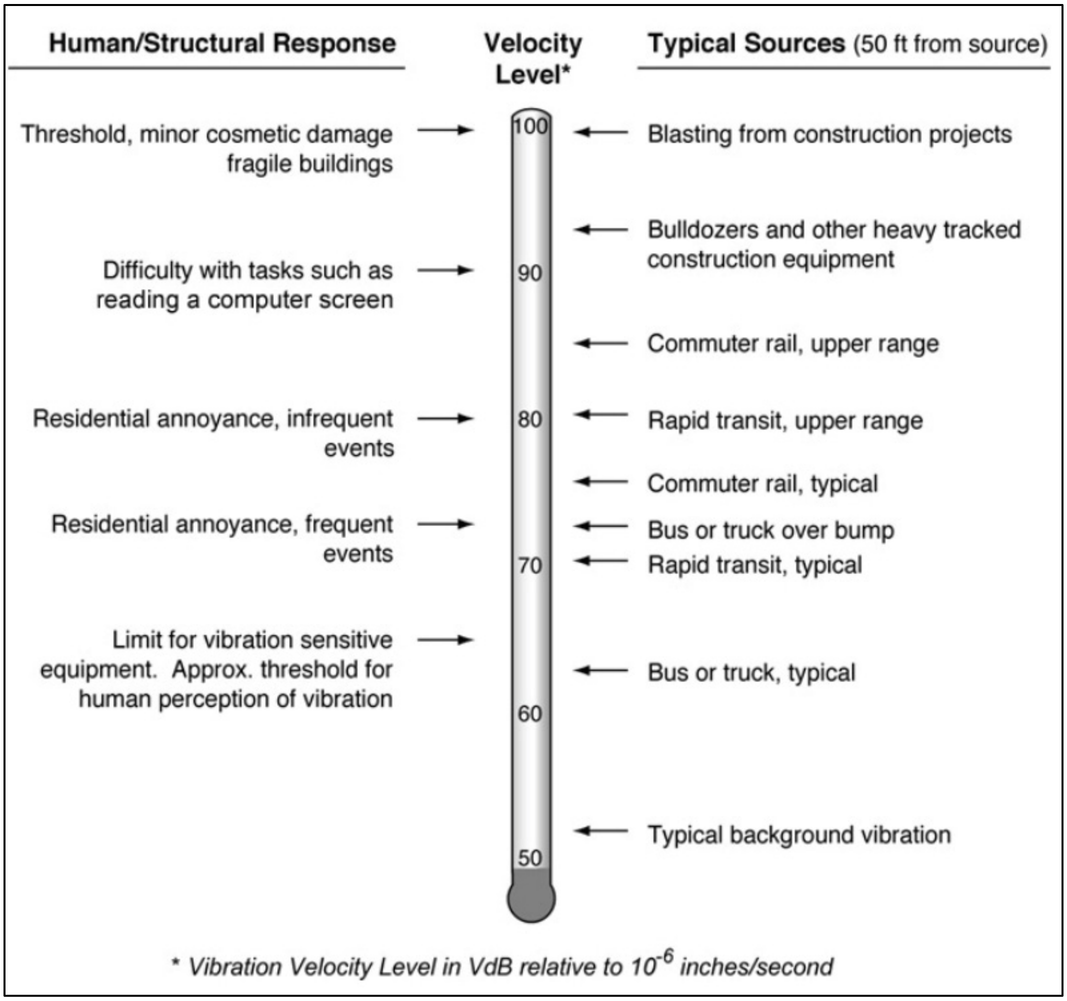

Figure 3-2: Typical Levels of Ground-Borne Vibration
Source: FTA 2018

4 Regulatory Setting

4.1 Washington Administrative Code (WAC)

The Washington Administrative Code (WAC) sets noise criteria based on the land use of the noise source and receiving properties.[1] The Environmental Designation for Noise Abatement (EDNA) classes are as follows:

- Class A – Residential zones
- Class B – Commercial zones
- Class C – Industrial zones

[1] Washington Administrative Code. Chapter 173-60. Maximum Environmental Noise Levels. https://app.leg.wa.gov/wac/default.aspx?cite=173-60

Table 4-1 shows the maximum permissible noise levels established in WAC 173-60-040. The criteria that apply to most, but not all, noise originating from the port and received at residences is 60 dBA.

Table 4-1: Base EDNA Values per WAC

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

Source: WAC 173-60-040

Several adjustments to the EDNA in **Table 4-1** are made for certain circumstances. For residential (Class A EDNA) receivers, the permissible noise limit is reduced by 10 dBA between 10:00 pm and 7:00 am. For short-term noise increases in any one-hour period, the levels in **Table 4-1** are increased by:

- dBA for noises occurring less than 15 minutes
- 10 dBA for noises occurring less than 5 minutes
- 15 dBA for noises occurring less than 1.5 minutes

Construction noise during daytime hours (7:00 am to 10:00 pm) is exempt from the WAC EDNA limits. Other daytime exemptions from the WAC noise limits that are applicable to the Proposed Project include:

- Sounds created by surface carriers engaged in interstate commerce by railroad
- Sounds created by warning devices not operating continuously for more than five minutes, or bells, chimes, and carillons
- Sounds created by safety and protective devices where noise suppression would defeat the intent of the device or is not economically feasible

The only consequential sources of noise associated with the Proposed Project – construction noise and rail noise – are both exempted from the WAC noise limits.

4.2 Grays Harbor County

Grays Harbor County municipal code sets no applicable noise criteria beyond the maximum permissible noise levels set in WAC 173-60.[2]

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[2] Grays Harbor County, WA Code of Ordinances. Chapter 9. Public Peace, Morals and Welfare. Adopted 2017. https://library.municode.com/wa/grays_harbor_county/codes/code_of_ordinances?nodeId=TIT9PUPEMOWE_CH9.12KEDIHO_9.12.010KEDIHO

4.3 City of Hoquiam

The City of Hoquiam municipal code does not set specific noise limits but does define many sources of noise as public nuisance.[3] The two that may apply to the Proposed Project are:

- Any sound made by a horn or siren or other similar signaling device attached to a motor vehicle which is audible greater than seventy-five feet from the vehicle except when reasonably necessary to ensure safe operation.
- The creation of frequent, repetitive, or continuous sounds made in connection with outdoor construction, excavation, repair, demolition, destruction or alteration of any building or property, or the movement of construction-related materials, including noises made by devices capable or producing sound by either striking or cutting objects, such as hammers, saws, or other equipment with internal combustion engines; provided, however, such sounds shall be exempt from the provisions of this code under the following circumstances:
    - During the hours of 7:00 a.m. through 8:00 p.m.; or
    - In commercial areas not adjacent to residential areas.

Because any operation of horns by trains associated with the operation of the Proposed Project would be necessary and required for safety purposes, this source of noise would not be considered a nuisance under the City of Hoquiam municipal code.

4.4 City of Aberdeen

The City of Aberdeen's municipal code does not set specific noise limits or define other noise criteria that may apply to the Proposed Project.[4]

4.5 FRA/FTA Guidance

Railroad operations in the United States are overseen by the Federal Railroad Administration (FRA). The FRA has published a document entitled *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012). In that document, the FRA states, "The Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment* (FTA 2018) manual provides guidance for projects with conventional train speeds below 90 mph." As such, the FTA guidance was applied to the Proposed Project.

4.5.1 Operational Noise

Per the FTA Manual, noise impacts from increased rail traffic are determined by the increase in ambient noise level (day-night average sound level [L_{dn}] or hourly equivalent sound level [L_{eq}] depending on the type of receptor). The amount of increase that is needed to result in an impact depends on the existing ambient noise level. The FTA has established separate noise limits for three

[3] City of Hoquiam Municipal Code. Chapter 3A.30. Public Noise Nuisances. Adopted 2007. https://cityofhoquiam.com/code/Hoquiam03A/Hoquiam03A30.html

[4] Aberdeen, WA Municipal Codes. https://aberdeen.municipal.codes/

different land-use categories. **Table 4-2** provides detailed category descriptions as well as the assessment metric for each category.

Table 4-2: FTA Land Use Categories

Land Use Category	Land Use Type	Noise Metric, dBA	Description of Land Use Category
1	High Sensitivity	Outdoor $L_{eq(1hr)}$*	Land where quiet is an essential element of its intended purpose. Example land uses include preserved land for serenity and quiet, outdoor amphitheaters and concert pavilions, and national historic landmarks with considerable outdoor use. Recording studios and concert halls are also included in this category.
2	Residential	Outdoor L_{dn}	This category is applicable all residential land use and buildings where people normally sleep, such as hotels and hospitals.
3	Institutional	Outdoor $L_{eq(1hr)}$*	This category is applicable to institutional land uses with primarily daytime and evening use. Example land uses include schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also included in this category.

* $L_{eq(1hr)}$ for the loudest hour of project-related activity during hours of noise sensitivity.

Source: FTA 2018

Noise impacts are assessed based on land use categories as well as the existing noise exposure level. As shown in **Figure 4-1**, the FTA noise impact criteria are defined by two curves that allow smaller increases in areas that are already noisy. In general, receivers that have a low existing noise can tolerate a greater increase due to the project than receivers that have a high existing noise level.

The FTA noise criteria are delineated into two categories: "moderate impact" and "severe impact." The moderate impact threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The severe impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact for a project such as the Proposed Project which generates more noise of a type already in the community is best assessed by assessing the increase in noise level in the context of the existing noise exposure. **Figure 4-1** shows the FTA assessment criteria for this purpose graphically. For residences near the Proposed Project, the metric to be assessed is the L_{dn} (residences are Category 2 land use in the FTA methodology).

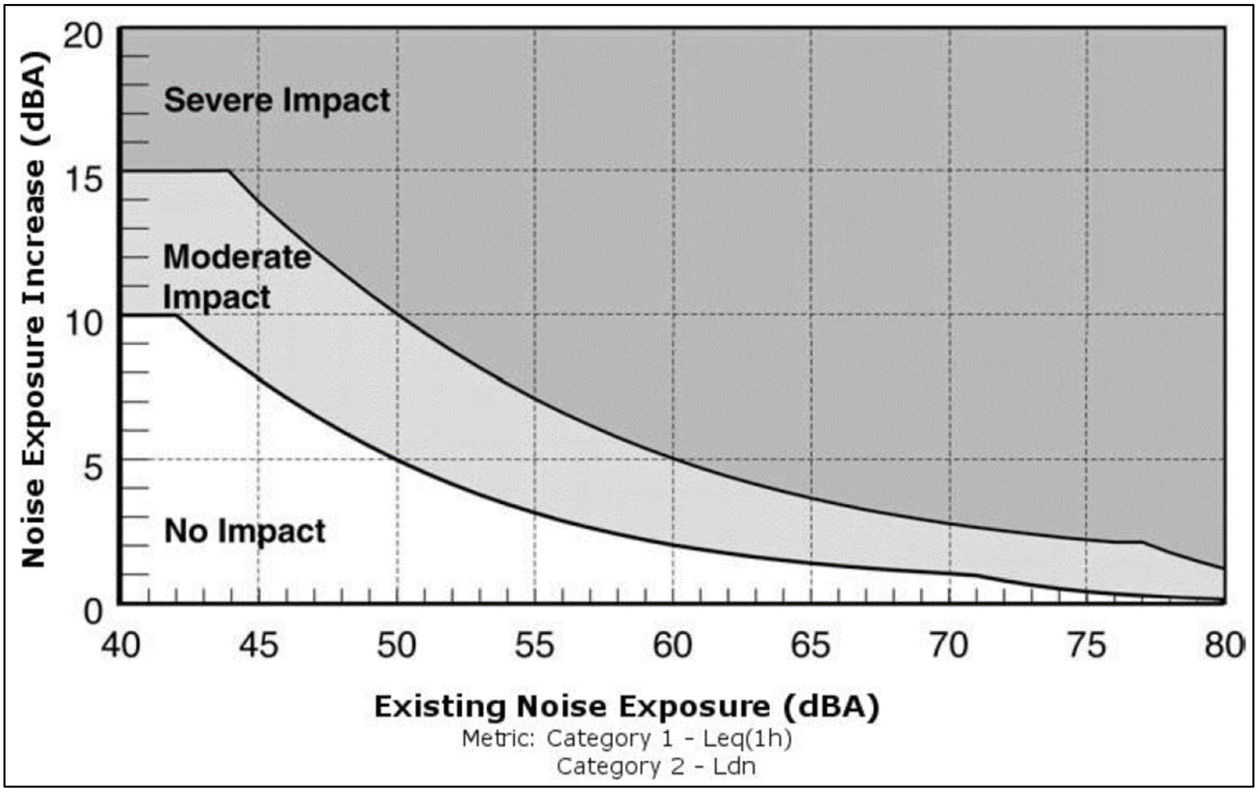

Figure 4-1: Increase in Cumulative Noise Levels Allowed by Criteria (Land Use Cat. 1 & 2)
Source: FTA 2018.

4.5.2 Rail Vibration

Vibration annoyance impacts from rail operations are assessed using the FTA ground-borne vibration (GBV) criteria provided in **Table 4-3**. Unlike the FTA noise assessment, the vibration assessment does not distinguish between moderate and severe impacts – there is only one impact assessment level, and the vibration is either above or below that. Vibration impacts are assessed based on land use categories as well as the number of vibration events that the receptor is exposed to. The FTA "number of events" categories are presented in **Table 4-4**. However, the FTA Manual also states:

> When assessing vibration from freight train operations, consider the locomotive and rail car vibration separately. Since locomotive vibration lasts for a very short time, it can be characterized by the infrequent events category. Rail car vibration from a typical line-haul freight train usually lasts for several minutes and can be characterized by the frequent events category (FTA 2018).

Table 4-3: FTA Vibration Impact Criteria[5]

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch /sec)			GBN Impact Levels (dBA re 20 micro Pascals)		
	Frequent Events	**Occasional Events**	**Infrequent Events**	**Frequent Events**	**Occasional Events**	**Infrequent Events**
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB*	65 VdB*	65 VdB*	N/A**	N/A**	N/A**
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

* This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a Detailed Vibration Analysis must be performed.
** Vibration-sensitive equipment is generally not sensitive to ground-borne noise; however, the manufacturer's specifications should be reviewed for acoustic and vibration sensitivity.

Source: FTA 2018

Table 4-4: FTA "Number of Event" Categories

Category	Definition	Typical Project Types
Frequent Events	More than 70 events per day	Most rapid transit
Occasional Events	30–70 events per day	Most commuter trunk lines
Infrequent Events	Fewer than 30 events per day	Most commuter rail branch lines

Source: FTA 2018

As described in Section 5.2.2 of the Project Description Technical Report (Anchor QEA 2023a), it is assumed there are 637 train round trips under baseline conditions and 937 train round trips with the Proposed Action through the Port of Grays Harbor. Therefore, at the Port of Grays Harbor, there currently are and will be with the Proposed Project far fewer than 30 trains passbys (events) per day, so locomotive assessment falls under the Infrequent Events category (80 VdB for Category 2 Residences). As per the guidance quoted above, the rails cars are assessed as Frequent Events (72 VdB).

Because homes near the PSAP and Port are all exposed directly to airborne sound from the trains, groundborne noise – a "byproduct" of vibration – is not considered in this analysis. Groundborne noise will be masked by airborne noise, even through a closed window.

4.5.3 Construction Noise & Vibration

Because construction noise is exempt from the WAC and local noise regulations, FTA guidance was used to determine potential impacts from construction. The FTA suggests the construction noise criteria outlined in **Table 4-5**. If construction occurs for up to 10 hours per day, only during daytime hours, and there is no construction on the weekends, then the 30-day average L_{dn} will be 5 dBA less

5 See Sections 3.1 Fundamentals of Noise and 3.2 Fundamentals of Vibration for definitions of dBA and VdB.

than the daily L_{eq}. Therefore, this assessment only explicitly considers the daily limit of 80 dBA L_{eq} (at residences) – if that that daily limit is not exceeded, then the 30-day average assessment criteria of 75 dBA L_{dn} will not be exceeded.

Table 4-5: FTA Detailed Construction Noise Assessment Criteria

Land Use	$L_{eq.equip(8hr)}$, dBA		$L_{dn.equip(30day)}$, dBA
	Day	Night	30-day Average
Residential	80	70	75
Commercial	85	85	80*
Industrial	90	90	85*

*Use a 24-hour $L_{eq(24hr)}$ instead of $L_{dn.equip(30day)}$.

Source: FTA 2018

The FTA has established criteria that can be used to evaluate the potential for building damage due to construction vibration. Vibration damage impact criteria are split into four categories based on the structure of the receiving building. The vibration damage impact level for each building category is outlined in **Table 4-6**. Stronger concrete or steel framed buildings have a higher vibration tolerance than wood-framed buildings. Residential buildings are assumed to be FTA Type III, so the applicable criterion is 0.2 PPV in/sec.

Table 4-6: FTA Construction Vibration Damage Criteria[6]

Building/ Structural Category	PPV, in/sec
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

Source: FTA 2018

Analysis of construction vibration annoyance at residential receivers uses the FTA "frequent occurrence" impact threshold of 72 VdB (**Table 4-3**).

5 Methodology

The potential for noise and vibration impacts from the Proposed Project was evaluated using procedures described in the FTA Manual (FTA 2018).

5.1 Operational Noise Assessment Procedure

The FTA Manual has three levels of analysis that may be used, depending on the type and scale of the project, the stage of project development, and the environmental setting. The three levels of analysis are:

- Noise Screening Procedure

[6] See Section 3.2 Fundamentals of Vibration for discussion of PPV.

- General Noise Assessment
- Detailed Noise Analysis

The screening procedure is used to identify noise-sensitive land uses in the vicinity of a project that potentially may be impacted. For the Proposed Project, there are receptors within the applicable screening distance (1,200 to 1,600 feet), and the future operational parameters are well established, so representative receptors along the land-side boundary of the Port property have been used to conduct a detailed noise analysis.[7]

A detailed noise analysis was conducted based on the FRA/FTA guidance manual. The model assesses the noise level at sensitive receptors by using baseline noise data measured by HDR to establish existing background noise levels and uses FRA/FTA noise exposure computation equations to model rail and vessel operations and project noise. The computed levels are then assessed using the criteria shown in **Figure 4-1**.

5.1.1.1 Rail Noise Assessment Procedure

The following parameters and assumptions were used in the detailed assessment of rail noise.

- Rail operations
  - 365 round trips for manifest trains per year, both existing and future (with the Proposed Project)
  - 272 round trips for unit model trains per year, existing
  - 572 round trips for unit model trains per year, future (with the Proposed Project)
  - No set daily schedule is available for freight rail operations, but noise data collected for the Proposed Project indicate that approximately 80% of the trains arrive during the "daytime" hours (defined for acoustical calculations as 7:00 a.m. to 10:00 p.m.) and 20% during the "nighttime" hours (10:00 p.m. to 7:00 a.m.)
- Reference noise levels based on FTA Manual guidance:
  - 99 dBA SEL[8] at 50 feet for manifest trains at 10 mph with 1 locomotive and 40 cars (on average; typically 20 to 60 cars)
  - 104 dBA SEL at 50 feet for unit model trains at 10 mph with 3 locomotives and 110 cars

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[7] The steps in the General Noise Analysis and Detailed Noise Analysis are identical. The main differentiator is the specificity of project information. If project information is well established, as it is here, noise levels are computed from equations rather than estimated from graphs and tables in the FTA Manual.

[8] Sound Exposure Level (SEL): The sound exposure level is similar to an Leq except that the reference time is always 1 second. In other words, the SEL is the sound level over 1 second that has the same amount of acoustical energy as the actual sound over a given time period or event (e.g., train passage). This unintuitive unit is useful for two reasons: (i) it allows for an "apples-to-apples" comparison of different sources (at a given reference distance), and (ii) it is useful for subsequent computations of Leq sound levels at sensitive receptors.

- 105 dBA SEL reference level for horns at receptors which are within ¼ mile of a grade crossing [9]
- A +2 dB adjustment factor is added to train noise when the nearest switch point is within 300 feet of the noise-sensitive receptor [10]

Horn noise was calculated using the perpendicular distance to the nearest rail for receptors within ¼ mile of a grade crossing (which includes all receptors in this analysis). Noise from trains operating on Port property between E Terminal Road and John Stevens Way does not measurably add to the noise levels at the off-site receptors because of the distances involved.

The new rails that will be built for the Proposed Project are shown in turquoise in **Figure 5-1.**

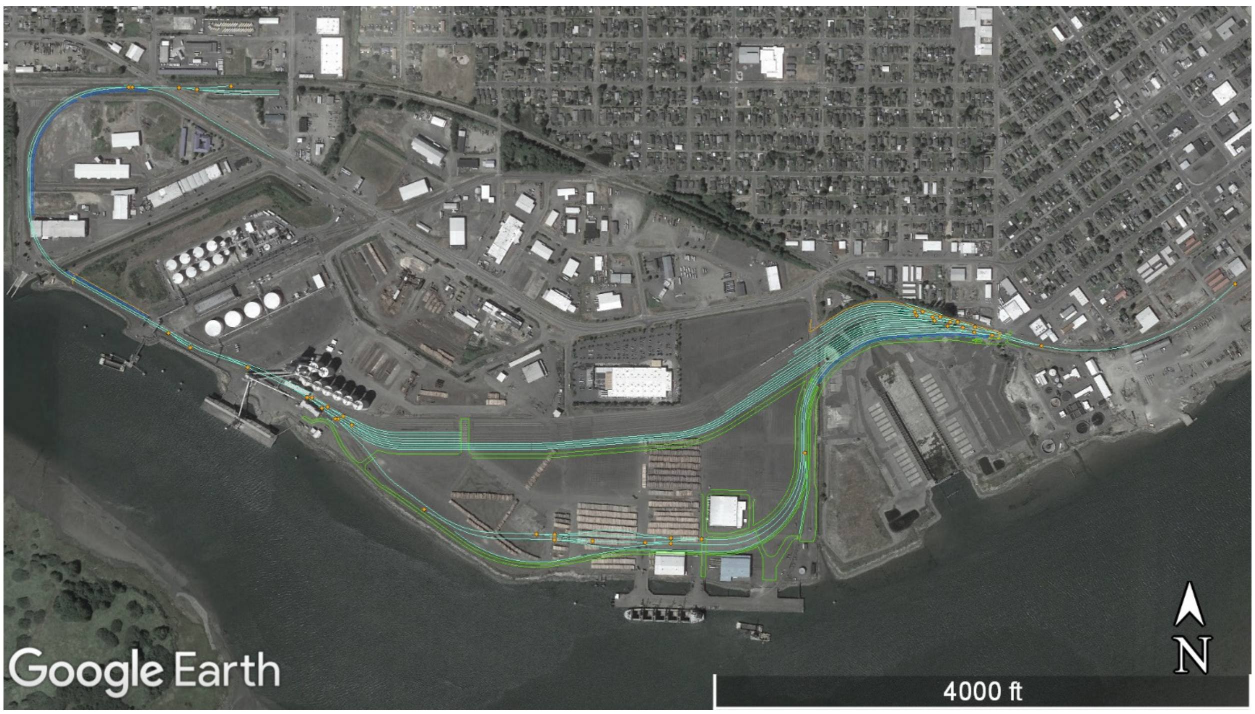

Figure 5-1: New Rail (Turquoise) and Roads (Green)

5.1.2 Ship Noise Assessment Procedure

The following assumptions were used in the assessment of ship noise:

[9] The FTA Manual proposes using 110 dBA SEL for train horns, but data collected by HDR at a location between S Division Street and W Wishkah Street indicate that the train horn levels are on the order of 5 dB lower. It is reasonable to assume that the locomotive engineers do not sound the horns at full strength because (i) the trains are moving slowly as they approach the Port and (ii) most of the grade crossings lead directly onto Port property.

[10] The FTA Manual proposes a +5 dB adjustment for trains traveling 50 mph but provides no guidance for trains traveling slower. The +2 factor is reasonable due to the low speed (10 mph) at which the wheels impact the switch frog.

- Shipping operations
  - 131 vessels per year, existing
  - 191 vessels per year, future (with the Proposed Project)
- Reference noise level
  - 100 dBA SEL reference level for vessel operations in the port. In the absence of measurements of vessel operations at the port, the analysis uses the ferry reference level found in the FRA/FTA manual, which is a 100 dBA SEL for 4 ferries per hour at 50 feet with foghorns.

The analysis uses the shortest distance from the receptors to the Terminal 4 pier to calculate the vessel noise exposure and does not include any shielding that might occur from buildings or other obstructions.

5.1.3 Facility Operational Noise Assessment Procedure

The only new facility operation that will be added by the Proposed Project is the loading and shiploader system being built for the AGP Project. Other uses on the Port property, including use of the casting basin area for storage once it is restored, produce noise similar to past industrial operations.

The following assumptions were used in the assessment of facility noise:

- Cargo operations
  - The major noise-generating activity anticipated going forward is the loading of lumber on ships using up to five (5), diesel-powered logstackers. Although this activity would only occur a few days every month, this analysis assumes that it occurs every day. In other words, the analysis considers a day when this activity is occurring.
  - It was assumed that ship-loading operations could occur at any time, including nighttime hours.
- Reference noise levels
  - 108 dBA SEL at 50 feet for the AGP loading facility. It is anticipated that the main source of noise for the AGP facility is expected to be shiploader motor noise. As noted by contractors from Anchor QEA who visited the site during existing operations, the noise level is qualitatively described as audible but not noisy at 100 yards and able to be spoken over at normal speech levels at 100 feet away. Based on this description, the analysis assumes a constant noise level of 65 dBA at a distance of 100 feet, which corresponds to a 107 dBA SEL at 50 feet.
  - 119 dBA SEL at 50 feet for cargo yard operations calculated using Lmax for Loader of 80 dBA and Usage Factor of 40% (both from FTA Manual), 5 Loaders, and 24-hour operation.

Facility operations were treated as point sources at the locations shown in **Figure 5-2**. In reality, some sources of noise (mobile equipment) would move around within each area, but, on average, would be centered around the points indicated. Therefore, treating these as a point source at the center of the area is reasonable.

Figure 5-2: Future Yard Operation Point Source Locations
Source: Google Earth, Wilson Ihrig

5.2 Rail Vibration Assessment Procedure

The following parameters and adjustments – all following or based on the FTA Manual – have been used in the vibration assessment:

- Locomotive-Powered Passenger or Freight Curve at a reference speed of 50 mph:
    - Locomotive: $L_v = 92.3 + 14.8 \log(D) - 14.7 \log(D)^2 + 1.7 \log(D)^3$; D = distance in ft
    - Subtract 5 dB for rail car vibration
- Speed adjustment for a 10-mph train: $20 \log(10\text{mph}/50\text{mph}) = -14$ dB
- Adjustment for special trackwork (switches):
    - < 50 ft: +10 dB
    - 50 – 230 ft: $10 - 15 \log(D/50)$
    - > 230 ft: no adjustment

- Building coupling loss
    - Houses on raised foundations / basements: −5 dB
    - Slab-on-grade: no adjustment
- Amplification due to floor resonances:
    - Suspended floor: +6 dB
    - Slab-on-grade: no adjustment
- Using the above parameters, a locomotive at 50 feet and 10 mph on standard track results in a vibration level of 71 VdB in a slab-on-grade building and 72 VdB in a raised building with suspended floor.

5.3 Construction Noise and Vibration Assessment Procedure

Construction for the Proposed Project is planned in 10 different work zones across the Port of Grays Harbor as described in detail in the Project Description Technical Report (Anchor QEA 2023a). Construction activity can be grouped into seven different categories: demolition, casting basin earthwork, grading, building construction, paving, trackwork, and pile installation. Not all construction categories are planned for all work zones. This analysis assumes that construction will normally take place during daytime hours. Evening and night work might occur on the AGP Project, but that would put it approximately 2,000 feet from the nearest residences so does not pose the potential for noise impacts. The analysis considers the effects of constructing the complete Project; however, the Port and AGP may construct project elements in phases. Any major differences in the Proposed Project would be re-evaluated as appropriate.

5.3.1 Construction Noise Analysis Procedure

The equipment modeled for each construction category is listed in **Table 5-1**, as well as the combined noise level at 50 feet for all of the equipment in each construction category. Noise levels are calculated with the FTA methodology using source noise levels from both the FTA Manual and the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) (FHWA 2006). This methodology calculates the average (L_{eq}) noise level based on:

- The types of equipment
- The number of machines
- The amount of time each machine operates at full power (loudest)
- The distance from the project site to the receptor

The types and numbers of equipment were taken from the *Air Quality and Greenhouse Gas Emission Technical Study* (Anchor QEA 2023b). The distance between the center of each work zone and the sensitive receiver is used to calculate expected levels at receivers using an attenuation rate of 6 dB per doubling of distance, which is standard for point-source mobile equipment. The calculated levels are compared to the FTA construction noise impact criteria listed in **Table 4-5** to evaluate impacts at the various receivers.

Table 5-1: Construction noise levels at 50 feet

Construction Category	Equipment	Units Operating	Total Reference Noise Level at 50 Feet (dBA Leq)
Demolition	Concrete Saw	1	85
	Dozer	1	
	Backhoe	2	
Casting Basin Earthwork	Excavator	6	88
	Dump Truck	8	
	Dozer	2	
	Roller	2	
Grading	Dozer	1	87
	Backhoe	2	
	Grader	1	
	Excavator	2	
	Scraper	2	
Building Construction	Crane	1	81
	Forklift	1	
	Backhoe	1	
	Welder / Torch	3	
	Generator	1	
Paving	Paver	1	82
	Concrete Mixer Truck	1	
	Roller	2	
	Backhoe	1	
	Paver	1	
Trackwork	Forklift	2	86
	Ballast Tamper	1	
	Grader	1	
	Rail saw	1	
	Compactor	1	
Pile Installation	Crane	1	88
	Backhoe	1	
	Dump Truck	1	
	Welder / Torch	1	
	Impact Pile Driver	1	

5.3.2 Construction Vibration Analysis Procedure

Construction vibration is assessed for individual pieces of equipment rather than construction phases. The equipment modeled for each construction phase comes from the *Air Quality and Greenhouse Gas Emissions Technical Study* (Anchor QEA 2023b). Source vibration levels in **Table 5-2** at 25 feet come from the FTA Manual. Vibration damage is evaluated using peak-particle-velocity (PPV) and annoyance is evaluated using the root-mean-square (rms) vibration level (VdB). The distance between work zones and sensitive receivers is used to calculate expected vibration levels at receivers using FTA vibration propagation equations. These levels are compared to the FTA construction vibration damage impact criteria listed in **Table 4-6** and the vibration annoyance impact criteria listed **Table 4-3**.

Table 5-2: Vibration Levels of Typical Equipment Used in Construction

Equipment	PPV at 25 ft, in/sec	Approximate Lv at 25 ft
Large Bulldozer	0.089	87
Vibratory Roller	0.210	94
Loaded Trucks	0.076	86
Pile Driver (impact) – typical	0.644	104

Source: FTA 2018

6 Existing Conditions

6.1 Existing Noise Environment in Aberdeen and Hoquiam

Acousticians from HDR measured noise levels at two locations in the project area in January 2023. The measurement locations are shown in **Figure 6-1**. HDR reported that the locations were selected to be representative of the nearest off-site noise sensitive areas in Hoquiam and Aberdeen (HDR 2023). The measurements started before 5:00 pm on Tuesday, January 24, 2023, and ended after 8:00 am on Thursday January 26, 2023. The eastern site, in the City of Aberdeen, was designated ML-1, and the western site, in the City of Hoquiam, was designated ML-2. **Figure 6-1** also shows the representative receptors used for this analysis.

Table 6-1 summarizes the noise level measurement data and **Figure 6-2** shows the hourly equivalent levels (L_{eq}) over the course of the noise survey. The data provided by HDR also includes the second-by-second noise levels over the course of the entire noise survey, e.g., for 145,277 seconds at ML-1.

Table 6-1: Summary of Ambient Noise Measurement Data

Location	Range of Hourly Leq (dBA)	Range of Ldn (dBA)
ML-1	51 – 75 dBA	66 – 70
ML-2	47 – 77 dBA	65 - 66

Figure 6-1: Noise Measurement Locations (ML) and Analysis Receptors

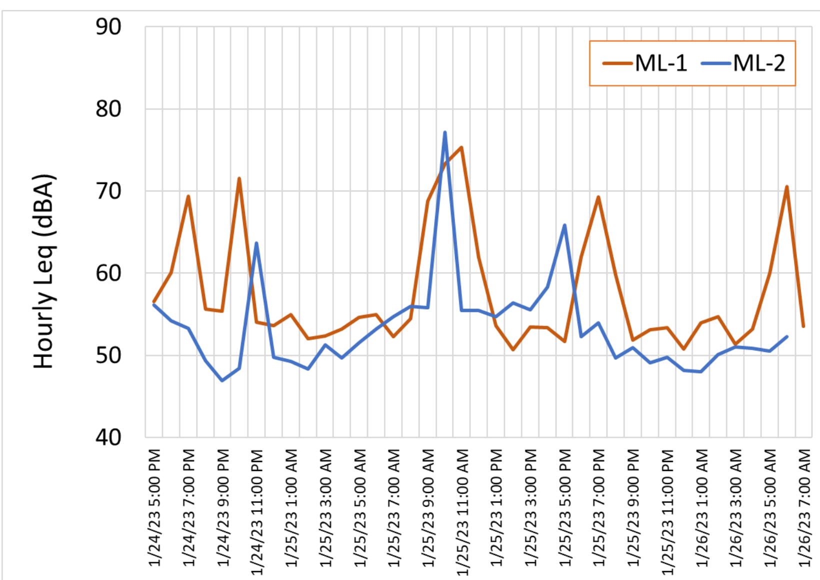

Figure 6-2: Hourly Leq Noise Levels
Source: HDR, 2023

Wilson Ihrig used the ML-1 and ML-2 ambient noise data to estimate existing noise levels at seven representative residences around the Port. The HDR data was collected on a 1-second basis which enabled Wilson Ihrig to find periods when there were no discernable noises sources, only background noise. These periods were used to calculate the background day-night sound level (L_{dn}). The data also provided noise levels for existing trains that enter and exit the Port, and these data were used to estimate the contribution of trains to the existing L_{dn}. Finally, the contribution from ships was estimated using the source level cited above and information about current ship movements. The contributions of the various elements were then combined to get an estimate of the total, existing L_{dn} at each residence. These are provided in **Table 6-2**.

Table 6-2 Estimates of Existing Day-Night Sound Levels

	Day-Night Sound Level (Ldn)						
	2841 Bay Ave	**208 Maple St**	**2108 W 1st St**	**1721 Martin St**	**1402 Hood St**	**1321/25 Hood St**	**1017 State St**
Existing Background	56.4	56.4	56.4	56.4	56.4	56.4	56.4
Existing Manifest Trains	42.9	52.4	52.7	53.8	55.3	61.6	50.1
Existing Unit Trains	46.4	55.9	56.2	57.3	58.7	65.0	53.6
Existing Train Horns	51.2	60.7	61.0	62.1	61.0	65.5	58.4
Existing Ships	27.9	25.7	25.5	25.9	30.4	30.4	33.1
Existing Cargo Yard	36.1	42.5	45.7	50.7	58.0	58.3	50.8
Existing Total	**58.0**	**63.4**	**63.7**	**64.7**	**65.3**	**69.7**	**62.0**

6.2 Existing Noise Environment – PSAP Alignment

No noise measurements have been made along the PSAP Railroad alignment other than those reported above. However, the background noise levels at ML-1 and ML-2 were 50 and 49 dBA, respectively, which results in a day-night level of 56.4 dBA L_{dn}. This is taken to be reasonably representative the background noise in other towns along the PSAP alignment.

7 Impact assessment

7.1 Operational Noise Assessment

7.1.1 Aberdeen/Hoquiam Receptors

Using the same methodology as was used to estimate the existing noise levels at the representative receptors, future noise levels were estimated based on the increased numbers of trains and ships and the new AGP shiploader system. The background noise level due to non-Port sources is assumed to remain similar to what it is today. The calculated future noise levels are shown in **Table 7-1** along with the comparison to the existing noise levels. A discussion of the various aspects of the assessment follows.

Table 7-1: Projected Future Day-Night Sound Levels (Ldn) with Proposed Project

	Day-Night Sound Level (dBA Ldn)						
	2841 Bay Ave	**208 Maple St**	**2108 W 1st St**	**1721 Martin St**	**1402 Hood St**	**1321/25 Hood St**	**1017 State St**
Future Background	56.4	56.4	56.4	56.4	56.4	56.4	56.4
Future Manifest Trains	42.9	52.4	52.7	53.8	53.8	59.8	50.1
Future Unit Trains	49.6	59.1	59.4	60.5	60.5	66.5	56.8
Future Train Horns	52.9	62.4	62.7	63.8	62.7	67.2	60.1
Future Ships	29.6	27.3	27.1	27.6	32.1	32.1	34.7
Future Cargo Yard	36.1	42.5	45.7	50.7	58.0	58.3	50.8
Future AGP	27.4	32.8	34.9	35.7	34.4	34.4	31.3
Future Total	**58.7**	**65.0**	**65.3**	**66.3**	**66.3**	**70.7**	**63.3**
Existing Total	58.0	63.4	63.7	64.7	65.3	69.7	62.0
Increase over Existing	**0.7**	**1.6**	**1.6**	**1.6**	**1.0**	**1.0**	**1.4**

The impact assessment for the Proposed Project is based on the noise exposure increase given the existing noise exposure level (**Figure 7-1)**.

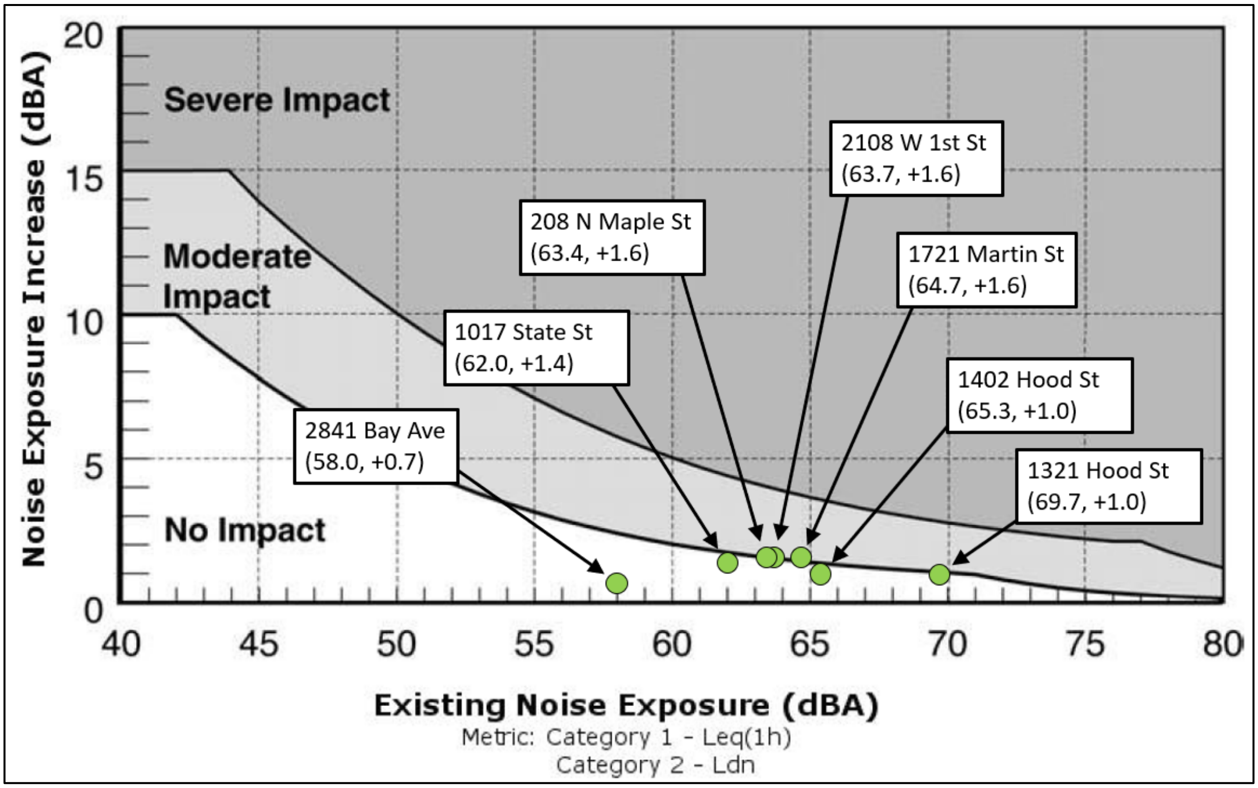

Figure 7-1: Impact assessment of analyzed receptors on FTA Noise Impact Criteria Figure

The increase in noise exposure ranges from +0.7 dB to 1.6 dB at the analyzed receptors. As such, all of the analyzed receivers in the Aberdeen/Hoquiam area are in the FTA "No Impact" region.

The contribution of each project component is discussed below.

7.1.1.1 Rail Noise Assessment

With the Proposed Project, the total annual number of trains will increase from 637 (365 manifest, 272 unit) to 937 (365 manifest, 572 unit). While the SEL reference values for the rolling noise of the two types of trains are about 5 dB apart, when they sound their horns, the difference is only about 1 dB apart because the horn noise dominates. All else being equal, the noise increase – in decibels – from increasing the number of a source is 10 times the logarithm of the ratio of the old number of sources to the new number of sources. In this case,

$$10 \times \log(937 \text{ trains}/637 \text{ trains}) = +1.7 \text{ dB}$$

This is, fundamentally, why the noise level increases by about 1.7 dB at the modeled receptors near the railroad tracks. Train noise will diminish at receptors that are far from the tracks, and, therefore, not totally dominate the noise environment. For far receptors, the increase in noise due to the greater number of trains will be less than 1.7 dB.

Two of the receptors analyzed, 1321 Hood (also representing 1325 Hood) and 1402 Hood are very near the existing tracks, but they are also near the area where, in the future, a number of switches will cause the tracks to fan out as they enter or exit the Port property (see **Figure 7-2**). For this analysis, we assume that each train will either enter via the fan and exit on the existing track (having looped through the Port) or enter the Port using the existing track and then exit via the fan. Trains going through the fan are assumed to use the tracks evenly distributed. For 1321 and 1325 Hood, the existing tracks are 35 feet away, but the effective center of the fan tracks (taking logarithmic attenuation into account) is 74 feet away. For 1402 Hood, the existing track is 92 feet away and the effective center of the fan tracks is 165 ft away. Currently, 1,272 trains per year pass 35 feet from 1321 Hood St (636 trains total, each passing twice – arriving and departing). In the future, only 936 will pass 35 feet from this location, and the other 936 will effectively pass 74 feet from this location. Because half the future trains would pass 1321 at the greater distance, this partially offsets the increase in noise exposure due to the larger number of trains, which is why the noise exposure only increases 1.0 dBA L_{dn} at this location. The same calculation applies to 1325 and 1402 Hood St.

Figure 7-2: Proposed Project Tracks (Turquoise) Fanning Out Near Hood St

7.1.1.2 Ship Noise Assessment

Ship noise is not currently contributing a measurable amount of noise to environment at residential receptors and the increase in shipping movements is not sufficient to cause this to change after completion of the Proposed Project.

7.1.1.3 AGP Facility Operational Noise Assessment

The AGP shiploader system (rail receiving building, conveyors, shiploader, and new silo) will not contribute a measurable amount of noise to the environment at the residential receivers.

7.1.2 PSAP Alignment Receptors

The same model that was used for the Aberdeen/Hoquiam receptors near the Port may be adapted for use along the PSAP alignment Off-Site Project Area. The model is adapted by removing the ship, cargo yard, and AGP facility noise levels, i.e., by assuming that the trains are the major noise source, and increasing their speed to 25 mph.[11] As noted above, the background is taken to be 56 dBA L_{dn}. One may then use the model to calculate the perpendicular distance from the tracks beyond which the increase in noise at the residence would be in the "No Impact" region of the FTA chart and lower than FTA's moderate impact criteria (**Figure 4-1**). The distance does depend on whether or not the residence is within a ¼ mile of a grade crossing in which case horn noise is included in the analysis. The resulting distances are:

- For residences near a grade crossing: 105 ft
- For residences not near a grade crossing: 55 ft

Residences located within these buffer distances along the PSAP between Aberdeen and Centralia may be exposed to noise above FTA's No Impact level as a result of additional Proposed Project-related train traffic along the PSAP depending on their distance to the rail alignment and other factors such as the actual level of ambient baseline noise at each receptor, which is not known at this time.

To address noise impacts along the PSAP that would result from the addition of Proposed Project-related trains, the Port of Grays Harbor, with the assistance of PSAP, may engage public authorities within the Off-Site Project Area to support further analysis and identification of noise impacts and work with affected communities to inform interested parties of the process to implement FRA quiet zones.

The FRA Final Train Horn Rule (49 Code of Federal Regulations [CFR] 222) provides a safe and effective way to decrease locomotive horn noise through creation of quiet zones. These are areas where trains do not sound their horns as long as FRA safety requirements are at the crossing is met. Quiet zones can be established using a procedure established in FRA regulations, typically requiring enhanced safety measures at grade crossings such that train horns would not be required to be used. Implementation of each quiet zone requires cooperation by all applicable jurisdictions and is contingent on approval by FRA.

As described in the Project Description Technical Report (Anchor QEA 2023a), the Aberdeen U.S. 12 Highway-Rail Separation is expected to occur in the foreseeable future, regardless of whether the Port Project or the AGP Project proceeds. This project would result in the creation of several grade-separated crossings over the PSAP in Aberdeen near the Olympic Gateway Plaza. This would eliminate train horn noise though portions of Aberdeen, east of the On-Site project area.

7.2 Rail Vibration Assessment

The Proposed Project will, on average, increase the number of train movements from 3.49 per day to 5.13 per day – still well within the Infrequent Event category for assessing locomotive vibration. As such, the criterion is 80 VdB. The rail cars themselves are assessed using the Frequent Event criterion of 72 VdB because of the length of the trains.

Table 7-2 presents the calculated vibration levels for both existing and future track configurations and for both locomotives and rail cars. The rail switch nearest to 1321 and 1325 Hood St is presently

[11] The PSAP tracks are registered with FRA as Class 2 with an overall maximum speed of 25 mph for freight trains.

approximately 115 away under current conditions. After construction of the Proposed Project, the closest rail switch would be 54 feet away. As can be seen, because the switch nearest to 1321 and 1325 Hood St goes from being 115 feet away to 54 feet away, the vibration levels are expected to increase by about 5 VdB. This would result in anticipated locomotive vibration 1 VdB over the FTA criterion and rail car vibration 4 VdB over the criterion.

Table 7-2: Assessment of Rail Groundborne Vibration

	Source	Criterion (VdB)	Residential Vibration Velocity Levels (VdB)						
			2841 Bay Ave	208 Maple	2108 W 1st St	1721 Martin	1402 Hood St	1321/25 Hood St	1017 State St
Existing	(Distance to Switch)		480 ft	970 ft	125 ft	1,140 ft	102 ft	115 ft	1,410 ft
	Locomotives	80	49	65	68	66	71	76	61
	Cars	72	44	60	63	61	66	71	56
Future	(Distance to Switch)		480 ft	970 ft	125 ft	1,140 ft	102 ft	54 ft	732 ft
	Locomotives	80	49	65	68	66	71	**81**	61
	Cars	72	44	60	63	61	66	**76**	56

Note: Vibration levels that exceed the FTA criterion are shown in **boldface** type.

To address vibration impacts at 1321 and 1325 Hood St, the Port could install ballast mats under the new rail at the location of the rail switch closest to these residences. According to the FTA guidance manual, a ballast mat can provide 8 to 12 VdB of attenuation when placed over a concrete pad (FTA 2018). Ballast mat may be placed directly over compacted soil with some degradation of performance, but as only 4 VdB of attenuation would be required for the Proposed Project, it is a likely that ballast mats at this location would reduce vibration impacts to a level below the FTA criteria.

7.3 Construction Noise and Vibration Assessment

Construction is planned in 10 work zones across the Port property, pictured in **Figure 7-3.** Almost all Hoquiam and Aberdeen residences are located more than 300 feet away from the nearest Work Zone. Noise levels from the planned construction activity in any work zone are not expected to exceed either the daily L_{eq} or monthly average L_{dn} FTA criteria at most residences. The exceptions are five residences on Hood St (1321, 1325, 1402, 1408, and 1412 Hood St) and 2 residences on State Street (1017 and 1021 State St). These residences are separate from the rest of the residential blocks – and closer to the Port – so the noise and vibration levels are higher than at residences set further back from the planned work zones.

7.3.1 Construction Noise Assessment

Table 5-1 details the specific equipment modeled for each construction category. **Table 7-3** shows the Work Zones where each construction category is planned to occur.

Work Zone 1 is more than 300 feet from the nearest residence. The loudest activity proposed for Work Zone 1 is trackwork, with a predicted level of 71 dBA L_{eq} at 300 feet. This is well below the FTA impact level of 80 dBA L_{eq}, and prolonged construction activity at Work Zone 1 would not exceed the FTA 30-day average L_{dn} criteria of 75 dBA.

Work Zones 2 to 7 are all 800 to 2,700 feet away from the nearest residence. The loudest activity proposed for Work Zone 7 – the closest to sensitive receptors – is grading, with a predicted level of 63 dBA Leq at 800 feet. Pile driving is only planned to occur in Work Zone 5, which is more than 2,000 feet from any residential receiver and over 850 feet from The Home Depot. Daily noise levels from pile installation activity could reach 61 dBA Leq at 850 feet and 56 dBA Leq at 2,000 feet, both well under the FTA impact criteria for even residential receivers.

Figure 7-3: Construction Work Zones

Table 7-3: Construction Phases & Work Zones

Construction Phase	Work Zones with this construction category
Demolition	2, 3, 5, 10
Casting Basin Earthwork	10
Grading	2, 3, 4, 5, 6, 7, 8, 9, 10
Building Construction	2, 3, 5, 6, 7, 8, 10
Paving	1, 3, 4, 6, 7, 8, 10
Trackwork	1, 2, 3, 4, 5, 6, 7, 8, 9
Pile Installation	5

The edge of Work Zone 8 is a section of the PSAP directly adjacent to several residences on Hood St. These residences could experience daily levels at or above the FTA assessment criterion of 80 dBA Leq during certain construction activities. The estimated noise levels are summarized in **Table 7-4**. These levels are above the FTA daily criterion. As discussed previously, construction noise is not subject to any WAC or local noise ordinance limits, and the noise exposure would be temporary, only occurring when new tracks were being constructed.

All other residences are located more than 400 feet away from Work Zone 8, and daily construction noise levels would reach, at most, 69 dBA Leq.

Table 7-4: Potential Impacts at Hood St Residences

Work Zone	Activity	Affected receivers	Distance to edge of Work Zone	Leq at receiver
8	Building Construction	1321, 1325 Hood St 1402, 1408, 1412 Hood St	20 ft 60 ft	89 dBA 80 dBA
	Grading	1321, 1325 Hood St 1402, 1408, 1412 Hood St	20 ft 60 ft	95 dBA 86 dBA
	Paving	1321, 1325 Hood St 1402, 1408, 1412 Hood St	20 ft 60 ft	90 dBA 80 dBA
	Trackwork	1321, 1325 Hood St 1402, 1408, 1412 Hood St	20 ft 60 ft	94 dBA 85 dBA

Work Zone 9 is a section of the PSAP railroad mostly adjacent to industrial receivers. The residences at 1017 and 1021 State St are 130 feet away from the Work Zone and could experience daily noise levels of up to 79 dBA with trackwork and grading activity at and near the Monroe St grade crossing. This is below the FTA daily criteria of 80 dBA L_{eq}. Other residential receivers are more than 300 feet away from any section of Work Zone 9. Daily noise levels from trackwork could reach 71 dBA L_{eq} at 300 feet.

The edge of Work Zone 10 is closer to the Hood St residences, with distances of 130 feet (1321 and 1325 Hood St) and 260 feet (1402, 1408, and 1412 Hood St). Noise levels during grading activities at the near edge of Work Zone 10 could cause daily noise levels of up to 77 dBA L_{eq} and 73 dBA L_{eq}, respectively, below the FTA daily criteria of 80 dBA L_{eq}. Even prolonged grading activity at the near edge of Work Zone 10 would not cause the 30-day average day-night sound level to rise above 75 dBA L_{dn}. All other residences are more than 600 feet away from the edge of Work Zone 10 and could experience daily noise levels of up to 66 dBA L_{eq}. However, as construction activity in Work Zone 10 including casting basin earthwork would be spread throughout the Work Zone, noise levels would be lower than the levels calculated for activity at the very edge of the Work Zone.

7.3.2 Construction Vibration Assessment

Impacts at residences due to vibration annoyance are unlikely at any residential receiver except for the Hood St residences. Damage impact at any residential receiver is unlikely. Vibration levels of representative construction equipment are summarized in **Table 5-2**. These values are used to calculate buffer distances within which construction vibration could be greater than residential annoyance or building damage criteria. **Table 4-6** shows construction vibration damage criteria and **Table 4-3** shows construction annoyance criteria.

Residential buildings are assumed to be FTA Type III, non-engineered timber and masonry buildings. No buildings adjacent to the On-Site project area appear to be buildings where vibration would interfere with interior operations, so the vibration annoyance criteria selected from **Table 4-3** is for frequent events at residences and buildings where people normally sleep. The buffer distances to the different criteria are summarized in **Table 7-5**.

Table 7-5: Buffer distances for damage and annoyance criteria

Equipment	Distance to Type II building damage criteria (ft)	Distance to Type III building damage criteria (ft)	Distance to Residential annoyance criteria (ft)
Large Bulldozer	12	15	79
Vibratory Roller	20	26	135
Loaded Trucks	10	14	73
Pile Driver (impact) – typical	42	55	291

Pile driving is only planned in Work Zone 5, more than 850 feet away from any building that is not owned by the Port of Grays Harbor. (The closest non-Port building is The Home Depot.) The nearest residence is over 2,000 feet away. Vibration from pile driving at any residential receiver or non-Port industrial building will be well under both the damage and annoyance criteria.

Vibration levels at the Hood St residences may exceed annoyance criteria during vibratory rolling and similar activities in Work Zone 8. However, any impact experienced would be temporary and limited to the operation of the heavy machinery and temporary in nature.

Ballast tamping in Work Zone 9 could create vibration levels similar to a vibratory roller. Residences at 1017 and 1021 State St could experience vibration levels above the annoyance criteria for residential receivers during trackwork at and near the Monroe St grade crossing. However, any impact would be temporary and limited to the duration of the ballast tamping activity

Industrial buildings adjacent to the PSAP railroad may be located close enough to Work Zones 8 and 9 to experience vibration above the damage criteria for Type II or Type III buildings during vibratory rolling or ballast tamping. Real-time vibration monitors that could alert construction crews to levels above the damage threshold level be deployed in them when heavy construction work is undertaken.

8 Cumulative Effects

Cumulative impacts are caused by the incremental impact of the alternatives when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor, but collectively significant actions, which take place over time (40 CFR 1508.7) The geographic study area for cumulative impacts is the same as the biological resources study area.

The cumulative impacts analysis was prepared in accordance with SEPA requirements (WAC 197.11.060) and considered the federal Council on Environmental Quality approach for analyzing cumulative impacts. The following steps were used:

- Identify the resources that could be adversely affected by the Proposed Project.
- Consider other actions in the same geographic study area for each resource.
- Consider other actions with effects during the same time period as effects from the Proposed Project, both during construction and operation.
- Analyze cumulative impacts using the best available data.

Current conditions are a result of past and present actions. The current conditions in the study area that were used as the baseline existing environmental condition are described in Section 6. Therefore, the cumulative effect of past actions were assumed to be captured in the analysis of project impacts and were not separately called out in the analysis of cumulative impacts.

A number of other projects are currently in progress or are expected to occur in the foreseeable future, regardless of whether the Port Project or the AGP Project proceeds. The impacts of these projects may have the potential to contribute to a cumulative impact on resources when combined with the impacts of the Proposed Project. A complete list of projects with project descriptions is provided in Table 1 of the Project Description Technical Report (Anchor QEA 2023a).

Of these projects, the Port Industrial Road Pavement Preservation Project and the Fry Creek Restoration and Pump Station project are the only two projects identified that would take place within Port property near the planned Proposed Project. If construction activities for either of these projects were to occur at the same time as the construction of the Proposed Project in one of the nearby work zones, the combined construction noise and vibration impacts may result in short term and temporary cumulative noise impacts. However, any potential cumulative impacts would be short term, temporary, and would depend on the distance to the closest receptor.

9 Mitigation

As described above, the construction of the Proposed Project may result in vibration impacts at nearby receptors above the FTA annoyance criteria. However, these impacts would be temporary and limited to specific construction activities and as such, no mitigation is proposed. The operation of the Proposed Project would result in ongoing vibration impacts above FTA annoyance criteria at two residences: 1321 and 1325 Hood St. The installation of ballast mat under the rail in the location of the rail switch closest to these residences would be anticipated to reduce the vibration impacts experienced by those residences to below the FTA annoyance criteria.

The FTA manual is intended to support the objective assessment of the need for mitigation. Using the assessment methods in the FTA manual, the addition of Proposed Project-related trains to existing baseline rail traffic along the PSAP may result in noise levels at receptors exceeding the FTA no-impact criteria. However, as noted in the FTA manual, the views of the community should be considered when a project may result in noise impacts predicted through the manual. For projects that may result in noise levels in the FTA moderate impact range, FTA recommends making mitigation decisions after considering input from the affected public, relevant government agencies, and community organizations.

As such, to address noise impacts along the PSAP that would result from the addition of Proposed Project-related trains, the Port of Grays and Harbor, with assistance from PSAP, may engage public authorities within the Off-Site Project Area to support further analysis and identification of noise impacts and work with affected communities to inform interested parties of the process to implement FRA quiet zones.

10 References

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