SEATTLE HARBOR
NAVIGATION IMPROVEMENT PROJECT

APPENDIX C

Supplemental Information
on the Affected Environment

Final Integrated Feasibility Report and Environmental Assessment

US Army Corps of Engineers
Seattle District

Port of Seattle

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Supplemental Information on the Affected Environment

This appendix provides supplemental and background information that was used during the analysis of potential environmental effects.

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1 Water Quality

The Washington Department of Ecology tests water quality to comply with the Clean Water Act and to place waters of concern on the Section 303(d) list. The study area contains water bodies that are listed as Category 5 on the 303(d) list (Figure 1). The East Waterway is listed as Category 5 in the 2016 assessment for polychlorinated biphenyl, dissolved oxygen, and bacteria. The West Waterway is listed as Category 5 in the 2016 assessment for high molecular weight polycyclic aromatic hydrocarbons (Ecology 2016).

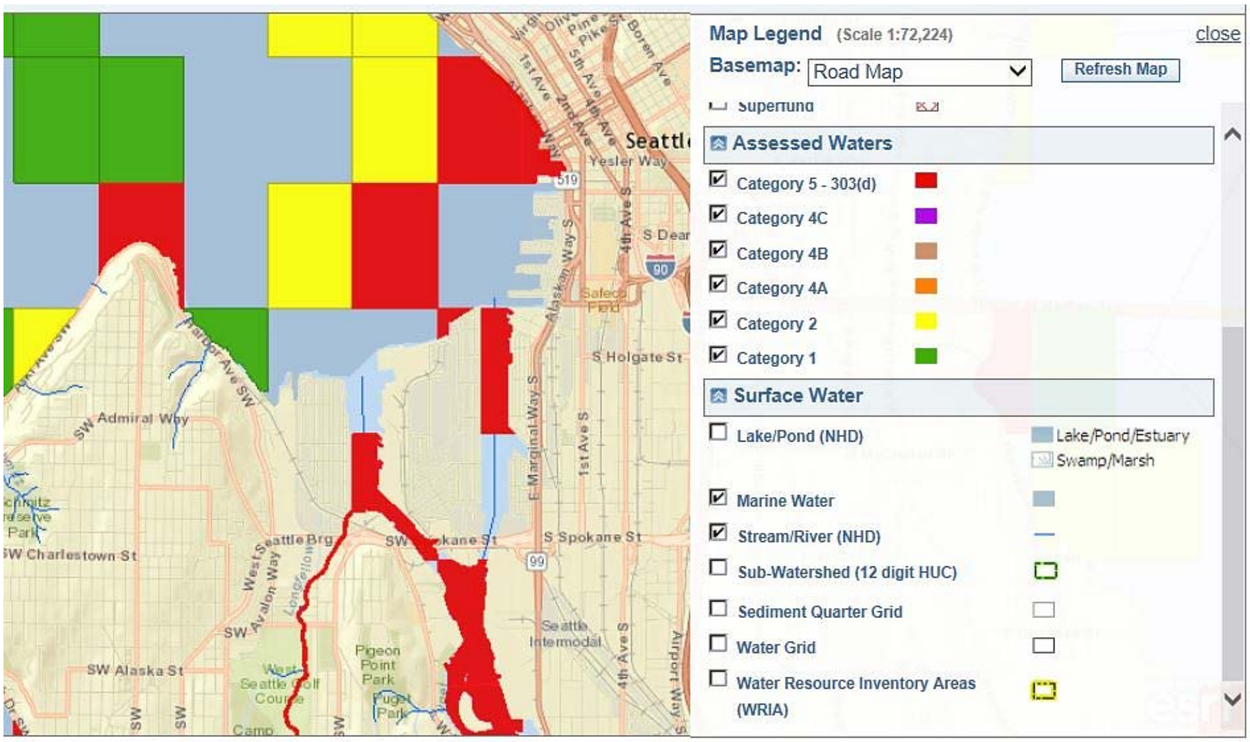

Figure 1. Map of assessed waters and 303(d) listing status (Ecology 2016).

An important aspect of the existing conditions of the project area is the presence of many completed restoration sites in the Lower Duwamish River. Figure 2 depicts over 20 sites along the estuarine mixing zone that have been restored. The proposed action was analyzed for its potential to affect these important investments in shoreline restoration and fish habitat.

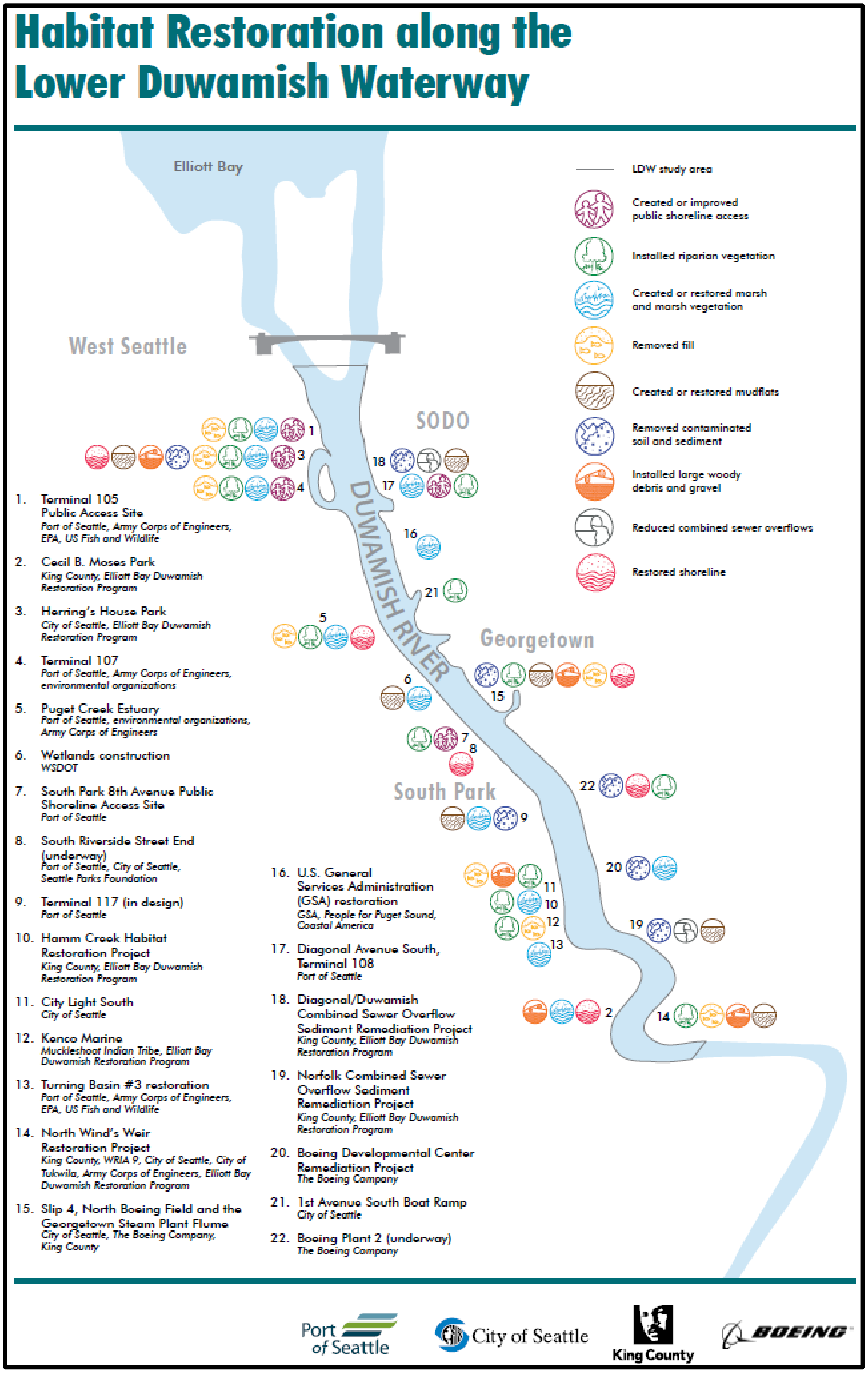

Figure 2. Habitat restoration sites along the Lower Duwamish Waterway completed as of 2012.

2 Air Quality

Ambient air quality standards as adopted by the State of Washington (WAC 173-476) are in Table 2-1.

Table 2-1. NAAQS as adopted by the State of Washington**

Pollutant		Averaging Time	Level	Remarks	Measurement Method	Interpretation Method
Particle Pollution	PM-10	24-hour	150 μg/m³	Not to be exceeded more than once per year averaged over 3 years	40 C.F.R. Part 50, Appendix J	40 C.F.R. Part 50, Appendix K
	PM-2.5	Annual	12.0 μg/m³	Annual mean, averaged over 3 years	40 C.F.R. Part 50, Appendix L	40 C.F.R. Part 50, Appendix N
		24-hour	35 μg/m³	98th percentile, averaged over 3 years		
Lead		Rolling 3-month average	0.15 μg/m³	Not to be exceeded	40 C.F.R. Part 50, Appendix G	40 C.F.R. Part 50, Appendix R
Sulfur Dioxide		Annual*	0.02 ppmv	Not to be exceeded in a calendar year	40 C.F.R. Part 50, Appendix A-1 or A-2	WAC 173-476-130(3)
		24-hour*	0.14 ppmv	Not to be exceeded more than once per year		
		3-hour	0.5 ppmv	Not to be exceeded more than once per year		
		1-hour	75 ppbv	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years		
Nitrogen Dioxide		Annual	53 ppbv	Annual Mean	40 C.F.R. Part 50, Appendix F	40 C.F.R. Part 50, Appendix S
		1-hour	100 ppbv	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years		
Ozone		8-hour	0.075 ppmv	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years	40 C.F.R. Part 50, Appendix D	40 C.F.R. Part 50, Appendix P
Carbon Monoxide		8-hour	9 ppmv	Not to be exceeded more than once per year	40 C.F.R. Part 50, Appendix C	WAC 173-476-160(3)
		1-hour	35 ppmv			

*Annual and 24-hour SO2 standards have a "sunset provision". They will no longer apply to those areas that have been in attainment status (designated by EPA) for the one-hour SO2 standard for one year. (See WAC 173-476-130 and 40 C.F.R. 50.17 for additional details.)
**Table taken from http://www.ecy.wa.gov/programs/air/sips/pollutants/naaqs.htm
ppmv – parts per million (ppm) by volume, ppbv – parts per billion (ppb) by volume, μg/m³- micrograms per cubic meter of air

Emissions of air pollutants were estimated by the following methodology:

engine power rating * hours of engine operation * emissions factor = emissions

Engine power ratings are typically expressed in terms of kilowatts (kW). Emission factors are specific to the pollutant and type of engine for which the emission estimate is being made and are typically expressed in terms of metric tons of pollutant emitted per kilowatt hour. Emissions are typically express in terms of metric tons of pollutant.

Short-term, direct impacts to air quality from construction activities air emissions were estimated for each project alternative. Air emissions estimates for construction activities considered the emissions for off-road diesel equipment and harborcraft, such as tug boats and the clamshell dredge. Emissions factors for off-road diesel equipment were obtained from the website of the California South Coast Air Quality Management District (SCAQMD 2016). Emissions factors for harborcraft operations were derived using the data and methodology presented in an EPA study titled "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" (EPA 2009). Equipment and harborcraft types, engine power ratings, and hours of operation were provided by the cost engineering analysis for the project.

An estimate of locomotive emissions was made for carbon dioxide (CO_2) emissions only; the sum of air pollutant emissions reported in the main text do not include emissions from this source. Locomotives would be used under the NED and LPP alternatives to transport dredged material not suitable for open water disposal to an upland disposal site. The analysis assumes that the upland disposal site would be the Roosevelt Landfill in Roosevelt, Washington, which is approximately 300 miles from the project location. Because most of the emissions from locomotive transportation would occur away from the project site, they would have little impact to local air quality.

Air emissions reported in the main report section 4.7 Air Quality (Table 4-12), show the sum of estimated annual construction emissions for the NED alternative.

Long-term, indirect impacts to air quality consisting of air emissions due to port activities (local transit, maneuvering, and hoteling of ocean going vessels (OGVs)) were estimated for each project alternative. These estimates are expressed as the sum of emissions for each NAAQS pollutant for the period of 2020 to 2034 for each project alternative (Table 4-13). Vessel and engine characteristics of OGVs use in the emissions estimate was based on the characteristics of the average OGV calling at POS in 2011 (Starcrest Consulting, LLC. 2013). For large vessel classes (PPX 3 and PPX4) for which no data existed in the 2011 Puget Sound Maritime Air Emission Inventory, engine power ratings were estimated based on the following formula (EPA 2000):

Engine Horsepower = 2581 + 0.719 * (Dead Weight Tonnage)

Emissions factors used for the estimate of long term, indirect impacts were from the California Air Resources Board Appendix D Emissions Estimation Methodology for Ocean-Going Vessels, Table II-6: Main Engine Emissions Factors – Transit Mode (CARB 2011). The emissions factors selected for estimating the emissions due to transiting correspond to the scenario of medium main engine speed utilizing marine distillate fuel with 0.5% sulfur content. By 2020, ocean-going container ships will likely be required to use marine distillate fuel with a maximum allowable limit of 0.5% sulfur (EIA 2015a). The emissions factors selected for estimating the emissions due to maneuvering and hoteling correspond to the scenario of medium alternate engine speed utilizing marine distillate fuel with 0.1% sulfur content. Beginning in 2015, container ships and other large OGVs have been required to use fuel with 0.1% or less sulfur content while transiting through the SOx Emission Control Area (SECA) on the west coast of North America (EIA 2015a).

The number of vessel calls used for the estimate of long-term, indirect air quality effects was based on the vessel traffic information presented in Appendix A – Economics, and Tables 4-7 and 4-8 of the document. Hours in local transit were estimated based on the assumption that meaningful local air impacts occur within 60 nautical miles of Seattle. Emissions due to maneuvering were estimated on the assumption that an average call takes 2 hours for maneuvering (i.e. 1 hour getting into berth and 1 hour getting out). Hoteling time averages from the 2011 Puget Sound Maritime Air Emission Inventory (Table 3.33) (Starcrest Consulting Group, LLC. 2013) are the basis for hours in berth hoteling used in the estimate.

3 Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions were estimated by the following methodology:

engine power rating * hours of engine operation * emissions factor = emissions

Engine power ratings are typically expressed in terms of kilowatts (kW). Emission factors are specific to the GHG and type of engine for which the emission estimate is being made and are typically expressed in terms of metric tons of GHG emitted per kilowatt hour. Emissions are typically expressed in terms of metric tons of GHG.

GHGs have differing abilities to reflect infrared radiation and therefore have differing potentials to alter Earth's greenhouse effect. GHG emissions are typically standardized to metric tons of carbon dioxide (CO_2) equivalent by multiplying the tons of GHG by its 100-year global warming potential (IPCC 2013). For standardizing the estimate of methane (CH_4) emissions, the 100-year global warming potential incorporating climate carbon feedbacks was selected (IPCC 2013).

Greenhouse gas emissions were modeled for short-term sources and considering the following three components: off-road diesel equipment emissions, harborcraft emissions, and locomotive emissions.

An estimate of CO_2 and CH_4 emissions under the various proposed alternatives was performed. These are the two primary GHGs produced by diesel engines in construction equipment, marine vessels, and locomotives. Nitrous oxide (N_2O) is a greenhouse gas that is produced by the combustion of fossil fuels in internal combustion engines. However, N_2O emissions from diesel powered engines are much lower than those from gasoline engines. The equipment and marine vessels used to construct the maximum extent proposal is assumed to be all diesel powered. The associated N_2O emissions are assumed to be negligible and therefore were not calculated.

Emissions factors for off-road diesel equipment were obtained from the website of the South Coast Air Quality Management District (SCAQMD 2015). Emissions factors for clamshell dredge and tugboat operations (i.e. harborcraft) were derived using the data and methodology presented in an EPA study titled "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" (EPA 2009).

Locomotive emissions were modeled using a fuel consumption model that assumed each gallon of diesel fuel combusted produces approximately 22 pounds of CO_2 (EIA 2015b). Methane emissions from locomotive emissions were not modeled. It is assumed that dredged material not suitable for open water disposal would be transported via locomotives to the Roosevelt Landfill in Roosevelt, Washington.

The sum of short-term GHG emissions for the NED plan are in Table 4-15.

Long-term sources of GHG emissions due to port activities (transit, maneuvering, and hoteling of ocean going vessels (OGVs)) were estimated for each project alternative. These estimates are expressed as the sum of GHG emissions for the period of 2020 to 2034 for each project alternative (Table 4-16). Vessel and engine characteristics of OGVs use in the emissions estimate was based on the characteristics of the average OGV calling at POS in 2011 (Starcrest Consulting, LLC. 2013). For large vessel classes (PPX 3 and PPX4) for which no data existed in the 2011 Puget Sound Maritime Air Emission Inventory, engine power ratings were estimated based on the following formula (EPA 2000):

Engine Horsepower = 2581 + 0.719 * (Dead Weight Tonnage)

Emissions factors used for the estimate of long-term, indirect impacts were from the California Air Resources Board 2011 Emissions Estimation Methodology for Ocean-Going Vessels (CARB 2011).

The number of vessel calls used for the estimate of long-term, indirect GHG emissions was based on the vessel traffic information presented in Appendix A – Economics, and Tables 4-7 and 4-8 of the document. Emissions due to maneuvering were estimated on the assumption that an average call takes 2 hours for maneuvering (i.e. 1 hour getting into berth and 1 hour getting out). Hoteling time averages from the 2011 Puget Sound Maritime Air Emission Inventory (Table 3.33) (Starcrest Consulting Group, LLC. 2013) are the basis for hours in berth hoteling used in the estimate.

4 Underwater Noise

To analyze the proposed action's potential effects of underwater noise on aquatic resources, some fundamental characteristics of sound and the existing conditions (i.e., the status of underwater noise in Puget Sound) are laid out here for a basic understanding for the analysis.

Sources of Sound

Ambient noise is the combination of all sound sources, which creates a steady background noise. Underwater sound source categories are biological (caused by marine life), hydrodynamic (caused by wind, waves, and rain), marine vessel traffic, and seismically produced such as during earthquakes or seismic surveys for oil exploration. Ambient noise conditions underwater in Puget Sound have many contributors including shipping traffic to the Ports of Everett, Seattle, and Tacoma, U.S. Navy activities, the Washington State ferry routes across Puget Sound with up to 23 vessels operating at a time, cruise ships, commercial fishing vessels, and recreational boats. As one example location, permanent ambient underwater noise in Admiralty Inlet, a major route for shipping traffic near Port Townsend, is around 98 dB (1 µPa @ 1 m; Bassett 2010). Mean ambient level in most marine waters is 80 to 100 dB (Richardson et al. 1995).

Sources of sound are intermittent as well as ambient. Some temporarily occurring noises include dredging, ships passing nearby, naval sonar testing, and pile driving or other construction-related activities. For example, in addition to the ambient noise in Admiralty Inlet, the Washington state ferry vessel in the Port Townsend-Coupeville route emits roughly 179 dB (1 µPa @ 1 m; Bassett 2010). Small ships around 100 to 150 feet long are common in Puget Sound and their engines emit broadband sound (20 Hz to 1 kHz) at 150 to 170 dB (1 µPa @ 1 m; Richardson et al. 1995). Larger commercial vessels emit lower frequency noise as loud as 170 to nearly 200 dB (1 µPa @ 1 m). Naval active sonar testing is likely the loudest sound produced emitting 230 dB (1 µPa @ 1 m) in the range of 2 to 5 kHz.

Animals in Puget Sound Potentially Affected by Underwater Noise

The major groups of animals in Puget Sound that can be affected by underwater noise are fish, diving birds, pinnipeds (seals, sea lions, and sea otters), and the two types of whales, mysticetes (baleen whales) and odontocetes (toothed whales). The species of focus for this analysis are identified as significant biological resources or are otherwise protected by the Marine Mammal Protection Act.

Fish can be harmed in different ways, particularly through their swim bladder because of the large difference in impedance between the gas-filled bladder and the surrounding water-filled body tissues (Nedwell et al. 2004). Intense sound pressure waves can cause physical harm and mortality. Fishes' sensitivity to hearing varies, but most exhibit a response to sounds in the range of 50 Hz to 2 kHz, with a minimum threshold around 70 dB (Hastings 1995). Herring, a forage fish with declining populations, have high sensitivity to sound due to their specialization of pressure-sensing mechanisms (Blaxter and Hoss 1981); this is in contrast to Cottids (sculpins), which have no swim bladder and are therefore not sensitive to sound waves (Nedwell et al. 2004).

Diving birds, such as marbled murrelets, are vulnerable to excessive underwater noise because it affects their ability to catch prey while diving, and can cause disorientation and injury. Excessive noise can cause a range of problems including aborted feeding attempts, disorientation, and even injury if the sound pressure wave is strong enough.

Marine mammals use vocalizations to identify themselves, their location, territory, or reproductive status and communicate with each other about presence of prey, another animal, or danger. Loudness, frequency, duration, and types of sounds vary widely among the species, and can be compared to the audiogram for the species if one has been developed. Audiograms are the graphic display of hearing sensitivity, which plot frequency against hearing threshold. Available data show that whales' auditory thresholds can extend as low as 10Hz for the mysticetes and as high as 500kHz for some odontocetes (Gordon and Moscrop 1996). California sea lions are most sensitive to sounds between 1 kHz and 28 kHz with peak sensitivity around 16 kHz (Schusterman et al. 1972). Harbor seals have a slightly broader range with ability to hear up to about 50 kHz for sounds over 60 dB (1 μPa @ 1 m; Richardson et al. 1995). The Steller sea lion hearing range is 500 Hz to 32 kHz with less sensitivity at the low and high frequencies.

Killer whales rely on their highly developed acoustic sensory system for navigating, locating prey, and communicating with other individuals (Ford 1989). Noise pollution from marine vessel traffic is one of the main concerns with decline in the endangered Southern Resident killer whale population because of how it may affect their vocalizations and hearing. Excessive noise levels may mask echolocation and other signals the species use, as well as temporarily or permanently damage hearing sensitivity (NMFS 2005). Vessel traffic negatively affects foraging behavior of the Southern Resident killer whales, which can have biologically significant consequences and is likely a factor in their low population level (Lusseau et al. 2009).

For a determination on whether construction related noise would affect marine mammals, fish, and birds, one must consider the frequency, location, intensity, and duration of the sound source as well as the audiogram of the recipient species. If an audiogram is available for a species, then using that audiogram helps to analyze the effects of noise on important biological resources; otherwise, the hearing frequency range may be the best available information. Effects analysis requires calculating the sound exposure level

(SEL) that the animal receives. Table 4-1 displays data collected on hearing capabilities of potentially affected species in the project area.

Table 4-1. Hearing capabilities of aquatic species and sound threshold for continuous and pulsed noise that can cause behavioral disruption and injury.

Species	Audible Frequencies	Level B harassment (continuous)	Level B harassment (pulsed)	Level A injury
Fish (general)[2]	50Hz – 2kHz	150 dB_{RMS}	187 dB_{RMS}	206 dB_{RMS}
Herring[2]	70Hz – 200Hz	150 dB_{RMS}	187 dB_{RMS}	206 dB_{RMS}
Salmonids[2,7]	10Hz – 600Hz	150 dB_{RMS}	187 dB_{RMS}	206 dB_{RMS}
Rockfish[8]	50Hz – 2kHz	150 dB_{RMS}	187 dB_{RMS}	206 dB_{RMS}
Pinnipeds[5]	500Hz – 50kHz	120 dB_{RMS}	160 dB_{RMS}	190 dB_{RMS}
California sea lions	1kHz – 28kHz	120 dB_{RMS}	160 dB_{RMS}	190 dB_{RMS}
Harbor seals	1kHz – 50kHz	120 dB_{RMS}	160 dB_{RMS}	190 dB_{RMS}
Steller sea lions	500Hz – 32kHz	120 dB_{RMS}	160 dB_{RMS}	190 dB_{RMS}
Mysticete whales[4]	10Hz – 8kHz	120 dB_{RMS}	160 dB_{RMS}	180 dB_{RMS}
Minke whale[4]	10Hz – 500Hz	120 dB_{RMS}	160 dB_{RMS}	180 dB_{RMS}
Odontocete whales[4]	100Hz – 500kHz	120 dB_{RMS}	160 dB_{RMS}	180 dB_{RMS}
Killer Whale (orca)[3]	500Hz – 105kHz	120 dB_{RMS}	160 dB_{RMS}	180 dB_{RMS}
Diving birds[9] (developed for marbled murrelet)	Not available, presumed at 1kHz – 5kHz	150 dB_{RMS} (guideline)	183 dB_{RMS} (onset of injury)	202 dB_{RMS}

[1] square root of the mean of the squares of the values recorded over a given time interval [2]Blaxter and Hoss 1981; [3] Hall and Johnson 1971, Bain et al. 1993, Szymanski et al. 1999; [4] Gordon and Moscrop 1996; [5] Schusterman et al. 1972; [6] Bailey et al. 2010; [7] Knudsen et al. 1992; [8] Skalski et al. 1992; [9] SAIC 2011

Potential effects to marine mammals would come from elevated sound (underwater), which could disrupt foraging behavior, diving patterns, and social interactions. The established threshold for harassment of seals and sea lions is 120 dB_{RMS} for continuous sound, 160 dB_{RMS} for pulsed sound, and 190 dBRMS for injury (both pulsed and continuous) (NMFS 2013). A study of dredging in the Snohomish River with a clamshell dredge generated peak noise levels as high as 170 dB re µP (SAIC and RPS Evans Hamilton 2011). Another study in Cook Inlet recorded a peak noise level of 124 dB re µP when the clamshell hit a course substrate bottom (Dickerson et al. 2001). The Snohomish River study reported peak sound in dB re µP. Note that the thresholds listed above are in dB_{RMS}, which is the root mean square over some determined period of time. NMFS gives clear guidance for calculating dB_{RMS} for impact and vibratory pile driving, but there is no guidance for the type of sound generated by a clamshell dredge. It is assumed that since dB_{RMS} is an "average" that clamshell dredging would generate a lower dB_{RMS} than the peak sound levels reported in the Snohomish study. In addition, the dB_{RMS} reported in the Cook Inlet are just barely above harassment thresholds, and the substrate around Seattle Harbor is softer (sand and gravel) than that of both of studies. The Cook Inlet study also found that softer substrates are more effective at absorbing sound and peak sound measurements in softer substrates did not exceed thresholds for continuous sound. Furthermore, the clamshell size that would be used is a six-yard bucket, whereas a 26-yard bucket was used in the Cook Inlet study; the smaller bucket would weigh significantly less and therefore generate less sound. Finally, seals and sea lions in the area are likely accustomed to a higher level of underwater noise due to the heavy vessel traffic around Elliott Bay. Large shipping vessels can generate noise levels well above harassment and injury thresholds depending on variables like vessel speed, oceanic conditions, water temperatures, and bathymetry (McKenna et al. 2013 and Richardson et al. 1995). Many commercial and recreational vessels transit the area multiple times a day.

According to the Washington Department of Fish and Wildlife's Atlas of Seal and Sea Lion Haulout Sites in Washington (Jeffries et al. 2000), the nearest haulout sites are more than 3 miles away from the project area (Figure 2).

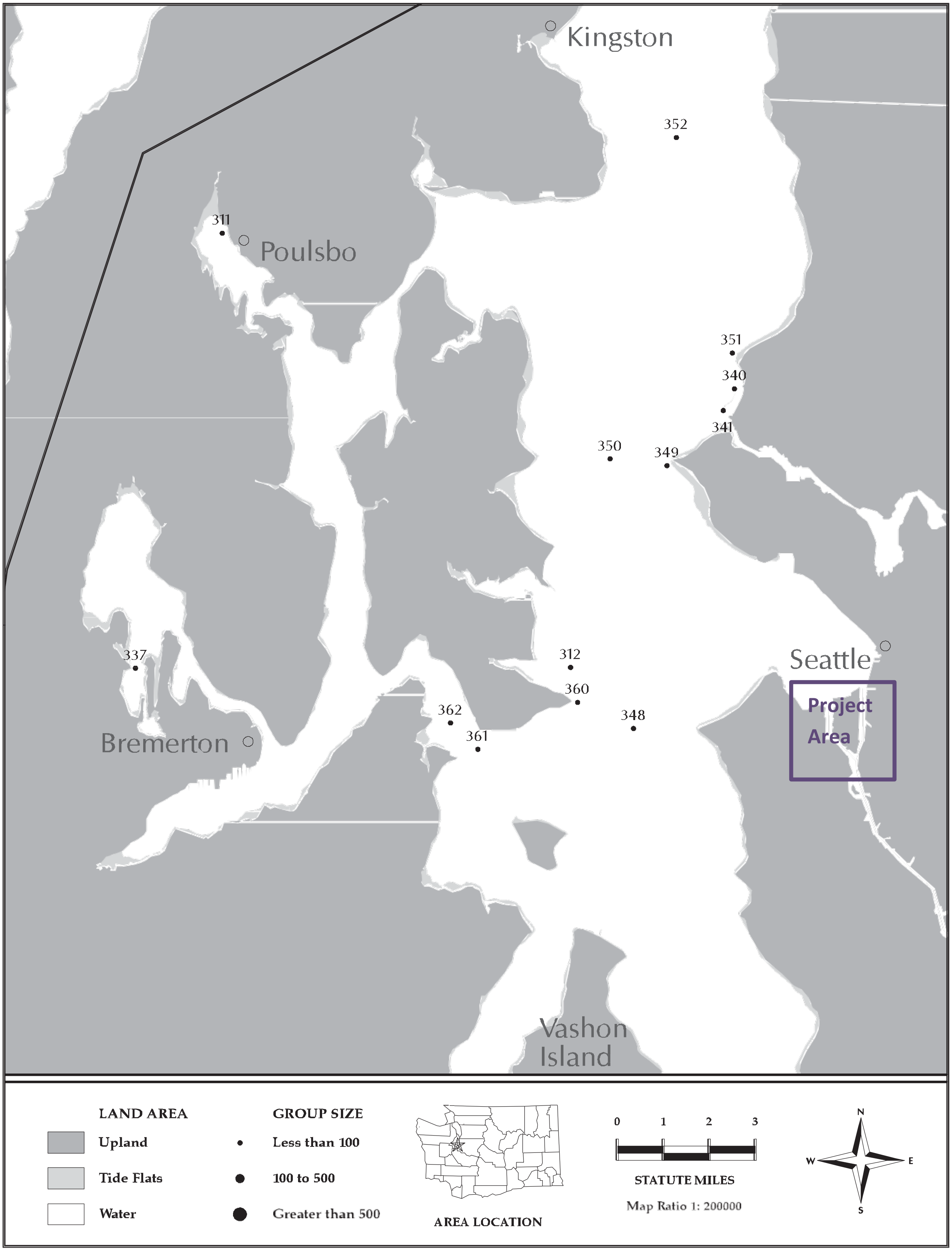

Figure 3. Seal and sea lion haulout sites in central Puget Sound from WDFW (Jeffries et al. 2000).

5 Invasive Species

The relevant vectors for invasive species are ship fouling and exchange of ballast water. Cohen et al. (2001) identified 21 exotic species in Elliott Bay; however, none appeared dominant or common. Vessels must exchange ballast water at least 50 nautical miles offshore (RCW 77.120). Enforcement has been effective at decreasing discharge of non-indigenous zooplankton, and exchange methods have increased effectiveness (Cordell et al. 2015).

6 Cultural Resources

Six archaeological sites have been recorded within half a mile of the project area. These sites include the reported location of a boulder with petroglyphs, which has since been buried by construction (McClure 1978); the Duwamish No. 1 site (45KI23), which has been identified as a prehistoric shell midden and is listed on the NRHP (Munsell 1975; Robbins 1998); an ethnographically known village site (45KI52) that was located at the "former mouth of the Duwamish River" (Hanley 1979); a shell midden (45KI432) located on a hillside west of the west waterway (Robbins 1992); and two historic dumps (45KI529 and 45KI530) located approximately 1,800 feet east of the East Waterway located under the westbound lane of South Spokane Street. The historic dump material was placed there prior to the filling of the tidelands in that location (Cole 2002a, b). Site 45KI52 has not been field verified and it is likely the village was not located right at the mouth of the Duwamish in the tidelands but at some place along the shoreline. The location has since been covered by warehouses.

7 Public Health and Safety

The Port of Seattle maintains an emergency response plan for all of its facilities, including marine and seaport facilities within the study area. The Port of Seattle Police patrol major portions of the Seattle waterfront and Elliott Bay. The Port Police provide law enforcement response and patrol services for several commercial properties located at Port-owned piers and terminals in the study area. The Burlington Northern Santa Fe Railway (BNSF) Police Solutions Team coordinates with other law enforcement agencies to investigate crimes committed on railroad property. Some of the typical crimes involve cargo from containers being offloaded from ships, loaded onto rail cars or trucks, or in transit.

8 Land-based Transportation and Traffic

Two mainline railroads serve the Seattle seaport, the Burlington Northern/Santa Fe (BNSF) and the Union Pacific (UPRR) railroads. In general, the railroads play a key part in the Seattle seaport's role as a leading intermodal port. Furthermore, the railroads are integral in the movement of grain from Midwestern states to the Seattle seaport for export. Terminal 5 on the West Waterway is currently seizing operations while the Port of Seattle completes a multi-year design and permitting process to modernize this terminal, which may include power upgrades, berth deepening, and dock strengthening. Terminal 5 includes an on-dock intermodal yard with loading capacity of 54 five-platform doublestack railcars equivalent to two full trains for both UPRR and BNSF Railway. Trains are assembled within the terminal for direct access to UPRR and BNSF Railway mainlines. Terminal 18 on Harbor Island located along the East Waterway also contains on-dock rail with loading capacity of 54 five-platform doublestack railcars equivalent of more than two full trains for both the UPRR and BNSF Railway. Terminal 30 on the East Waterway does not contain on-dock rail, but is within two miles of both the UPRR and BNSF Railway yards (POS 2014).

Many local and national trucking firms serve the seaport, as do numerous individual owner-operators. Trucking firms are involved in distributing local containerized cargo (both full container loads, as well as less-than-container load (LCL) cargo). Typically, trucks distribute the imported containers moving locally, as well as to Canada, and move export containers originating in the Seattle area to the marine terminals for export. Truck transportation is also the major mode used for moving Alaska-bound cargo to the marine terminals; trucks are also a primary mode to distribute the dry bulk products. Finally, trucks play a major role in the drayage of containers between rail yards and the marine terminals (Martin Associates 2014).

9 Federal Trust Responsibility

The Federal government and federally recognized Indian tribes have a unique trust relationship; rights guaranteed by treaty cannot be abrogated without Congressional approval, and Federal agencies may not take any action that would infringe upon those treaty rights. There are two federally recognized tribes that hold a treaty right to take fish within the project area. The Muckleshoot Indian Tribe and the Suquamish Indian Tribe of the Port Madison Reservation are both signatories to the Point Elliott Treaty of 1855, which guarantees “the right of taking fish at usual and accustomed grounds and stations.” The Muckleshoot and Suquamish Tribes’ usual and accustomed fishing grounds overlap in the Duwamish estuary, where both tribes harvest seafood. The Duwamish Tribe, while not federally recognized, also resides in and is active in the project area. They are an organized group with approximately 600 enrolled members with a cultural center on the west bank of the Duwamish just upstream of the project area.

The East and West Waterways, and the Duwamish Waterway include aquatic area and bank line treaty fishing access locations used seasonally by the Muckleshoot and Suquamish Indian Tribes. The principal focus of treaty-authorized fishing is harvest of adult salmon and steelhead, using free-floating and fixed gill nets. Set nets are tied to points on the shoreline and extend into deep water in adjacent channel areas, held in place with anchors. Set nets may be up to 300 feet in length and 60 feet deep (Port of Seattle 2006). Typically, treaty fishing takes place from August through February of each year. Chinook salmon fishing is in August. Fishing for coho salmon begins in September and, generally, concludes in late November. In October, fishing expands to include chum salmon, followed by steelhead fishing in late fall through February (Port of Seattle 2006).

10 Hazardous, Toxic, and Radiological Waste (HTRW)

The following figures depict the approximate extent of contaminated sediments in West and East Waterways and are taken from relevant CERCLA documents (Figure 3, Figure 4, and Figure 5). The sediment surface is a dynamic environment, subject to biotic and abiotic influences. Under the NED and LPP, some characterization of sediments will be necessary to confirm that the location of contamination identified in CERCLA documents has not changed. The additional characterization data will also be used to verify whether sediments are suitable for open water disposal, or whether upland disposal will be required. The additional characterization data will also help designers ensure that the final dredge surface is free of unacceptable contamination.

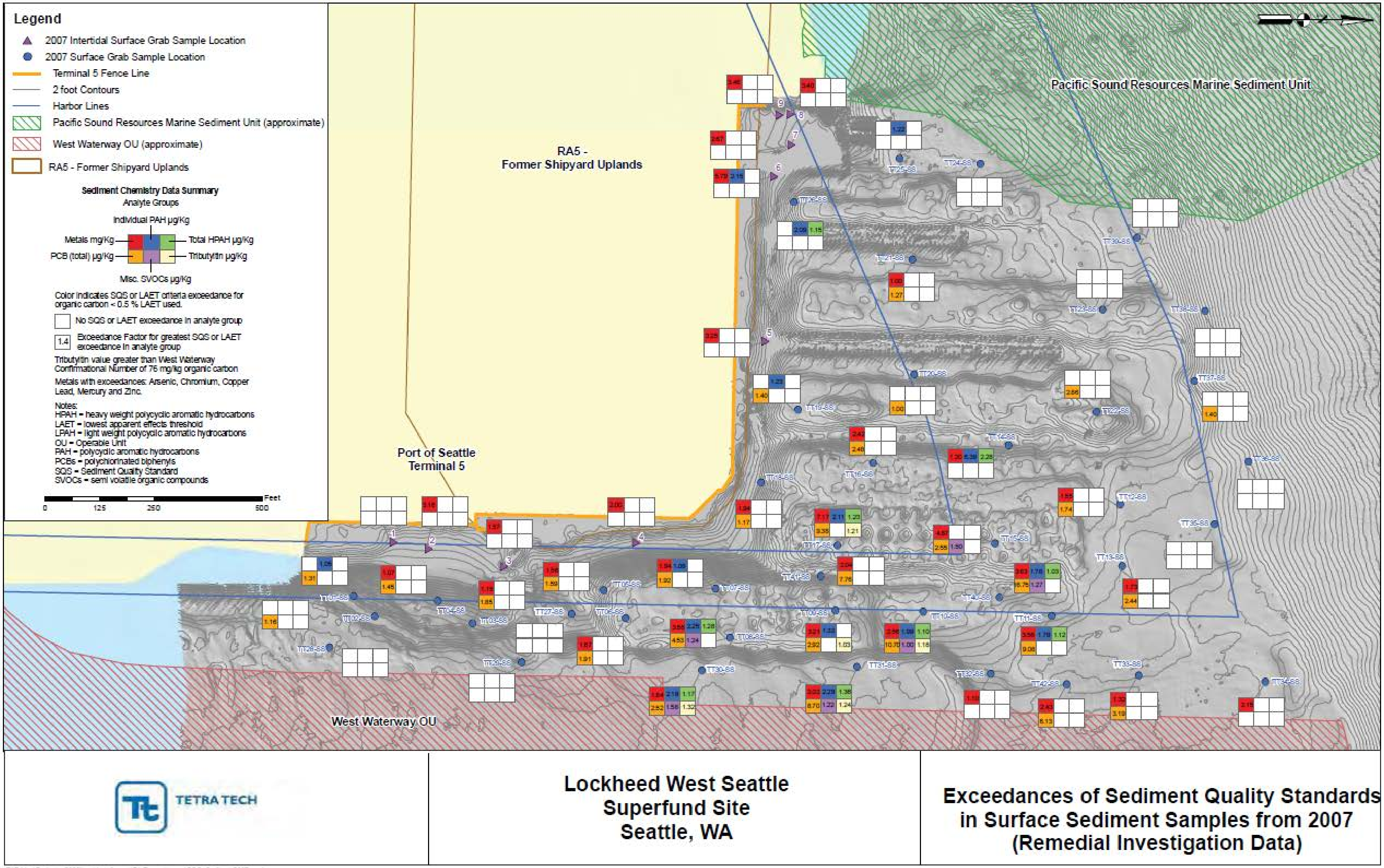

Figure 4. Lockheed West Superfund Site 2007 Remedial Investigation Surface Sediment Results (EPA 2013)

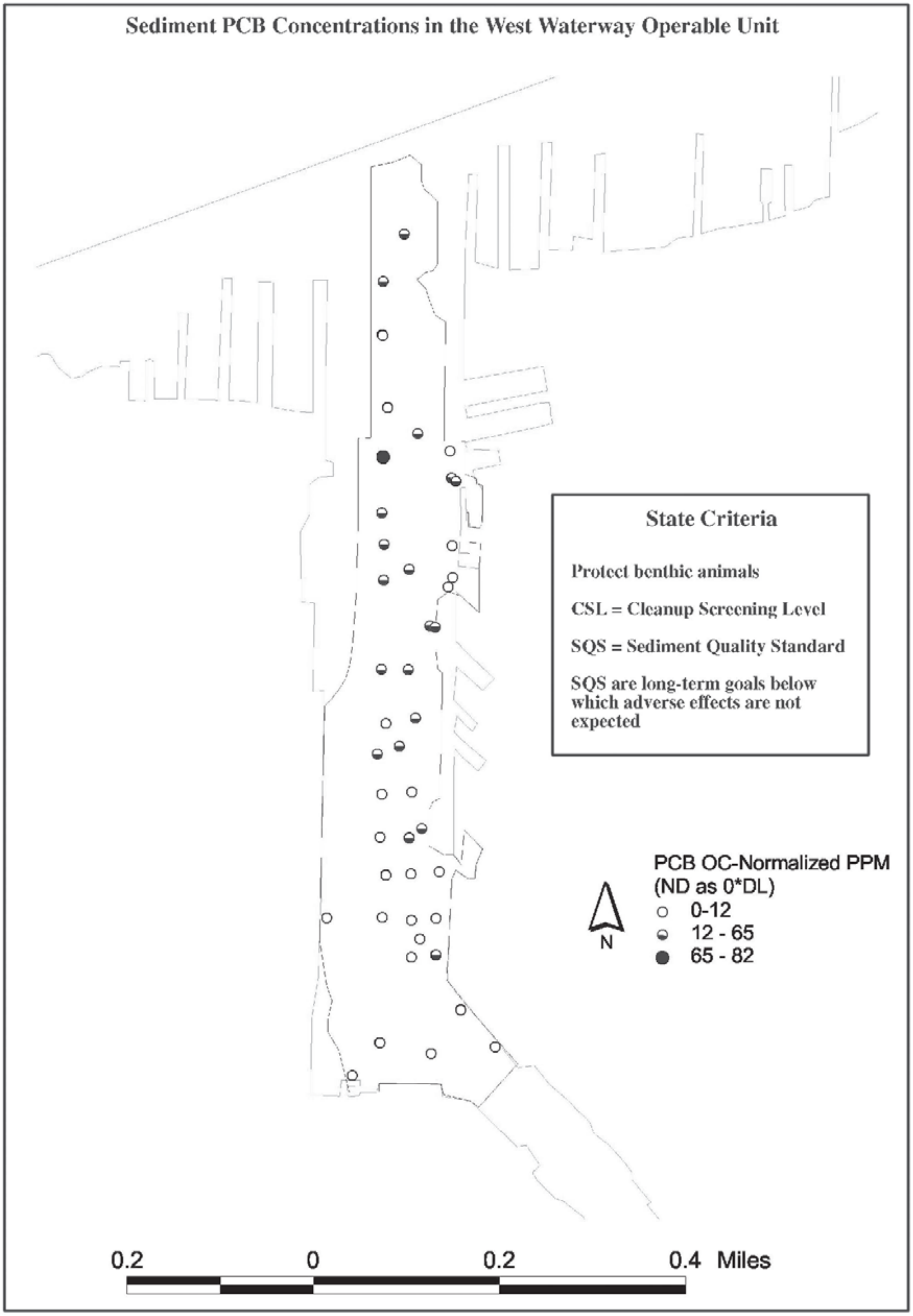

Figure 5. Sediment PCB Concentrations in West Waterway (EPA 2003)

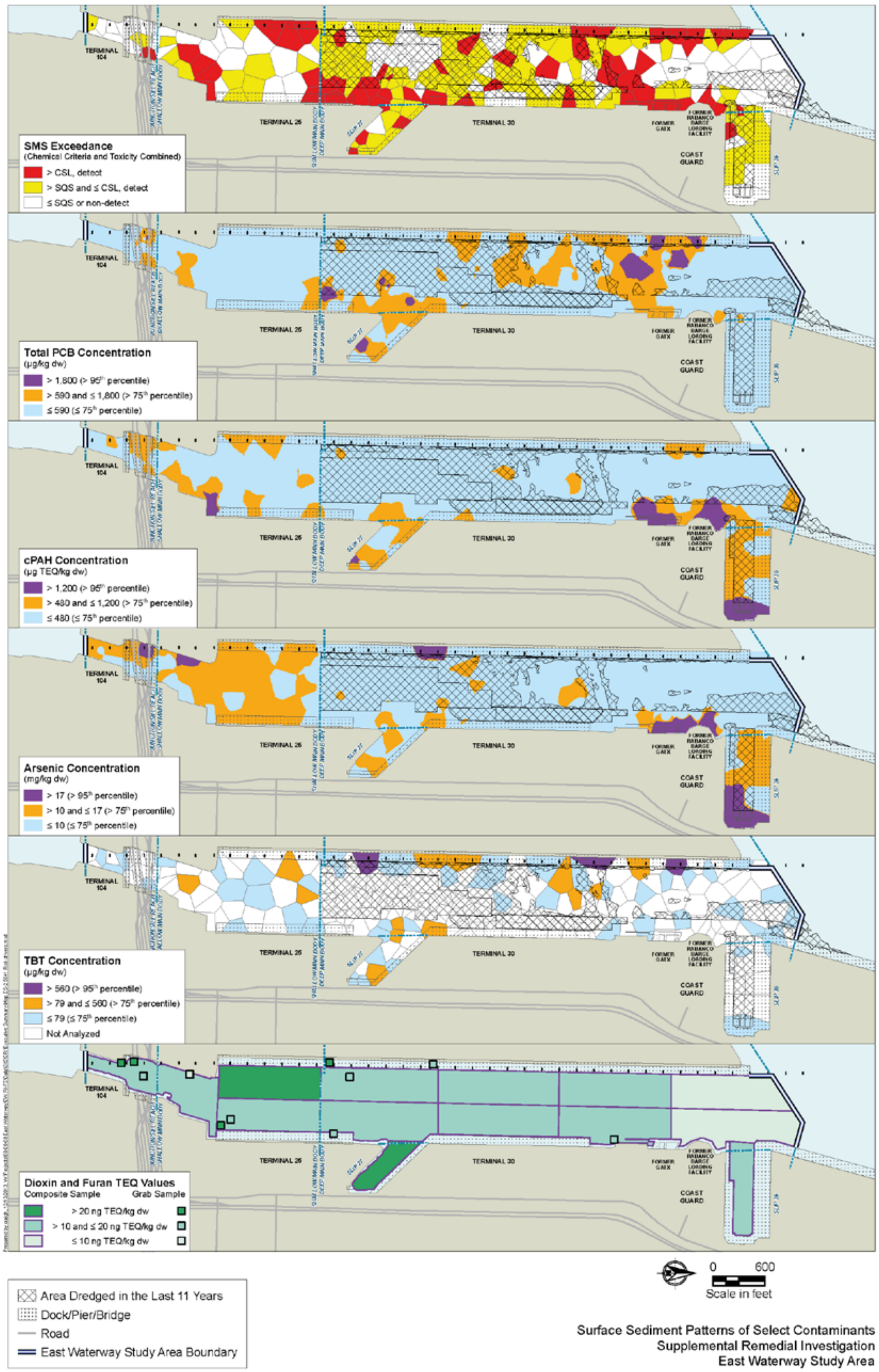

Figure 6. East Waterway 2014 Supplemental RI/FS Surface Sediment Results (EPA 2014)

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