7. AVOIDANCE AND MINIMIZATION MEASURES

This section highlights the impact avoidance and minimization measures that will be placed into contracts for this project. For specific construction BMPs and minimization measures, consult the most current ODOT and WSDOT standard specifications. For transit construction BMPs and minimization measures, refer to the applicable standard specification where TriMet or C-TRAN does not have specifications to address BMPs or minimization measures.

7.1 SUMMARY OF AVOIDANCE AND MINIMIZATION MEASURES

7.1.1 General Measures and Conditions

- A biologist shall re-evaluate the project for changes in design and evaluation methods not previously employed in the BA to assess potential impacts associated with those changes, as well as the status and location of listed species, every 6 months until project construction is completed. Re-initiation of consultation with the Services is required if new information reveals project effects that may affect listed species or critical habitat in a manner or to an extent not previously considered. Re-initiation of consultation is also required if the identified action is modified in a manner that causes an effect to species that was not considered in the BA or if a new species is listed or critical habitat is designated that may be affected by the action.
- All work shall be performed according to the requirements and conditions of the regulatory permits issued by federal, state, and local governments. Seasonal restrictions, e.g., work windows, will be applied to the project to avoid or minimize potential impacts to listed or proposed species based on agreement with, and the regulatory permits issued by DSL, WDFW, and USACE in consultation with ODFW, USFWS, and NMFS.
- Drilled shafts will be installed while water is still in the cofferdam. The drilled shaft casing will function to contain and isolate the work. Cofferdams will be installed to minimize fish entrapment. Sheet piles will be installed from upstream to downstream, lowering the sheet piles slowly until contact with the substrate. When cofferdams are used, fish salvage must be conducted according to protocol approved by ODFW, WDFW, and NMFS (see Appendix E).

  Contractor shall provide a qualified fishery biologist to conduct and supervise fish capture and release activity as to minimize risk of injury to fish, in accordance with ODOT Standard Specification 00290.31(i) or its equivalent; and/or the 2009 WSDOT Fish Exclusion Protocols and Standards, or its equivalent.
- The contractor shall prepare a Water Quality Sampling Plan for conducting water quality monitoring for all projects occurring in-water in accordance with the specific conditions issued in the Oregon and Washington 401 Water Quality Certifications. The Plan shall identify a sampling methodology as well as method of implementation to be reviewed and approved by the engineer. If, in the future, a standard water quality monitoring plan is adopted by ODOT and/or WSDOT, this plan, with the agreement of NMFS and USFWS, may replace the contractor plan.

- State DOT policy and construction administration practice in Oregon and Washington is to have a DOT inspector on site during construction. The role of the inspector will ensure contract and permit requirements. ODOT/WSDOT environmental staff will provide guidance and instructions to the onsite inspector to ensure the inspector is aware of permit requirements.
- If in-water dredging is required outside of a cofferdam, a clamshell bucket shall be used. Dredged material shall be disposed of in accordance with relevant permits and approvals.
- Piles that are not in an active construction area and are in place 6 months or longer will be have cones or other anti-perchings devices installed to discourage perching by piscivorous birds.
- All pumps must employ a fish screen that meets the following specifications:
    - An automated cleaning device with a minimum effective surface area of 2.5 sq. ft. per cubic foot per second, and a nominal maximum approach velocity of 0.4 foot per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second, and a nominal maximum approach rate of 0.2 foot per second; and
    - a round or square screen mesh that is no larger than 2.38 millimeters (mm) (0.094") in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069") in the narrow dimension; and
    - Each fish screen must be installed, operated, and maintained according to NMFS fish screen criteria.

7.1.2 Spill Prevention/Pollution Control

- The contractor shall prepare a Spill Prevention, Control, and Countermeasures (SPCC) Plan prior to beginning construction. The SPCC Plan shall identify the appropriate spill containment materials; as well as the method of implementation. All elements of the SPCC Plan will be available at the project site at all times. For additional detail, consult ODOT Standard Specification 00290.00 to 00290.90 and/or WSDOT Standard Specification 1-07.15(1). For transit construction in Oregon, consult TriMet Standard Specification 01450{1.04}).
- The contractor will designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead will be responsible for the implementation of the SPCC Plan. The contractor shall meet the requirements of and follow the process described in ODOT Standard Specifications 00290.00 through 00290.30 and/or WSDOT Standard Specification 8-01.3(1)B. The ESC lead shall be listed on the Emergency Contact List as part of ODOT Standard Specification 00290.20(g) and/or WSDOT Standard Specification 1-07.15(1).
- All equipment to be used for construction activities shall be cleaned and inspected prior to arriving at the project site, to ensure no potentially hazardous materials are exposed, no leaks are present, and the equipment is functioning properly. Identify equipment that will be used below OHW. Outline daily inspection and cleanup procedures that will insure that identified equipment is free of all external petroleum-based products. Should a leak be detected on heavy equipment used for the project, the equipment shall be immediately

removed from the area and not used again until adequately repaired. Where off-site repair is not practicable, the implemented SPCC Plan will prevent and/or contain accidental spills in the work/repair area to insure no contaminants escape containment to surface waters and cause a violation of applicable water quality standards.

- Operation of construction equipment used for project activities shall occur from on top of floating barge or work decks, existing roads or the streambank (above OHW). Any equipment operating in the water shall use only vegetable-based oils in hydraulic lines.
- All stationary power equipment or storage facilities shall have suitable containment measures outlined in the SPCC Plan to prevent and/or contain accidental spills to insure no contaminants escape containment to surface waters and cause a violation of applicable water quality standards.
- Process water generated on site from construction, demolition or washing activities will be contained and treated to meet applicable water quality standards before entering or re-entering surface waters.
- No paving, chip sealing, or stripe painting will occur during periods of rain or wet weather.
- For projects involving concrete, the implemented SPCC Plan shall establish a concrete truck chute cleanout area to properly contain wet concrete as part of ODOT Standard Specification 00290.30(a)1 and/or WSDOT Standard Specification 1-07.15(1).

7.1.3 Site Erosion/Sediment Control

- The contractor shall prepare a Temporary Erosion and Sediment Control (TESC) Plan and a Source Control Plan and implemented for the project requiring clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation. The BMPs in the plans will be used to control sediments from all vegetation removal or ground-disturbing activities. The engineer may require additional temporary control measures beyond the approved TESC Plan if it appears pollution or erosion may result from weather, nature of the materials or progress on the work. For additional detail, consult ODOT Standard Specifications 00280.00 to 00280.90 and/or WSDOT Standard Specification 1-07.15. For transit construction, consult TriMet Standard Specification 02276.
- As part of the TESC Plan, contractor shall delineate clearing limits with orange barrier fencing wherever clearing is proposed in or adjacent to a stream/wetland or its buffer and install perimeter protection/silt fence as needed to protect surface waters and other critical areas. Location will be specified in the field, based upon site conditions and the TESC Plan. For additional silt fence detail, consult ODOT Standard Specification 00280.16(c) and/or WSDOT Standard Specification 8-01.3(9)A.
- The contractor shall identify at least one employee as the ESC lead at preconstruction discussions and the TESC Plan. The contractor shall meet the requirements of and follow the process described in ODOT Standard Specifications Section 00280.30 and/or WSDOT Standard Specification 8-01.3(1)B. The ESC lead shall be listed on the Emergency Contact List as part of ODOT Standard Specification 00290.20(g) and/or WSDOT Standard Specification 1-05.13(1). The ESC lead will also be responsible for

ensuring compliance with all local, state, and federal erosion and sediment control requirements.

- All TESC measures shall be inspected on a weekly basis. Contractor shall follow maintenance and repair as described in ODOT Standard Specifications 00280.60 to 00280.70 and/or WSDOT Standard Specification 8-01.3(15). Inspect erosion control measures immediately after each rainfall, and at least daily during for precipitation events of more than 0.5 inches in a 24-hour period.
- For landward construction and demolition, project staging and material storage areas shall be located a minimum of 150 feet from surface waters, in currently developed areas such as parking lots or managed fields, unless a site visit by an ODOT/WSDOT biologist determines the topographic features or other site characteristics allow for site use closer to the edge of surface waters. Excavation activities (dredging not included) shall be accomplished in the dry. All surface water flowing towards the excavation shall be diverted through utilization of cofferdams and/or berms. Cofferdams and berms must be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material.
- Bank shaping shall be limited to the extent as shown on the approved grading plans. Minor adjustments made in the field will occur only after engineer's review and approval. Bio-degradable erosion control blankets will be installed on areas of ground-disturbing activities on steep slopes (1V:3H or steeper) that are susceptible to erosion and within 150 feet of surface waters. Areas of ground-disturbing activities that do not fit the above criteria shall implement erosion control measures as identified in the approved TESC Plan. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14(e) and/or WSDOT Standard Specification 9-14.5(2)A.
- Erodible materials (material capable of being displaced and transported by rain, wind or surface water runoff) that are temporarily stored or stockpiled for use in project activities shall be covered to prevent sediments from being washed from the storage area to surface waters. Temporary storage or stockpiles must follow measures as described in ODOT Standard Specification 00280.42 and/or WSDOT Standard Specification 8-01.3(1).
- All exposed soils will be stabilized as directed in measures prescribed in the TESC Plan. Hydro-seed all bare soil areas following grading activities, and re-vegetate all temporarily disturbed areas with native vegetation indigenous to the location. For additional detail, consult ODOT Standard Specifications 01030.00 to 01030.90 and/or WSDOT Standard Specification 8-01.3(1).
- Where site conditions support vegetative growth, native vegetation indigenous to the location will be planted in areas disturbed by construction activities. Re-vegetation of construction easements and other areas will occur after the project is completed. All disturbed riparian vegetation will be replanted. Trees will be planted when consistent with highway safety standards. Riparian vegetation will be replanted with species native to geographic region. Planted vegetation will be maintained and monitored to meet regulatory permit requirements. For additional detail, consult ODOT Standard Specifications 01040.00 to 01040.90 and/or WSDOT Standard Specification 8-01.3(2)F.

7.1.4 Work Zone Lighting

- Site work shall follow local, state and federal permit restrictions for allowable work hours. If work occurs at night, temporary lighting should be used in the night work zones. The work area and its approaches shall be lighted to provide better visibility for drivers to travel safely travel through the work zone, and illumination shall be provided wherever workers are present to make them visible.
- During overwater construction, contractor will use directional lighting with shielded luminaries to control glare and direct light onto work area; not surface waters.

7.1.5 Hydroacoustics

7.1.5.1 Minimization Measure 1 – Drilled Shafts for Foundations

Permanent foundations for each in-water pier will be installed by means of drilled shafts. This approach significantly reduces the amount of impact pile driving, the size of piles, and amount of in-water noise.

7.1.5.2 Minimization Measure 2 – Piling Installation with Impact Hammers

Installation of piles using impact driving may only occur between September 15 and April 15 of the following year. On an average work day, six piles could be installed using vibratory installation to set the piles; then impact driving to drive the piles to refusal per project specifications to meet load-bearing capacity requirements. This method reduces the number of daily pile strikes over 90 percent. No more than two impact pile drivers may be operated simultaneously within the same waterbody channel.

In waters with depths more than 0.67 meter (2 feet), a bubble curtain or other sound attenuation measure will be implemented for impact driving of pilings. If a bubble curtain or similar measure is used, it will distribute small air bubbles around 100 percent of the piling perimeter for the full depth of the water column. Any other attenuation measure (e.g., temporary noise attenuation pile) must provide 100 percent coverage in the water column for the full depth of the pile.

A performance test of the noise attenuation device in accordance with the approved hydroacoustic monitoring plan shall be conducted prior to any impact pile driving. If a bubble curtain or similar measure is utilized, the performance test shall confirm the calculated pressures and flow rates at each manifold ring.

7.1.5.3 Minimization Measure 3 – Impact Pile Installation Hydroacoustic Performance Measure

Sound pressure levels from an impact hammer will be measured in accordance with the hydroacoustic monitoring plan. Recording and calculation of accumulated sound exposure levels shall be performed. Analysis of the data shall be used to calculate exposure factors as defined in Appendix K of this BA. Exposure factors shall be calculated using the moving fish model, based on a fish of over 2 grams with a movement rate of 0.1 meter per second. Exposure factors shall account for all attenuated and un-attenuated impact pile driving in both the mainstem Columbia River and North Portland Harbor. The accumulated SEL shall be recorded.

The following thresholds must not be exceeded:

1. The maximum weekly exposure factor shall not exceed 0.18649, based on one calendar week. The weekly exposure factor is defined as the proportion of channel affected by impact pile driving as measured by accumulated sound exposure level multiplied by the proportion of a 24-hr day affected multiplied by the proportion of calendar week affected.
2. The maximum yearly (calendar year) total exposure factor shall not exceed 0.202181. The maximum yearly exposure factor is the sum of all weekly exposure factors in one calendar year.
3. The average yearly exposure factor must not exceed 0.120090 per calendar year of construction. The average yearly exposure factor is the mean value of all yearly total exposure factors.
4. A total exposure factor of 0.480359 shall not be exceeded throughout the construction period of the project. The total exposure factor equals the sum of all weekly exposure factors throughout the project.

One 12-hour rest period will occur each work day in which no impact pile driving will occur. In addition, to limit the exposure of migrating fish that may be present in the behavioral disturbance zone,[1] impact striking of piles that produce hydroacoustic levels over 150 dB RMS will not occur for more than 12 hours per work day. Unattenuated pile striking may occur to meet the requirements of the hydroacoustic monitoring plan or account for malfunction of the sound attenuation device, but will not occur for more than 300 impact pile strikes per week in the mainstem Columbia River and no more than 150 impact pile strikes per week in North Portland Harbor. To ensure that this measure is not being exceeded, an approved hydroacoustic monitoring plan will be in place to test a representative number of piles installed during the project (see Section 7.1.5.5, Minimization Measure 5).

If the predicted accumulated sound exposure level exceeds the levels described above, then the Services will be contacted within 24 hours to determine a course of action, so that incidental take estimates are not exceeded. Necessary steps may include modifications to the noise attenuation system or method of implementation.

7.1.5.4 Minimization Measure 4 – Hydroacoustic Monitoring

The project will conduct underwater noise monitoring to test the effectiveness of noise attenuation devices. Testing will occur based on an underwater noise monitoring plan based on the most recent version of the Underwater Noise Monitoring Plan Template.[2] This template has been developed in cooperation with the NMFS, USFWS, and WSDOT, and has been approved by NMFS and USFWS for use in Section 7 consultation for transportation projects in Washington.

[1] Behavioral disturbance is expressed in dB RMS re: 1 µPa.

[2] Available at: http://www.wsdot.wa.gov/Environment/Air/Noise.htm.

Testing will occur according to protocols outlined in an Underwater Noise Monitoring Plan (WSDOT 2008). Underwater noise monitoring will occur as follows:

- Hydroacoustic monitoring will occur for a representative number of piles per structure (minimum of five piles installed with an impact hammer).
- Monitoring will occur for piles driven in water depths that are representative of typical water depths found in the areas where piles will be driven.
- Ambient noise will be measured as outlined in the template in the absence of pile driving.

A report that analyzes the results of the monitoring effort will be submitted to the Services as outlined in the monitoring plan template.

Unattenuated impact pile driving for obtaining baseline sound measurements will be limited to the number of piles necessary to obtain an adequate sample size for the project, as defined in the final Hydroacoustic Monitoring Plan.

7.1.5.5 Minimization Measure 5 – Biological Monitoring

A qualified biologist will be present during all impact pile driving operations to observe and report any indications of dead, injured, or distressed fishes, including direct observations of these fishes or increases in bird foraging activity.

7.1.5.6 Minimization Measure 6 – Temporary Pile Removal

Temporary piles shall be removed with a vibratory hammer and shall never be intentionally broken by twisting or bending. Except when piles are hollow and were placed in clean, sand-dominated substrate, the holes left by the removed pile shall be filled with clean native sediments immediately following removal. No filling of holes shall be required when hollow piles are removed from clean, sand-dominated substrates. At locations where hazardous materials are present or adjacent to utilities, temporary piles may be cut off at the mud line with underwater torches.

7.2 STELLER SEA LION MINIMIZATION MEASURES[3]

7.2.1 Equipment Noise Standards

To mitigate noise levels and impacts to sea lions, all construction equipment will comply with applicable equipment noise standards of EPA, and all construction equipment will have noise control devices no less effective than those provided on the original equipment.

7.2.2 Sound Attenuation Measures

Specific to pile driving, the hydroacoustic minimization measures listed in Section 7.1.5 will be implemented to reduce impacts to sea lions to the greatest extent practicable.

[3] Because seal and sea lion species present in the Columbia River are protected under the Marine Mammal Protection Act (MMPA), an application for a Letter of Authorization under the MMPA Section 101(a)(5)(A) is being submitted to NMFS's Office of Protected Resources. The project will comply with any additional minimization measures issued for seals and sea lions as part of the authorization.

7.2.3 Marine Mammal Monitoring

7.2.3.1 Establishment of Monitoring Zones

For impact pile driving, a safety zone (defined as where SPLs equal or exceed 190 dB RMS) and a disturbance zone (defined as where SPLs equal or exceed 160 dB RMS) will be established. The initial safety and disturbance zones will be established based on the worst-case underwater sound modeled from impact driving of 36- to 48-inch steel pile.

For vibratory pile or vibratory steel casing installation, an initial disturbance zone (defined as where SPLs equal or exceed 120 dB RMS) will be established based on the worst-case sound modeled from vibratory installation of 36- to 72-inch steel pile for pipe piles or the loudest value modeled for sheet piles. Noise levels for vibratory installation of steel sheet or pipe piles are not anticipated to be above the 190 dB RMS thresholds based on literature values; therefore, no safety zone for vibratory installations of steel pile is anticipated. If steel casings for drilled shafts are installed by a vibratory hammer, an initial safety zone of 5 meters will be established.[4]

Once impact or vibratory installation begins, the safety and disturbance zones will either be enlarged or reduced based on actual recorded SPLs from the acoustic monitoring. The zones will be based on actual acoustic monitoring results collected at an approximate 10-meter distance. If new zones are established based on SPL measurements, NMFS requires each new zone be based on the most conservative measurement (i.e., the largest zone configuration).

Tables 7-1 and 7-2 show initial monitoring distances for safety and disturbance zones in the Columbia River and North Portland Harbor, respectively.

Table 7-1. Initial Underwater Distance to Safety and Disturbance Monitoring Zones in the Columbia River

		Calculated Distance to Monitoring Zones (meters)[a]		
Pile Type	Hammer Type	190 dB RMS[b] Safety Zone	160 dB RMS Disturbance Zone (impulse noise)	120 dB RMS Disturbance Zone (continuous noise)
18- to 24-inch steel pipe	Impact	9	858	N/A
36- to 48-inch steel pipe	Impact	54	5,412	N/A
48-inch steel pipe	Vibratory	N/A	N/A	20,166 upriver 8,851 downriver
120-inch steel casing	Vibratory	~5[c]	N/A	20,166 upriver 8,851 downriver
Sheet pile	Vibratory	N/A	N/A	6,962

a Monitoring zones based on worst case modeled values where the attenuation device is not operating. Upriver and downriver distances vary if a landform is encountered prior to noise attenuating to a threshold value.

b All values unweighted and relative to 1µPa.

c No source value available. To obtain a worst case estimate, distance is based on extrapolation of vibratory sound values from 36- and 72-inch piles.

[4] No published information is available on vibratory installation of 120-inch steel casings. Published information from Caltrans (2007) shows that 36-inch pile produced up to 175 dB RMS and 72-inch pile produced up to 180 dB RMS, both measured at 5 m from the pile. By extrapolating from these published values, the project assumes the energy imparted through a larger casing would be up to 10 dB RMS (an order of magnitude) higher than the highest value for a 72-inch pile. That is, vibratory installation of a 120-inch steel casing may yield a maximum value of 190 dB RMS, 5 m from the pile. As noted, monitoring will be conducted to determine actual values and distances.

Table 7-2. Initial Underwater Distance to Safety and Disturbance Monitoring Zones in North Portland Harbor

		Calculated Distance to Monitoring Zones (meters)[a]		
Pile Type	Hammer Type	190 dB RMS[b] Safety Zone	160 dB RMS Disturbance Zone (impulse noise)	120 dB RMS Disturbance Zone (continuous noise)
18- to 24-inch steel pipe	Impact	9	858	N/A
36- to 48-inch steel pipe	Impact	54	3,058 upriver 5,412 downriver	N/A
48-inch steel pipe	Vibratory	N/A	N/A	3,058 upriver 5,632 downriver
120-inch steel casing	Vibratory	~5[c]	N/A	3,058 upriver 5,632 downriver
Sheet pile	Vibratory	N/A	N/A	3,058 upriver 5,632 downriver

a Monitoring zones based on worst case modeled values where the attenuation device is not operating. Upriver and downriver distances vary if a landform is encountered prior to noise attenuating to a threshold value.

b All values unweighted and relative to 1µPa.

c No source value available. To obtain a worst case estimate, distance is based on extrapolation of values from 36- and 72-inch piles.

7.2.3.2 Visual Marine Mammal Monitoring

The CRC project will develop a monitoring plan in conjunction with NMFS that will collect sighting data for marine mammals observed during activities that include impact or vibratory installation of steel pipe or sheet pile or steel casings. A qualified biologist will be present on site at all times during impact or vibratory installation of steel pile or steel casings. In order to be considered qualified, the biologist will meet the following criteria for marine mammal observers:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance. Use of binoculars may be necessary to correctly identify the target.
- Advanced education in biological science, wildlife management, mammalogy, or related fields (Bachelors degree or higher is preferred).
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds), including the identification of behaviors.
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations that will include information such as the number and type of marine mammals observed; the behavior of marine mammals in the project area during construction, dates and times when observations were conducted; dates and times when in-water construction activities were conducted; dates and times when marine mammals were present at or within the defined safety zone; dates and times when in-water construction activities were suspended to avoid incidental potential injury from construction noise within the defined safety zone; etc.

- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

The CRC project proposes the following marine mammal monitoring for steel impact and vibratory sheet or pipe pile or vibratory casing installation:

- Monitoring of safety and disturbance zones will occur for all impact pile driving activities. Monitoring of the disturbance zone will occur for all vibratory pipe or sheet pile installation. No SPLs above 190 dB RMS are anticipated for vibratory installation of pipe or sheet piles; therefore, a safety zone will not be established. If hydroacoustic monitoring of vibratory installation of steel casings for drilled shafts indicates SPLs of 190 dB RMS or higher, then a safety zone will be established and monitored for vibratory installation of steel casings.
- Through acoustic monitoring, the CRC project will determine the actual distance to safety or disturbance zones and establish the new zones at that distance.
- Until determination of safety and disturbance zones is accomplished, monitoring will occur for the area within the calculated zones.
- Safety and disturbance zones will be monitored from a work platform, barge, the existing bridge, or other vantage point or by driving a boat along and within the radius of the zones while visually scanning the area. For activities within a safety zone, full observation of the safety zone will occur. If a small boat is used for monitoring, the boat will remain 50 yards from swimming pinnipeds in accordance with NMFS marine mammal viewing guidelines (NMFS 2007a).
- If vibratory installation of steel pipe piles or casings occurs after dark, the disturbance zone will be monitored with a night vision scope and/or other suitable device. Vibratory installation of steel pipe piles or sheet piles is not expected to produce SPLs at or above 190 dB RMS; therefore, no safety zone will be established or monitored for these activities. If hydroacoustic monitoring of vibratory installation of steel casings for drilled shafts indicates SPLs of 190 dB RMS or higher, then a safety zone will be established and monitored with a night vision scope and/or other suitable device.
- If the safety zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire safety zone is visible.
- The safety zone will be monitored for the presence of sea lions before, during, and after any pile driving activity.
- The safety zone will be monitored for 30 minutes prior to initiating the start of pile driving. If sea lions are present within the safety zone prior to pile driving, the start of pile driving will be delayed until the animals leave the safety zone.
- Monitoring of the safety zone will continue for 20 minutes following the completion of pile driving.
- Monitoring will be conducted using high-quality binoculars. When possible, digital video or still cameras will also be used to document the behavior and response of sea lions to construction activities or other disturbances.
- Each monitor will have a radio for contact with other monitors or work crews.

- A GPS unit or electric range finder will be used for determining the observation location and distance to sea lions, boats, and construction equipment.

Data collection will include a count of all sea lions observed by species, sex, age class, their location within the zone, and their reaction (if any) to construction activities, including direction of movement, and type of construction that is occurring, time that pile driving begins and ends, any acoustic or visual disturbance, and time of the observation. Environmental conditions such as wind speed, wind direction, visibility, and temperature will also be recorded.

7.2.3.3 Shutdown Procedure

The safety zone will also be monitored throughout the time required to drive a pile (or install a steel casing if applicable). If a sea lion is observed approaching or entering the safety zone (190 dB RMS isopleth for pinnipeds), piling operations will be discontinued until the animal has moved outside of the safety zone. Pile driving will resume only after the sea lion is determined to have moved outside the safety zone by a qualified observer or after 15 minutes have elapsed since the last sighting of the sea lion within the safety zone.

7.2.3.4 Acoustical Monitoring

Hydroacoustic monitoring will be conducted for impact driving of steel piles. Acoustic monitoring will be conducted on a representative number of piles as described in the monitoring plan template that has been developed with and approved by NMFS and USFWS for Section 7 consultations (see Appendix K, the CRC Hydroacoustics Technical Report). The number, size, and location of piles monitored will represent the variety of substrates and depths, as necessary, in both the Columbia River and North Portland Harbor. Hydroacoustic monitoring will be condcuted during vibratory installation of at least one pile of the largest diameter used by the project to confirm the distance to the 120 dB RMS threshold level. If steel casings are installed with a vibrator hammer, hydroacoustic monitoring will occur for the first casing installed; this will represent a worst case for size, depth, and substate for vibratory installation of casings. For standard underwater noise monitoring, one hydrophone positioned at midwater depth and 10 meters from the pile is used. Some additional initial monitoring at several distances from the pile is anticipated to determine site-specific transmission loss and directionality of noise. This data will be used to establish the radii of the safety and disturbance zones for sea lions.

7.2.3.5 Marine Mammal Monitoring Reporting

Reports of the data collected during sea lion monitoring will be submitted to NMFS weekly. In addition, a final report summarizing all sea lion monitoring and construction activities will be submitted to NMFS annually.