



Bull Run
TREATMENT
PROJECTS

Filtration

Technical Memorandum

Subject: Bull Run Filtration Facility Exterior Noise Analysis

PWB Project #s: W02229

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1. Executive Summary

This memo presents Stantec's results of an updated exterior noise analysis of the Bull Run Portland Filtration Facility mechanical equipment. The updated study was prompted by two changes made to the site layout. Since the initial memo was issued, the Pleasant Home Pump station and Fire Pump station within areas 45 and 46 were relocated and consolidated into the Sandy Pump Station.

In Summary:

Mechanical equipment with continuous operations will comply with both Multnomah and Clackamas County Noise Codes at the adjacent property lines (60 dBA daytime limit, 50 dBA nighttime limits as outlined in Multnomah County Noise Code chapter 15.269 and Clackamas County Noise Code 6.05.040).

Emergency generators and fire pumps are emergency equipment and not considered mechanical equipment with continuous operations. Therefore, noise from this equipment is exempt from the noise code (Multnomah County Noise Code, Chapter 15.270.B, Clackamas County Noise Code, Chapter 6.05.06.B).

2. Introduction

This memo presents Stantec's method and comments resulting from an updated exterior noise analysis for the proposed filtration facility in Multnomah County, Oregon as it relates to the neighboring noise-sensitive receptors surrounding the project which includes properties in the adjacent county of Clackamas. All the information contained in this memo is based on the architectural drawings and sound power level information provided for the filtration facility. Included below are sections addressing a description of the project location and conditions, a discussion of the project's design criteria, and the analysis conditions.

3. Bull Run Filtration Facility

The Bull Run Filtration Facility is in Multnomah County near Dodge Park Boulevard to the north and the Clackamas County line to the south. The location of the buildings on the site, the buildings removed from the previous analysis, and the new pump and generator building are shown in Figure 1.

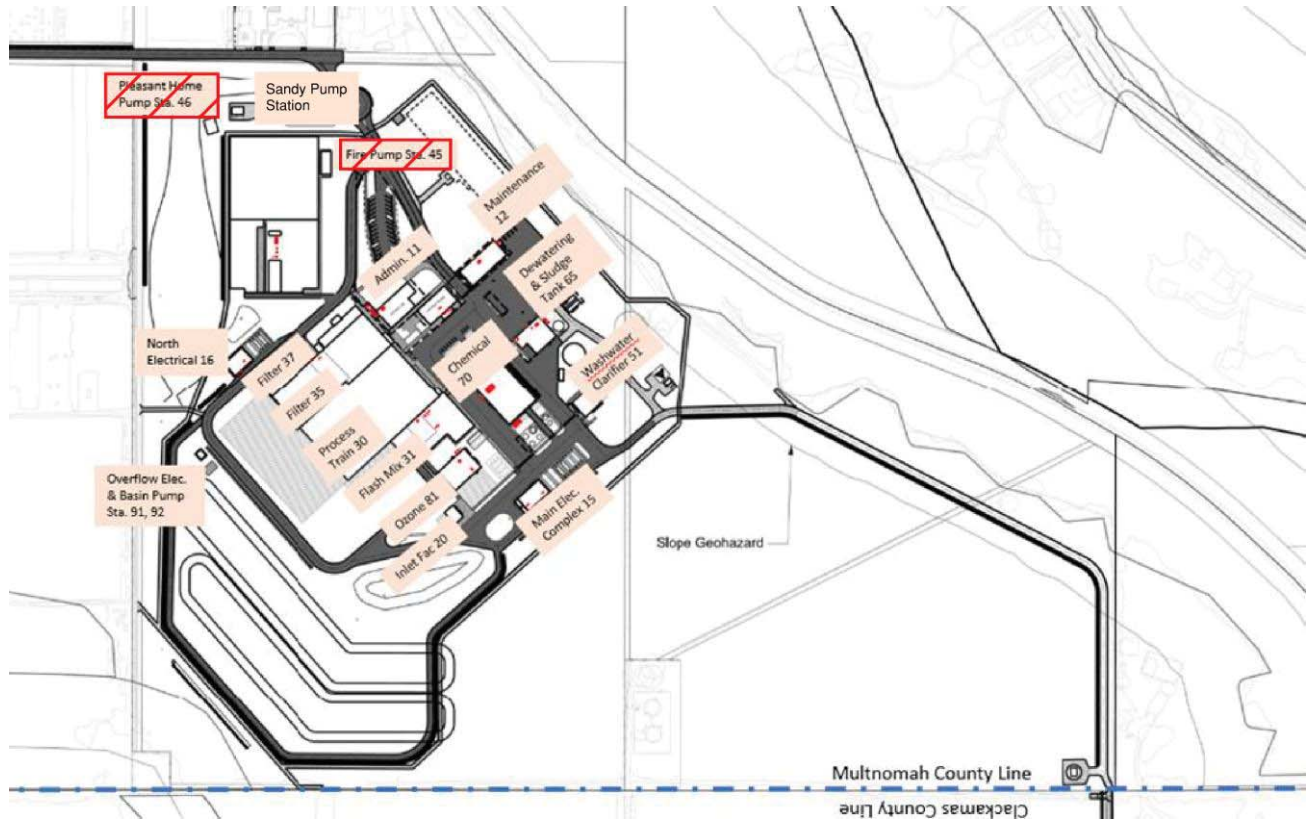


Figure 1. Location of Bull Run Filtration Project Buildings and Structures.

The Bull Run Filtration Facility will incorporate many pieces of mechanical equipment including air handling units, centrifugal blowers, flocculators, air source heat pumps, sediment pumps, water pumps, condensing units, generators, and transformers. The equipment (source) locations are shown in Figure 2 as they relate to the various site locations labeled in Figure 1.

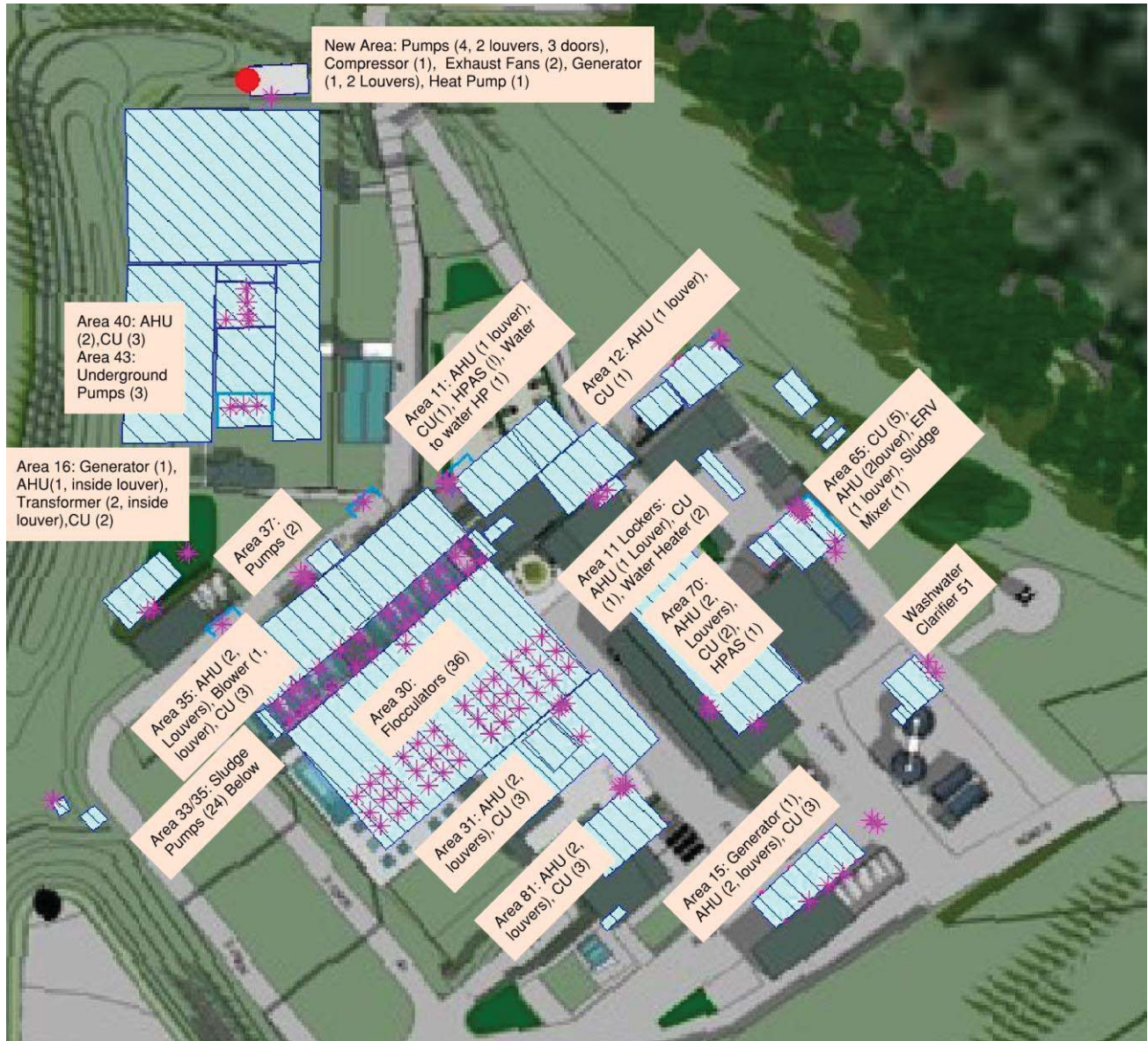


Figure 2. Source Locations (Pink Stars and Red Dots) for Noise Analysis

4. Noise Regulations

Since the project site resides within Multnomah County and the adjacent properties to the south of the site reside in Clackamas County, both noise codes will be applicable. Where standards in the counties are different, the more restrictive standard has been used to ensure compliance with both.

4.1 Multnomah County Noise Code

Chapter 15.269 (A), (B), (C) and Chapter 15.270 (B)

15.269 PROHIBITIONS.

It shall be unlawful for any person to produce or permit to be produced, with a sound production device sound which:

When measured at or within the boundary of the property on which a noise sensitive unit which is not the source of the sound is located, or, within a noise sensitive unit which is not the source of the sound, exceeds:

Fifty dBA at any time between 10:00 p.m. and 7:00 a.m. the following day; or

Sixty dBA at any time between 7:00 a.m. and 10:00 p.m. the same day; or

Is plainly audible at any time between 10:00 p.m. and 7:00 a.m. the following day:

Within a noise sensitive unit which is not the source of sound; or

On a public right-of-way at a distance of 50 feet or more from the source of the sound.

If a measurement of the sound is made, division (A) of this section shall supersede division (B) of this section and shall be used to determine if a violation exists. Penalty, see 15.999.

15.270 EXCEPTIONS.

Notwithstanding 15.269, the following exceptions from this subchapter are permitted:

Sounds caused by organized athletic or other group activities, when those activities are conducted on property generally used for those purposes, including stadiums, parks, schools, churches, athletic fields, racetracks, airports, and waterways, provided, however, that this exception shall not impair the Sheriff's power to declare the event or activities otherwise to violate other laws, ordinances or regulations.

Sounds caused by emergency work, by the ordinary and accepted use of emergency equipment, vehicles and apparatus, whether or not the work is performed by a public or private agency, upon public or private property.

Note that if a measurement of the sound is made then division (A) shall supersede division (B) to determine if a violation exists.

4.2 Clackamas County Noise Code 6.05

Chapters 6.05.040, 6.05.050, 6.05.060

6.05.040 NOISES SPECIFICALLY PROHIBITED

Sounds It shall be a per se violation of this chapter for any person to produce or permit to be produced, from a sound source either owned and operated by them or under their control, sound which exceeds:

50 dBA at any time between 10 p.m. and 7 a.m. the following day: or,

60 dBA at any time between 7 a.m. and 10 p.m.

The following acts are declared per se violations of this chapter based upon a reasonable person standard. The enumeration does not constitute an exclusive list;

Unreasonable Noises: The unreasonable making of, or knowingly and unreasonably permitting to be made, any unreasonably loud, boisterous, or unusual noise, disturbance, commotion, or vibration in any boarding facility, dwelling, place of business or other structure, or upon any public right of way, public spaces or other place or building. The ordinary and usual sounds, noises, commotion or vibration incidental to the operation of these places when conducted in accordance with the usual standards of practice and in a manner which will not unreasonably disturb the peace and comfort of adjacent noise sensitive areas or which will not detrimentally affect the operators of adjacent places of business are exempt from this provision.

Vehicle, Horns, Signaling Devices, and Similar Devices: The sounding of any horn, signaling device, or other similar device on any vehicle on any right of way or in the public space of the County, for more than ten consecutive seconds. The sounding of any horn, signaling device or other similar device, as a danger warning is exempt from this prohibition.

Non-Emergency Signaling Devices: Sounding any amplified signal from any bell, chime, siren, whistle or similar device, intended primarily for non-emergency purposes, from any place for more than ten consecutive seconds in any hourly period.

Emergency Signaling Devices: The intentional sounding or permitting the sounding outdoors of any emergency signaling device including fire, burglar, civil defense alarm, car alarm, siren, whistle, or similar emergency signaling device, except in an emergency.

Radios, Televisions, Stereos, Musical Instruments and Similar Devices: The use or operation of a radio, television, stereo, musical instrument, or similar device, including but not limited to computers, mp3 players, and cellular phones, that produces or reproduces sound in a manner that is plainly audible to any person other than the player(s) or operator(s) of the device, and those who are voluntarily listening to the sound, and which unreasonably disturbs the peace, quiet, and comfort of neighbors as received or perceived in dwellings or noise sensitive areas or passers-by, or is plainly audible at a distance of 50 feet from any person in a noise sensitive area.

Loudspeakers, Amplifiers, Public Address Systems and Similar Devices: The unreasonably loud and raucous use or operation of a loudspeaker, amplifier, public address system, or other device for producing or reproducing sound between the hours of 10 p.m. and 7 a.m. the following day in the following areas

Within or in proximity to dwellings or noise sensitive areas.

Within the public space if the sound is plainly audible across the real property line of the public space from which the sound emanates, and is unreasonably loud.

Yelling, Shouting and Similar Activities: Yelling, shouting, hooting, whistling or singing received or perceived in dwellings, noise sensitive areas or in public places, between the hours of 10 p.m., and 7 a.m. the following day, or at any time or place so as to unreasonably disturb the quiet, comfort, or repose of reasonable persons of ordinary sensitivities. This section is to be applied only to those situations where the disturbance is not a result of the content of the communication but due to the volume, duration, location, timing, or other factors not based on content.

Animals and Birds: Within urban residential zoning districts, unreasonably loud and raucous noise emitted by an animal or bird for which a person is responsible. A person is responsible for an animal if the person owns, controls, or otherwise cares for the animal or bird.

Dogs: Any dog that unreasonably causes annoyance, alarm or noise disturbance in violation of the Clackamas County Animal Licensing, Services, and Enforcement Chapter 5.01.

Loading or Unloading Merchandise, Materials, Equipment: The creation of unreasonably loud, raucous and excessive noise relating to the loading or unloading of any vehicle at a place of business or residence.

Construction or Repair of Buildings, Excavation of Streets and Highways: The construction, demolition, alteration, or repair of any building or the excavation of streets and highways other than between the hours of 7 a.m. and 10 p.m..

Blowers, and Similar Devices: Between the hours of 10 p.m. and 7 a.m. the following day, the operation of any noise-creating blower, power fan, or any internal combustion engine, the operation of which causes noise due to the explosion of operating gases or fluids, provided that the noise is unreasonably loud and is received or perceived in dwellings or noise sensitive areas.

Commercial Establishments Adjacent to Dwellings: Unreasonably loud and raucous noise from the premises of any commercial establishment, including any outdoor area which is part of or under control of the establishment, between the hours of 10 p.m. and 7 a.m. that is plainly audible at a distance of five feet from any dwelling.

6.05.050 SOUND MEASUREMENT

Any dBA measurements taken shall be made with a sound level meter. The sound level meter shall be an instrument in good operating condition, meeting the requirements of a Type I or Type II meter, as specified in ANSI Standard 1.4-1971. For purposes of this chapter, a sound level meter shall contain at least an A-weighted scale, and both fast and slow meter response capabilities.

Personnel making measurements shall have completed training in the use of the sound level meter, and measurement procedures consistent with that training shall be followed.

Measurements may only be made inside of a noise sensitive unit occupied by a person making a complaint under this chapter at, or within, three (3) feet of a closed window or closed door.

All measurements made pursuant to this chapter shall comply with the provisions of this section.

6.05.060 EXEMPTIONS

Notwithstanding 6.05.040, the following exceptions from this chapter are permitted when conditions therefor are met:

- (A) Sounds caused by organized athletic, religious, educational, civic or racing activities on property generally used for such purposes, including stadiums, parks, schools, churches, athletic fields, race tracks, airports and waterways, between the hours of 7:00 a.m. and 10:00 p.m. the same day;
- (B) Sounds caused by emergency work, or by the ordinary and accepted use of equipment, vehicles and apparatus in response to an emergency, whether or not such work is performed or equipment is used by a public or private agency, upon public or private property;
- (C) Sounds caused by sources regulated as to sound production by federal law, including, but not limited to, sounds caused by railroad, aircraft or commercially licensed watercraft operations;
- (D) Sounds caused by bona fide use of emergency warning devices and alarm systems authorized by the Clackamas County Alarm Permit Chapter 8.07 or successor provisions;
- (E) Sounds caused by blasting activities when performed under a permit issued by appropriate governmental authorities and only between the hours of 9 a.m. and 4 p.m. excluding weekends, unless such permit expressly authorizes otherwise;
- (F) Sounds caused by industrial, commercial, timber-harvesting, or utility organizations or workers during their normal operations;
- (G) Sounds caused by animals associated with agricultural operations, or animal husbandry;
- (H) Sounds caused by motor vehicles operated on a public right of way, which are regulated by state law (ORS 815.250) which the Sheriff has a mandate to enforce, and which are not otherwise prohibited by 6.05.040 (B)(2) or (B)(4);
- (I) Sounds caused by construction activity or by tools, including drills, chain saws, lawnmowers, saws, hammers, and similar tools, between the hours of 7 a.m. to 10 p.m. of the same day;
- (J) Repair or excavations of bridges, streets or highways by or on behalf of the County, the State or the federal government, between the hours of 10 p.m., and 7 a.m. the following day, when the public welfare and convenience renders it impractical to perform the work between 7 a.m. and 10 p.m.;
- (K) Outdoor gatherings, public dances, shows, sporting events and other similar outdoor events, provided that a permit has been obtained from the appropriate permitting authority or is being sponsored or hosted by the County;
- (L) Noise emanating from the combustion, detonation, or concussion caused by using fireworks or other similar devices from July 1 until July 5 of each year;
- (M) When the sound is emitted from a motorboat it shall not be subject to the standards above but a violation shall be established where the sound exceeds 75 dBA as measured on shore, provided that the measurement be taken no closer than 150 feet from the boat. Where a measurement is taken from a distance closer than 150 feet, a violation shall be established where the sound exceeds 84 dBA measured no closer than 50 feet from the boat. Motorboats shall not be operated on public waterways within the County unless equipped with a functioning underwater exhaust, muffler, or system which continuously pipes water into the exhaust line, except as may be permitted under ORS 830.260.

5. Exterior Noise Analysis

5.1 Analysis Conditions and Assumptions

The following conditions and assumptions were included in the revised exterior noise analysis of the Bull Run Filtration Facility:

Predicted noise levels at various receiver locations around the project site were calculated using the computer program SoundPlan. SoundPlan uses standardized prediction techniques (per ISO 9613) and accounts for distance, topography, vegetation, and the effect of shielding and reflections produced by buildings and acoustic barriers.

The receivers were positioned at 5' above ground level in the SoundPlan model.

Receiver locations are shown in Figure 3 below.

Receiver locations 1-6 coincide with measured ambient locations. Receiver locations, North, South, East, and West are the closest adjacent properties to an “on-site” continuous noise source.

All receiver locations were included in the model to determine compliance with the Multnomah County and Clackamas County Codes.

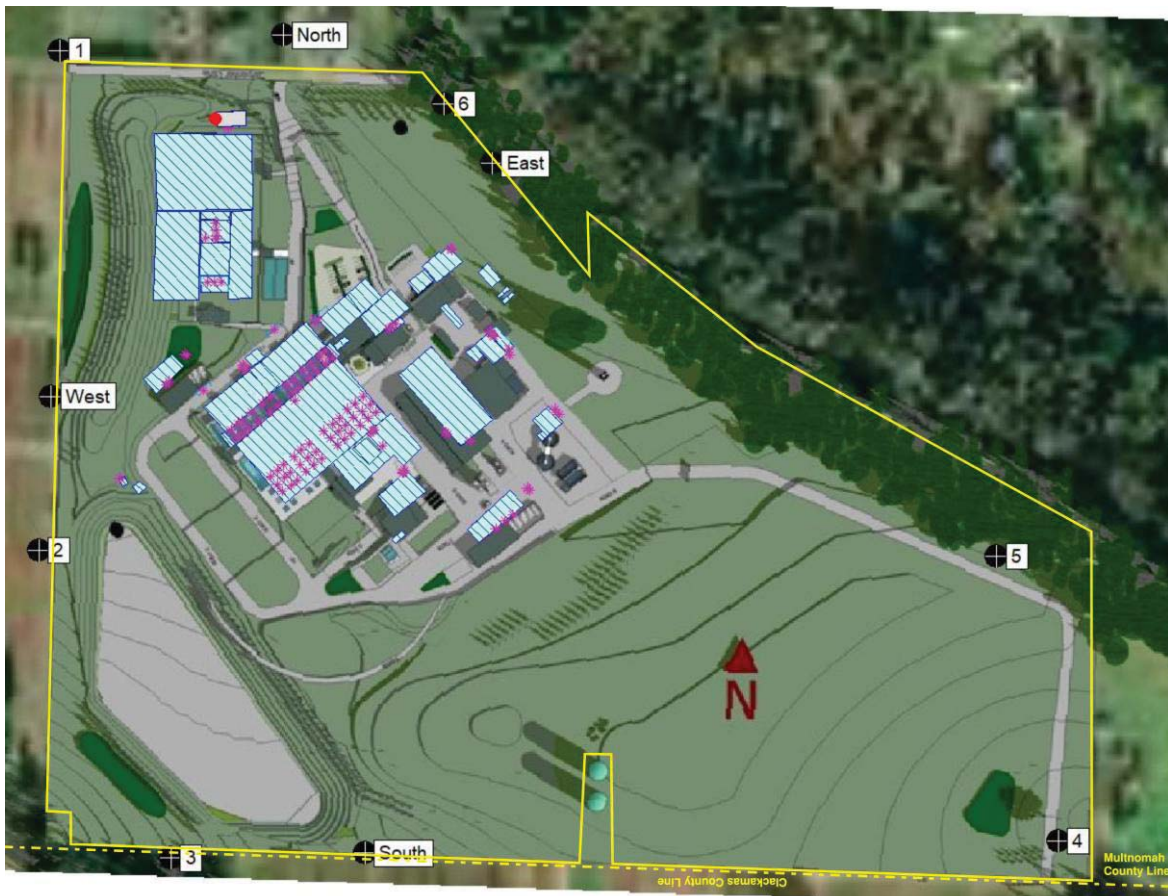


Figure 3. Bull Run Filtration Facility Receiver Locations (indicated by black circles).

Each louver was modeled as an area source representing the exhaust/inlet openings on facades of buildings in SoundPlan.

Each outdoor source was represented by a point source in SoundPlan (pink stars or red dots in Figure 3).

Noise sources and their associated buildings/structures are outlined above in Figures 1 and 2.

Unit octave band sound levels were provided by Stantec Mechanical Engineering. A table of the sound power levels used in the model is presented in Appendix A.

All mechanical equipment was assumed to be operating at full capacity and continuously, to simulate a worst-case condition.

The SoundPlan model does not include existing background levels or traffic data.

The model does not include noise during construction. Noise from construction activities is exempt from code restrictions as per Paragraph 15.270.(F) in the Multnomah County Code and Paragraph 6.05.040.B.11 in the Clackamas County Code.

Sections 15.270 in the Multnomah County Noise Code and 6.05.060 in the Clackamas County Noise Code provide exemptions for emergency work. It is assumed that the operation of emergency equipment pertaining to the testing, maintenance, and health of these systems is classified as emergency work. Therefore, the testing of emergency equipment on the Bull Run site, such as the generator and fire pumps, falls under an exemption in both the Multnomah and Clackamas Noise Codes.

Noise from the site was analyzed at the adjacent property lines surrounding the project. The distances between the nearest site noise from continuous sources and the neighboring property lines were measured in SoundPlan to be as follows (Table 1).

Table 1. Distances between Site Noise Sources and Adjacent Property Lines.

Location	Distance to Closest Continuous Source (Ft)
1	281
2	548
3	931
4	1731
5	1268
6	332
East	232
North	485
South	846
West	380

5.2 Analysis Results and Recommendations

Mechanical Equipment-Continuous Operation-No Emergency Generators and Fire Pumps

The results of the exterior noise analysis of the project include equipment operating continuously and does not include emergency equipment such as emergency generator or fire pumps. In Table 2, the predicted noise levels are presented along with the actual measured levels taken at the site in June of 2020. The daytime and nighttime noise code requirements are also presented as a reference for compliance. Since the mechanical equipment is scheduled to operate continuously, compliance to the nighttime code, 50 dBA, is the design goal. A noise grid map is shown in Figure 4. The grid map includes noise contour lines in 5 dBA increments ranging from less than 40 dBA (green) to greater or equal to 95 dBA (dark blue).

Table 2. Sound Pressure Levels (dBA) at the Neighboring Property Lines

Continuous Site Equipment-ON; Emergency Equipment-OFF					
Location	Meas. Daytime (Min-Max Leq in dBA)*	Prediction New Site (Ld in dBA)**	Daytime Noise Code in dBA	Nighttime Noise Code in dBA	Met Noise Code? (Y/N)
1	41-58	40	60	50	Y
2	41-52	40			Y
3	41-51	31			Y
4	46-55	29			Y
5	42-55	35			Y
6	48-57	46			Y
North	N/A	44	60	50	Y
East	N/A	44			Y
South	N/A	39			Y
West	N/A	46			Y
*Reference The Greenbusch Group, "Acoustic Design Criteria and Baseline Measurements," 02/02/2020					
**The predicted noise does not include the site background noise levels					

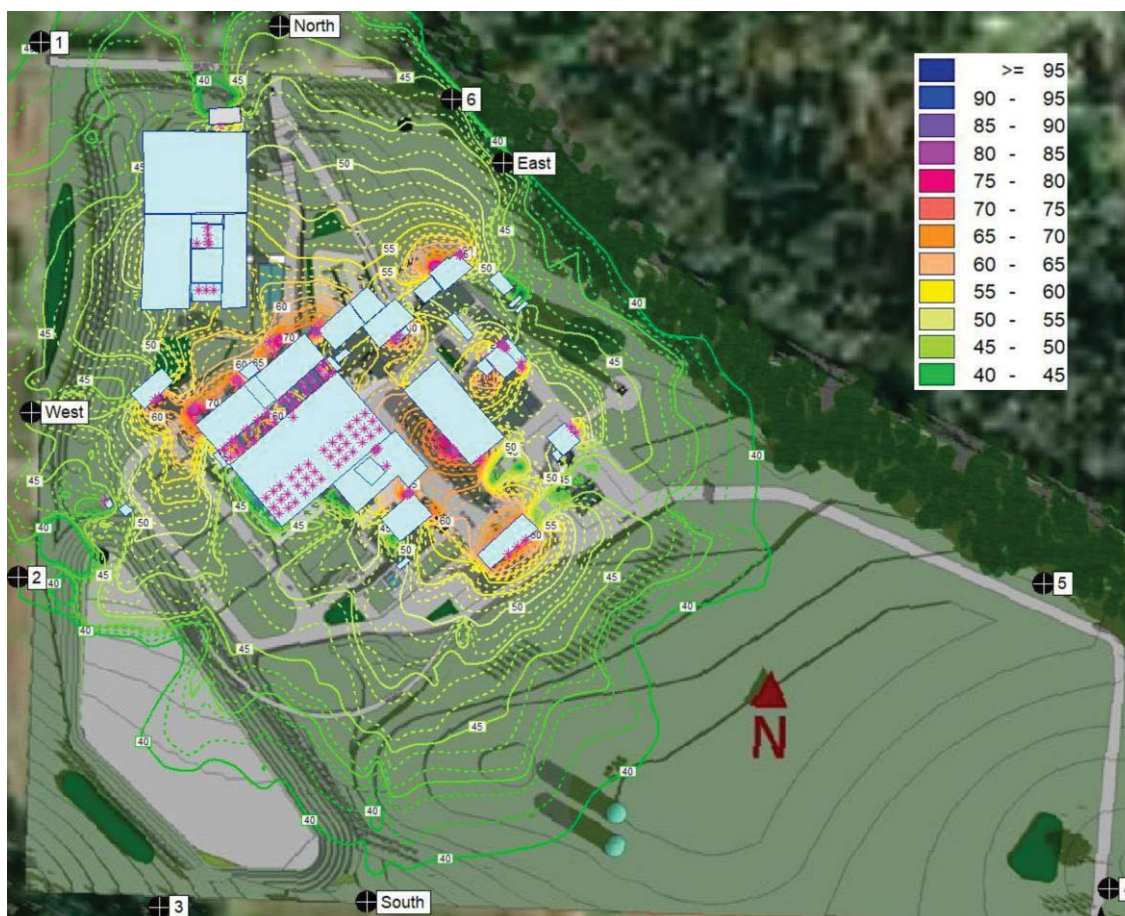


Figure 4. Noise Contours; Bull Run Filtration Facility-No Emergency Generator

As Table 2 and Figure 4 show, the modeled sound levels from the continuous mechanical equipment without additional mitigation measures is anticipated to meet the noise codes exterior limit of 50 dBA at all receiver locations.

Mechanical Equipment-Continuous Operation-With Emergency Generator and Fire Pumps (Scheduled Daytime Testing)

The results of the exterior noise analysis of the project continuous noise sources with the emergency generator and fire pumps in operation, including those in the new building, are shown in Table 3 below. A noise contour map is also shown in Figure 5 with noise contour lines that range between 40 and 95 dBA. Although the emergency generator and fire pumps will not operate continuously, they will have a maintenance schedule where the operation of the units will be tested. This testing will be conducted during the daytime hours between 7:00 am and 10:00 pm.

Table 3. Sound Pressure Levels Predicted at Property Line Receivers during Emergency Generator and Fire Pump Operations.

Continuous Site Equipment-ON; Emergency Equipment-ON					
Location	Meas. Daytime (Min-Max Leq in dBA)*	Prediction New Site (Ld in dBA)**	Daytime Noise Code in dBA	Nighttime Noise Code in dBA	Met Noise Code? (Y/N)
1	41-58	53	60	50	Y
2	41-52	49			Y
3	41-51	39			Y
4	46-55	38			Y
5	42-55	44			Y
6	48-57	50			Y
North	N/A	55	60	50	Y
East	N/A	52			Y
South	N/A	44			Y
West	N/A	56			Y
*Reference The Greenbusch Group, "Acoustic Design Criteria and Baseline Measurements," 02/02/2020					
**The predicted noise does not include the site background noise levels					

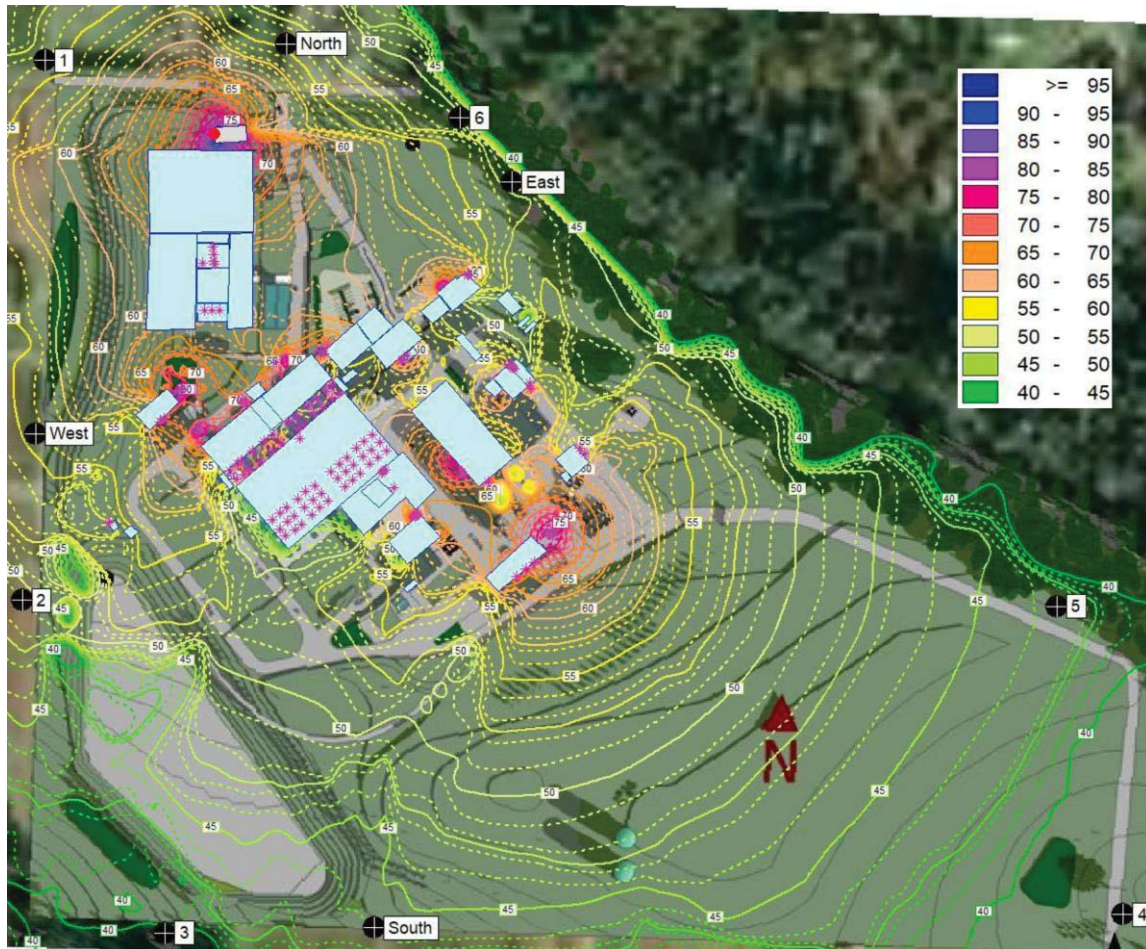


Figure 5. Noise Contour; Bull Run Filtration Facility During Generator and Fire Pump Daytime Testing.

As Table 3 and Figure 5 show, the modeled testing sound levels from the continuous mechanical equipment with the addition of the emergency generators louvers, generator exhaust pipe, and fire pumps tested together are not anticipated to exceed the daytime noise code exterior limit of 60 dBA at all of the south property line, all of the east property line, at all measured ambient locations included in the model, and at the closest adjacent properties to the project. In Figure 5, there is a small area at the north property line and a small area at the west property line where the modeled noise level does exceed 60 dBA. However, this exceedance is caused by the testing of the emergency generator and fire pumps, which are all emergency equipment. The testing of the emergency generator and fire pumps together is not a common condition and falls under the emergency equipment exemptions described in section 15.270 in the Multnomah County Noise Code and 6.05.060 in the Clackamas County Noise Code.

6. Conclusion

Calculated sound levels from the project continuous mechanical equipment with no additional mitigation are modeled to be below the noise code exterior limit of 50 dBA at all property lines. The modeled noise generated from the daytime testing of the emergency generators and fire pumps are anticipated to be below 60 dBA at all measured ambient locations included in the model, and at the closest adjacent properties to the project. Again, the testing of the emergency generator and fire pumps together is not a common condition and falls under the emergency equipment exemptions described in section 15.270 in the Multnomah County Noise Code and 6.05.060 in the Clackamas County Noise Code. Therefore, all modeled noise levels should comply with Multnomah and Clackamas County Noise Codes.

APPENDIX A: Equipment Sound Power Levels

Unit octave band sound levels were provided by Stantec Mechanical Engineering. Octave bands offer a filtering method of splitting the audible spectrum into smaller segments and allows one to identify different noise levels across individual frequencies. Octave analysis is often used in noise control, hearing protection and environmental noise issues.

(One-Full Octave Band Frequency between 63 Hz and 8000 Hz, in dB)

Portland Filtration Facility Design Sources in Noise Model					Octave Band Frequency (Hz)							
Building	Source	Type of Sound Data Available	Inside Building/ Outside Building	Overall PWL used in Model (dBA)	63	125	250	500	1000	2000	4000	8000
Administration	Water to Water Heat Pump	Generic Device Type Data	Outside	82	75	75	75	75	75	75	75	75
	11AHU-01	Mech. Eng (octave)	Inside	95	56	66	86	87	91	89	82	77
	11HPAS	Manufacture Data (octave)	Outside	86	52	62	68	86	79	80	74	64
	11CU-01	generic fan data (octave)	Outside	78	60	84	82	76	72	62	58	56
Locker Rooms	11AHU-02	Mech. Eng (octave)	Inside	87	88	88	87	86	79	78	75	71
	11CU-02	Manufacture Data (octave)	Outside	77	60	82	82	76	69	57	47	48
	Heat Pump Water Heaters	Generic Device Type Data	Outside	82	75	75	75	75	75	75	75	75
Maintenance	12CU-01	Manufacture Data (octave)	Outside	85	60	85	87	84	80	71	70	65
	12AHU-01	Mech. Eng (octave)	Inside	90	90	93	90	89	83	81	78	75
Main Electrical Center	Generators	Manufacture Data (octave)	Outside	123	101	107	111	117	118	112	116	118
	Generators -Outside	75 dBA SPL @ 23 ft Enclosure applied	Outside	103	96	96	97	95	96	97	95	94
	Generators Exhaust Stacks	Manufacture Data (octave)	Outside	132	111	121	124	126	124	127	125	120
	Generators Exhaust Stacks w/ Critical grade Muffler	Manufacture Data (octave) with critical grade muffler applied	Outside	80	61	76	66	75	72	75	72	66
	15AHU-01 Louver	Mech. Eng (octave)	Inside	83	71	73	79	78	75	75	75	76
	15AHU-02, Louver	Mech. Eng (octave)	Inside	89	74	76	84	84	86	81	79	77
	15CU-01	Manufacture Data (octave)	Outside	88	60	92	89	86	83	77	74	68
	15CU-02	Manufacture Data (octave)	Outside	88	60	92	89	86	83	77	74	68
	15CU-03 split sys.	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40

Orange fill indicates where manufactures-specific equipment data was not available, so conservative assumptions were used which will be used as design criteria

Portland Filtration Facility Design Sources in Noise Model					Octave Band Frequency (Hz)							
Building	Source	Type of Sound Data Available	Inside Building/ Outside Building	Overall PWL used in Model (dBA)	63	125	250	500	1000	2000	4000	8000
North Electrical Center	Generators	Manufacture Data (octave)	Outside	123	101	107	111	117	118	112	116	118
	Generators -Outside	75 dBA SPL @ 23 ft Enclosure applied	Outside	103	96	96	97	95	96	97	95	94
	Generators Exhaust Stack	Manufacture Data (octave)	Outside	132	111	121	124	126	124	127	125	120
	Generators Exhaust Stacks w/ Critical grade Muffler	Manufacture Data (octave) with critical grade muffler applied	Outside	80	61	76	66	75	72	75	72	66
	Transformers	Overall SPL Data 62 dBA @3 ft	Inside	62	55	55	55	55	55	55	55	55
	16AHU-01	Mech. Eng (octave)	Inside	83	71	73	79	78	75	75	75	76
	16CU-01	Manufacture Data (octave)	Outside	88		92	89	86	83	77	74	68
	16CU-02 Split Sys.	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40
Dewatering	Sludge Tank Mixer	Generic Device Type Data	Outside	71	64	64	64	64	64	64	64	64
	65AHU-01 Louver	Mech. Eng (octave)	Inside	85	71	79	84	84	80	75	68	63
	65AHU-02 Louver	Mech. Eng (octave)	Inside	89	78	79	85	83	86	80	76	71
	65 ERV Louver	Mech. Eng (octave)	Inside	85	71	79	84	84	80	75	68	63
	65ASHP-01 control cntr	Mech. Eng (octave)	Outside	72	76	76	76	70	64	63	58	53
	65ASHP-02 process cntr	Mech. Eng (octave)	Outside	78	81	80	82	77	70	68	64	58
	65CU-01 thru -03	Manufacture Data (octave)	Outside	88		92	89	86	83	77	74	68
	65CU-04	Manufacture Data (octave)	Outside	85	85	85	87	84	80	71	70	65
	65CU-05	Manufacture Data (octave)	Outside	87	86	86	88	86	82	76	75	68
Chemical	70AHU-01 Louver	Mech. Eng (octave)	Inside	98	87	91	96	98	91	88	83	79
	70HPAS-01	Mech. Eng (octave)	Outside	91	60	69	75	89	85	86	80	70
	70AHU-02 Louver	Mech. Eng (octave)	Inside	98	87	91	96	98	91	88	83	79
	70CU-01	Manufacture Data (octave)	Outside	84		87	83	80	78	74	74	71
	70CU-02 split sys.	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40

Orange fill indicates where manufactures-specific equipment data was not available, so conservative assumptions were used which will be used as design criteria

Portland Filtration Facility Design Sources in Noise Model					Octave Band Frequency (Hz)							
Building	Source	Type of Sound Data Available	Inside Building/ Outside Building	Overall PWL used in Model (dBA)	63	125	250	500	1000	2000	4000	8000
Ozone Generating	81AHU-01 process cntr Louver	Mech. Eng (octave)	Inside	87	70	75	81	82	81	79	80	79
	81AHU-02 Electric cntr Louver	Mech. Eng (octave)	Inside	72	62	68	72	67	65	65	63	62
	81CU-01	Manufacture Data (octave)	Outside	87		86	88	86	82	76	75	68
	81CU-02	Manufacture Data (octave)	Outside	78		84	82	76	72	62	58	56
	81CU-03 Split sys	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40
Ozone Contact/Flash Mix	31AHU-01	Mech. Eng (octave)	Outside	101	92	92	93	99	96	94	90	83
	31AHU-02 Louver	Mech. Eng (octave)	Inside	88	74	77	83	83	84	79	77	74
	31CU-01	Manufacture Data (octave)	Outside	88	60	92	89	86	83	77	74	68
	31CU-02	Manufacture Data (octave)	Outside	84	60	87	83	80	78	74	74	71
	31CU-03 Split sys	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40
Filter Gallery	Sed Basins Sludge Pumps	Generic Device Type Data	Inside	71	64	64	64	64	64	64	64	64
Flocculaton Basins	Flocculators	Generic Device Type Data	Outside	71	64	64	64	64	64	64	64	64
Filter Building	Centrifugal Blower Louvers	Overall SPL Data	Inside	90	81	79	83	82	83	83	83	82
	35AHU-01 Louver	Mech. Eng (octave)	Inside	86	78	81	83	83	83	77	73	68
	35AHU-02 Louver	Mech. Eng (octave)	Inside	88	74	77	83	83	84	79	77	74
	35CU-01	Manufacture Data (octave)	Outside	88		92	89	86	83	77	74	68
	35CU-02	Manufacture Data (octave)	Outside	84		87	83	80	78	74	74	71
	35CU-03 Split sys	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40
Waste Washwater Pmp Station	Pumps	Overal SPL 90 dBA at 3 ft	Outside	101	94	94	94	94	94	94	94	94
Finish Water	40AHU-01	Mech. Eng (octave)	Outside	94	86	85	90	92	90	87	81	74
	40AHU-02	Mech. Eng (octave)	Outside	91	94	91	96	88	80	78	76	70
	40CU-01	Manufacture Data (octave)	Outside	84	85	87	83	80	78	74	74	71
	40CU-02 Split Sys	generic fan data (octave)	Outside	68	71	72	73	62	58	60	50	40
Washwater Supply Pump Station	Pumps	Generic Device Type Data	Inside (Underground)	103	96	96	96	96	96	96	96	96

Orange fill indicates where manufactures-specific equipment data was not available, so conservative assumptions were used which will be used as design criteria

Portland Filtration Facility Design Sources in Noise Model					Octave Band Frequency (Hz)							
Building	Source	Type of Sound Data Available	Inside Building/ Outside Building	Overall PWL used in Model (dBA)	63	125	250	500	1000	2000	4000	8000
New Pump Station	Generator Intake Louver (North)	Manufacturer Data (Octave) w/ Acoustic Louver Applied	Outside	104	102	109	106	103	96	86	90	88
	Generator Intake Louver (West)	Manufacturer Data (Octave) w/ Acoustic Louver Applied	Outside	91	89	96	93	90	84	73	78	75
	Generator Exhaust Louver	Manufacturer Data (Octave) w/ Acoustic Louver Applied	Outside	112	109	117	114	111	105	95	99	96
	Generator Exhaust Pipe	Manufacture Data (octave) with muffler applied	Outside	101	110	96	95	96	95	95	92	92
	Pump + Compressor Intake Louvers	Manufacturer Data (Octave) w/ Acoustic Louver Applied	Outside	58	57	56	59	56	53	42	45	40
	Pump + Compressor Large Doors (North)	Manufacturer Data (Octave) w/ Metal Door Reduction	Outside	47	48	47	45	42	44	38	29	20
	Pump + Compressor Small Door (North)	Manufacturer Data (Octave) w/ Metal Door Reduction	Outside	38	40	38	36	33	36	29	20	11
	Pump + Compressor Doors (East)	Manufacturer Data (Octave) w/ Metal Door Reduction	Outside	48	50	48	46	43	46	39	30	21
	Exhaust Fan Louver	Manufacturer Data (Octave)	Outside	69	80	80	74	65	54	44	35	34
	Heat Pump	Manufacturer Data (Overall)	Outside	64	-	-	-	-	-	-	-	-
Wash Water Clarifier	Pumps	Generic Device Type Data	Outside	77	67	68	70	70	73	70	66	60
Gravity Thickener	Pump	Generic Device Type Data	Outside	77	67	68	70	70	73	70	66	60

Orange fill indicates where manufactures-specific equipment data was not available, so conservative assumptions were used which will be used as design criteria