Preassessment Screen

for the

Portland Harbor Superfund Site

Prepared by

The Portland Harbor Natural Resource Trustee Council

January 2007

I. INTRODUCTIONS, AUTHORITIES, AND DELEGATIONS

This document is a preassessment screen (PAS), prepared pursuant to 43 CFR Part 11, for the Portland Harbor Superfund site. The Portland Harbor Superfund site currently encompasses a 9-mile stretch of the lower Willamette River near Portland, Oregon, including upland sites along the shoreline of the river. The site is more fully described in Section II(A) below.

The ultimate purpose of this PAS is to provide the foundation for determining the need to conduct a formal natural resource damage assessment as authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 *et seq*., as amended; the Oil Pollution Act of 1990, 33 U.S.C. § 2701 *et seq*.; and the Clean Water Act, 33 U.S.C. § 1251 *et seq*. The criteria on which the decision to proceed past the preassessment phase to full assessment are listed below.

1) A discharge of oil or release of hazardous substance has occurred.
2) Natural resources for which a State or Federal agency or Indian Tribe may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the discharge or release.
3) The quantity and concentration of the discharged oil or released hazardous substances is sufficient to potentially cause injury to those natural resources.
4) Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.
5) Response actions from Superfund remedial activities carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

This preassessment screen has been prepared pursuant to 43 CFR § 11.23(e) by the Department of the Interior, National Oceanic and Atmospheric Administration (NOAA), State of Oregon, Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Grand Ronde Community of Oregon, Confederated Tribes of the Siletz Indians of Oregon, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and the Nez Perce Tribe. Collectively, pursuant to CERCLA Section 107 (f) and Section 300.600 of the National Contingency Plan, these sovereign entities are trustees for all of the natural resources in the environment potentially injured by releases from and into the Portland Harbor Superfund site.

II. INFORMATION ON THE SITE

A. Information on the Site and on the Discharge or Release

The Portland Harbor Superfund site is located along the lower Willamette River near Portland, Oregon (Figure 1). The Willamette River originates in the Oregon Cascade Range, drains a watershed area of about 11,400 square miles, and has a total length of 309 miles before its confluence with the Columbia River (Kammerer 1990). From the mouth of the Willamette, the Columbia River then flows another 100 channel miles before discharging into the Pacific Ocean. The river segment between River Mile (RM) 3 and RM 10 is the primary depositional area of the Willamette River system, and contains the highly-industrialized area known as Portland Harbor.

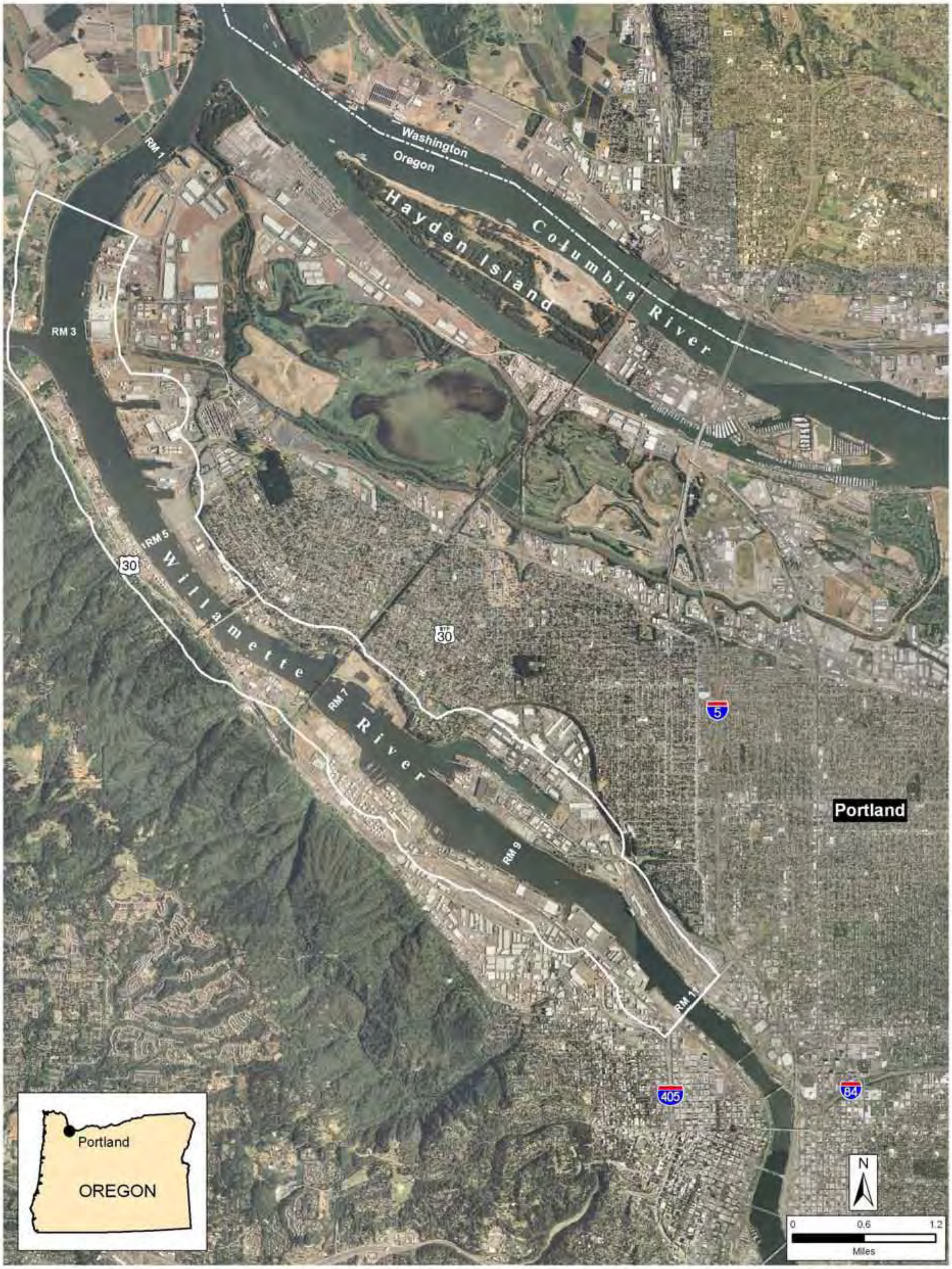

Figure 1. Portland Harbor Superfund site, lower Willamette River, Portland, Oregon. The general site area is outlined in white; as of January 2007 the site is defined as a 9-mile stretch from river mile (RM) 2 to 11, including some upland areas.

This area serves a commercial shipping industry and contains a multitude of facilities and both private and municipal wastewater outfalls. Numerous industrial operations have been identified as sources of contamination to Portland Harbor.

Portland Harbor was added to the National Priorities List in December 2000, and is being addressed through Federal and State actions. The U.S. Environmental Protection Agency (EPA) is the lead agency for Willamette River sediment contamination issues. The Oregon Department of Environmental Quality is the lead agency for upland site contamination. The initial 6-mile stretch of the Superfund site from RM 3.5 to 9.5 has been extended to a 9-mile stretch between RM 2 to 11 and includes upland areas. Remedial investigation sampling activities have been conducted by the potentially responsible parties within this area, as well as upriver of RM 11 over the last few years. Federal and State resource agencies actively participate with counterparts from six Tribes in overseeing the remedial investigation.

Although much of the Portland Harbor area is lined by vertical walls or rock revetment (North et al. 2002), some natural habitats and shoreline areas remain in the lower reach. In addition to unvegetated/disturbed areas, Adlolfson et al. (2000) classified 10 distinct habitat types along the lower Willamette River as bottomland forest, foothill savanna, conifer forest, scrub, meadow, shrub, emergent wetland, beach, rock outcrop, and open water. The more common habitat types in the Portland Harbor area include open water, unvegetated/disturbed areas, and beach areas, with remnants of bottomland forest, emergent wetlands, scrub/shrub, and rock outcrop communities. Mixed emergent and subemergent aquatic vegetation is associated with the natural nearshore areas, and beaches have generally been colonized by annual grasses, perennial shrubs, and willows. The upland areas are mostly comprised of fill, although some ponds, wetlands, sloughs, side channels, and forested habitats remain.

Despite the extensive industrial presence and mixed habitat quality of the Portland Harbor site, a wide variety of natural resources rely on the area as a corridor for upstream and downstream movements, or more permanently for nesting, breeding, foraging, and rearing young. At least 39 species of resident and anadromous fish, including 20 native species, have been documented in the lower Willamette River (Farr and Ward 1993). The area serves as a critical migratory corridor for both juvenile and adult anadromous fish, and as juvenile rearing habitat for several fish species including five stocks of Pacific salmon (*Onchorhynchus* spp.) listed as threatened or endangered under the Endangered Species Act, Pacific lamprey (*Lampetra tridentata*), and white sturgeon (*Acipenser transmontanus*). Migratory birds nesting near or within the site and foraging in the open water and nearshore habitats include piscivorous species such as bald eagle (*Haliaeetus leucocephalus*) (listed as threatened under the Endangered Species Act), osprey (*Pandion haliaetus*), double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), belted kingfisher (*Ceryle alcyon*), common (*Mergus merganser*) and hooded (*Lophodytes cucullatus*) mergansers, and other waterfowl. The beach habitats and aquatic plants along the shorelines provide good habitat for passerines and aquatic-associated birds. Bird species nesting and foraging along the beach, nearshore habitat, and in unvegetated areas or on developed structures include cliff swallows (*Petrochelidon pyrrhonota*), various waterbirds, and shorebirds such as spotted sandpiper *(Actitis macularius*). Mammals including mink (*Mustela vison*) and river otter (*Lontra canadensis*) use the area as a corridor, as well as forage in the river and rear young along the shoreline habitats. Some amphibian species such as northern redlegged frogs (*Rana aurora aurora*) and Pacific treefrogs (*Pseudacris regilla*) have been observed in the Portland Harbor area and could use the nearshore habitat as breeding areas, whereas reptiles such as turtles are more likely only using the lower river as a corridor. A number of species more common to habitats just outside the Portland Harbor site may visit as transients.

Lower trophic level inhabitants of the Portland Harbor site include infaunal and epifaunal benthic invertebrates such as oligochaete worms, chironomid larvae, and various midges. In the lower Willamette River, Friessan et al. (2005) found cladocerans such as daphnids, copepods, and aquatic insects made up the majority (89.6%) of organisms in drift net samples, daphnia and chironomids made up 94.9% of organisms on multi-plate samples, and oligochaetes and chironomids dominated 87.5% of the organisms from ponar samples. The authors noted a generally homogenous community structure in samples from the Portland Harbor area. Other representative invertebrate species include organisms of the classes Amphipoda such as *Corophium spp.*, Decapoda such as crayfish, and members of classes in the phylum Mollusca, including Gastropoda (snails) and Bivalvia (bivalves) (Integral et al. 2004a). The Columbia pebblesnail (*Fluminicola fuscus*) may occur in lower Willamette River, and this is a species of concern to the U.S. Fish and Wildlife Service. Two species of bivalves documented in the harbor include Asiatic clam (*Corbicula fluminea)* and western pearlshell (*Margaritifer falcata*); these organisms rely on plankton and detritus as food. All these invertebrate species are important for processing organic matter and serve as common prey items for higher trophic level species within the site. Daphnids and chironomids are particularly important food source for juvenile salmonids in the lower Willamette River.

The lower Willamette River also is a popular area for recreation, including swimming, boating, and wildlife viewing. Recreational fishing for spring chinook, steelhead, coho, American shad, and white sturgeon is very common. Exotic resident fish species such as largemouth bass and walleye, and panfish such as black and white crappie, support a large year-round sport fishery. Economically, sport fishing is very important to the Willamette Basin and generated approximately $63 million in personal annual income based on estimates made in 1980 (Howell 1986). In 1998, the Willamette River was named as an American Heritage River, a Federal designation to assist in restoring and protecting the river.

1. *Information on time, quantity, duration, and frequency of releases and discharges*

The lower Willamette River at Portland Harbor receives contaminant inputs from industrial activities and other sources. Discharges and releases of oil and hazardous substances into Portland Harbor have resulted from current and historical industrial and municipal activities and processes since the early 1900s. Facilities released materials through permitted and non-permitted discharges, spills during cargo transfer and refueling, stormwater runoff through contaminated soils at upland facilities, and discharge of contaminated groundwater. Other releases into the Willamette River upstream of Portland Harbor include metals from historical mining activity, agrochemicals from agricultural and timber operations along the river and its tributaries, and resuspension of deposited contaminated materials from aggregate mining operations.

There are numerous industrial facilities associated with contamination within Portland Harbor (Table 1; Integral et al. 2004a,b). Many sites have contamination in upland soils due to improper disposal of wastes or from spills and mishandling of chemicals and hazardous materials. Contaminated bank soils include shorelines around Arkema/Atofina Chemicals, Crawford Street Corp, Gasco, Linnton Plywood/Columbia River Sand and Gravel, and McCormick and Baxter facilities (Integral et al. 2004a). Other priority sites with documented contamination in groundwater, sediment, upland soil, or other media include ARCO Bulk Terminal, Cascade General (Portland Shipyard), Foss Maritime/Brix Marine, Gunderson, Kinder Morgan Linnton Terminal (GATX), Mar Com, Marine Finance Corporation, McCormick and Baxter Creosoting, Mobil Oil Terminal, Oregon Steel Mills, Port of Portland Terminal 4, Premier Edible Oils, Rhone-Poulenc (Aventis Crop Science), Triangle Park (Riedel Environmental), Union Pacific Railroad/Albina, Wacker Siltronic, and Willbridge Bulk Fuel Facility, which includes Chevron, Shell, and Conoco/Phillips (Integral and Groundwater Solutions 2004). Cleanup activities including barrier wall installation, removal of contaminated sediments, and sediment capping have been undertaken at some of these sites.

The groundwater transport pathway is a significant route for contaminants to enter the Willamette River from contaminated upland facilities within Portland Harbor. The shallow, unconfined groundwater system occurs at or below the shoreline, and low river stages expose seeps along the bank (Groundwater Solutions 2003). Rate of discharge of the shallow system is gradient dependent and full reversals are rare. Intermediate and deep groundwater discharges are also present in Portland Harbor, some of which are contaminated by upland sources. However, Groundwater Solutions (2003) reports that contaminated discharges from the shallow and intermediate systems pose the highest risk to natural resources as these systems contain the vast majority of contaminants. Risk is greatest at the transition zone area where mixing of groundwater and surface water occurs because these areas are attractive to benthic organisms and their predators. Fish and other aquatic organisms can be exposed to contaminants at the transition zone from direct contact with contaminated water or by consuming contaminated prey items.

About 113 upland sites between RM 2 to 11 have been identified that could represent a contaminant source to Portland Harbor through surface seeps or subsurface discharge to sediments (Groundwater Solutions 2003). Of these, 19 sites have contaminants confirmed in groundwater and reasonable likelihood that the groundwater plume reaches the Willamette River, 85 sites have insufficient data to determine if groundwater is contaminated or if contaminated groundwater reaches the Willamette River, and nine sites have data indicating contaminants are not present or will not reach the Willamette River (Groundwater Solutions 2003). Metals and volatile and semi-volatile organic compounds are the most common contaminant issues at sites with data available on groundwater.

Spills of hazardous materials into Portland Harbor occur on an intermittent basis and result from product transfer and handling, overwater activities, utility crossings, and releases from vessels refueling and accidents (Integral et al. 2004a). Records of some spills have been collected since at least the 1940s, and spills or mishandling of products and wastes were likely more common prior to development of regulations governing hazardous materials and reporting requirements. Spill reports indicate petroleum releases from vessels are fairly common (Integral et al. 2004a).

Although prevention and response techniques have improved in the Portland Harbor area, spills are considered an ongoing source of contamination for the harbor.

Contaminants are also discharged under permit from various facilities in Portland Harbor, which potentially increases the contaminant burden for ecological receptors in the area. There are at least 94 National Pollutant Discharge Elimination System (NPDES) permitted discharges into Portland Harbor, many of which discharge into the City of Portland's stormwater system (Integral et al. 2004a). The discharges include industrial process wastewater (contact and non-contact cooling waters), treated water from clean-up projects, and stormwater from municipal sources, construction sites, and industrial facilities. Although there are no discharges directly from municipal sewage treatment plants, there are about 250 non-city stormwater outfalls, 20 city stormwater outfalls, and four combined sewer overflow outfalls (which drain raw sewage into the Willamette River during certain high rain events) (Integral and Groundwater Solutions 2004, Integral et al. 2004a).

In addition to these sources, sediment acting as a sink for contaminants can be resuspended in the lower Willamette River and become more bioavailable to organisms due to bottom-disturbing activities such as dredging and shipping, recreational boating in shallow-water areas, and repair and maintenance of underwater cables and drainage pipes.

The full nature of the duration, quantity, and frequency of release or discharge of hazardous substances into the river from industrial and municipal operations is unknown due to the diversity of sources, industrial facility closings and transitions, and insufficient records of historical operations and spills. However, a list of operations and estimates of the types of discharge are presented in Table 1. Although many releases occurred in the past, ongoing injury is likely from discharges of contaminated groundwater, contact with stormwater runoff from contaminated uplands, and from sediments acting as a source of contaminants to organisms within Portland Harbor.

2. *Names of the Hazardous Substances*

Hazardous substances released to the Portland Harbor area include, but are not limited to, the following chemicals (reported by name and Chemical Abstract Service [CAS] Registry Number): polychlorinated biphenyls (CAS 1336363), including various Aroclor and other mixtures; dioxins and furans, including 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (CAS 1746016) and 2,3,7,8-tetrachlorodibenzofuran (CAS 51207319); organochlorine pesticides and related transformation products, including DDT (CAS 50293), DDD (CAS 72548), DDE (CAS 72559), heptachlor (CAS 76448), and dieldrin (CAS 60571); high and low molecular weight polyaromatic hydrocarbons; metals, including lead (CAS 7439921), mercury (CAS 7439976), copper (CAS 7440508), chromium (CAS 7440473), and arsenic (CAS 7440382); semi-volatile organic compounds such as bis(2-ethylhexyl)phthalate (CAS 117817), other phthalate esters, and pentachlorophenol (CAS 1336363); volatile organic compounds such as benzene (CAS 71432); and other compounds such as perchlorate (CAS 014797730), herbicides, organic solvents, and antifouling agents such as tributyltin (CAS 688733) and other butyltins.

3. *History of the current and past uses in relation to the sources of hazardous substances released or discharged*

Industrial facilities along Portland Harbor that have potentially contributed to contamination of the lower Willamette River have been operating since the early 1900s. Aerial photos indicate that lumber and steel mills, tank farms, a dry dock at Willamette Cove, and large rail yards existed prior to 1936, but much of the area was developed by 1948 and after (Integral and Groundwater Solutions 2004). Few land use changes occurred following 1974. Many of the industrial facilities are no longer in operation, but other facilities continue to release or discharge contaminants into the Portland Harbor area. Industrial activities that have resulted in releases of hazardous substances include bulk petroleum storage and distribution; manufacture, formulation, and storage of chemicals, pesticides, asphalt, paint, resins, and acetylene; raw materials handling and treatment, including loading and unloading; metal salvage and recycling; oil gasification; wood treating; lumber wood chip export; tar pitch distribution; marine construction, repair, and fueling; pipe manufacturing and coating; semiconductor manufacturing; electrical power generation and substation operations; and railroad operations, fueling, and maintenance (U.S. Environmental Protection Agency 1998, Integral et al. 2004a). Extensive ship building and repair was conducted in the 1940s during World War II, and some of this work continues in the harbor but on a much reduced scale (Integral et al. 2004a). Other activities contributing to contamination in the harbor include erosion of contaminated soils, stormwater runoff from roads and urban areas, recreational boating and marina operations, contamination associated with urban growth, sewage operations and overflows, atmospheric deposition of exhaust and emissions, industrial discharges, and historic direct waste disposal into the river.

Since the 1900s, much of the Willamette River has been modified to control flooding and for navigation, and the lower floodplain has been extensively modified from filling and development for industrial facilities. Lakes, wetlands, bottomlands, and sloughs within the floodplain of the lower river have been filled by hydraulic dredging, especially in Portland Harbor, including portions of Doane, Guilds, and Kittridge Lakes (Integral et al. 2004a). Numerous streams in the Portland Harbor area have been diverted and covered over during development of municipal and industrial areas. The lower reach from RM 0 to RM 11.6 has been dredged to maintain a 40-foot deep by 300-foot wide navigation channel, although depths of over 70 feet occur in the channel (Integral et al. 2004a). Much of the material dredged from the river was used for bank stabilization and for filling in the floodplain. Over the last 100 years, much of the natural shoreline has been replaced by rock revetment or vertical walls for flood control (North et al. 2002).

4. *Relevant operations occurring at or near the site*

Little industrial activity occurs downstream of RM 2 on the lower Willamette River, although the Port of Portland grain terminal (Terminal 5) at RM 1 receives slag from Oregon Steel Mills. Marinas, rail yard maintenance activities, aluminum storage facilities, and aggregate mining operations occur upstream of RM 11. Ross Island Sand and Gravel operates at RM 15. This large, inwater gravel pit collects aggregate materials and has accepted contaminated dredged material for disposal into confined cells within the pit. A former ship dismantling facility operated at the Zidell property is at RM 14. Upstream of Willamette Falls at RM 26.5 there are over 800 permitted discharges from facilities, including sewage treatment plants and industries related to pulp and paper and lumber manufacturing, and over 300 permits for discharge of industrial stormwater into the Willamette River (Integral et al. 2004a).

5. *Additional oil or hazardous substances potentially discharged from the site*

Additional substances discharged into the site include contaminants of emerging interest such as hormones, pharmaceuticals, and personal care products from treated effluent, untreated stormwater overflow, and discharges from nurseries and livestock facilities. Recent water samples collected from the Tualatin River at Boones Ferry Bridge (a tributary of the lower Willamette River) and from the Willamette River at Swan Island (about RM 8) showed relatively low concentrations of some pharmaceuticals such as caffeine (CAS 58-08-2), antibiotics such as sulfamethazine (CAS 57-68-1; Tualatin River only), hormones such as estrone (CAS 53-16-7; Swan Island only), and steroids such as cholesterol (CAS 57-88-5) and coprostanol (CAS 360-68-9) (Barnes et al. 2002, Kolpin et al. 2004). It is unknown if these contaminants occur at sufficient concentrations to affect aquatic organisms, but regulatory mechanisms of fish and other organisms can be impacted by hormones and pharmaceuticals such as those reported by the authors. In addition to contaminants of emerging interest, chemical mixtures such as creosote used in wood treating have been documented in the river, along with non-aqueous phase liquids in groundwater.

6. *Potentially responsible parties*

All the trustees have been involved in settlement negotiations with the major potentially responsible parties, which include the City of Portland, Port of Portland, Arkema/Atofina, ChevronTexaco Corporation, Gunderson, Inc., NW Natural Gas, Oregon Steel Mills, Time Oil Co., ConocoPhillips Company, and Union Pacific Railroad Company. There are over 65 identified potentially responsible parties as reported by Integral et al. (2004b) and Table 1. Recently, notices of potential liability for the Portland Harbor Superfund site have been sent by EPA inviting an additional 25 facilities into negotiations. Facilities receiving these notices are listed in Appendix 1.

B. Damages Excluded from Liability under CERCLA

Title 43 CFR Part 11.24(b) notes certain damages are excluded from liability under CERCLA, such as damages resulting from a discharge or release that was specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental assessment, damages from a release that occurred wholly before enactment of CERCLA, or damages resulting from other federally-permitted activities as those defined in Section 101(10) of CERCLA. In the Portland Harbor area, a significant amount of releases have occurred which have the potential to cause or continue to cause injury and damages that are not excluded from liability under CERCLA. There are significant historical releases which occurred at the site prior to any permitting under environmental laws, and these contaminants continue to be present at the site and potentially are causing both injury and damage to this date. No environmental impact statement or similar environmental analysis has ever identified an irretrievable or irreversible commitment of natural resources at this site. Moreover, continuing non-permitted releases still occur and are also potential sources resulting in injury to natural resources and natural resource damages.

Aside from discharges permitted under the NPDES, there are no other known concerns relative to 43 CFR Part 11.24(b) warranting exclusion from liability under CERCLA, the Oil Pollution Act, or the Clean Water Act. Any injuries that may have resulted exclusively from specific NPDES releases, or other releases found to be under exclusion during the remedial investigations or injury assessments, will be considered further during the damage assessment. At this time the natural resource trustees are not aware of any other possible defenses or exclusions of liability under applicable laws that would preclude initiating a natural resource damage assessment.

III. PRELIMINARY IDENTIFICATION OF RESOURCES AT RISK

A. Preliminary identification of pathways

Contaminants from specific sources identified previously are primarily introduced into the lower Willamette River through point and non-point discharges, from spills during overwater activities, and to a lesser degree from aerial deposition and soil erosion. The primary media for transport of contaminants and exposure to organisms are surface water, groundwater, transition zone water, sediment, and tissue (i.e., from consumption of contaminated prey items or food chain transfer). Surface water flow over upland areas erodes soil or collects material from impermeable surfaces and transports contaminants from urban or industrial areas in the dissolved or particulate phase to the river. Precipitation infiltrates upland soils and can leach contaminants from soils as it percolates to the water table and flows along the top of impermeable layers or alongside discharge pipes before entering the river as seeps above the waterline or as transition zone water below the waterline. Groundwater discharge at seeps or in the transition zone can be attractive to aquatic organisms and provides a pathway for contaminants to reach these organisms through direct contact and ingestion of surface water, particulates, and prey items. Contaminated bedload sediment, or suspended sediment and particulates, are transported from upriver or local sources and deposited, resuspended, and redeposited within Portland Harbor or transferred to downstream reaches and into the lower Columbia River. The degree to which contaminants can move in or through these media depends on various factors including the partitioning coefficients of the specific chemicals.

Exposure of aquatic organisms, including trust resources at the Portland Harbor site, occurs through direct contact or ingestion of dissolved or suspended contaminants in the water column, contact or ingestion of groundwater in seeps or transition zones, contact or ingestion of sediment or porewater, and ingestion of contaminated prey items. Specific ecological receptor groups that are vulnerable to exposure to contaminants specific to the Portland Harbor area include plants, benthic invertebrates, fish, amphibians and reptiles, birds, and mammals. Contaminants have been found in tissues of all these receptor groups in Portland Harbor except plants, amphibians, and reptiles; however, contaminant analysis has not occurred in these latter three groups. The primary exposure pathways of a contaminant from media to receptors are outlined in Figure 2. Additional pathways may be identified during the remedial investigation and injury assessment phases.

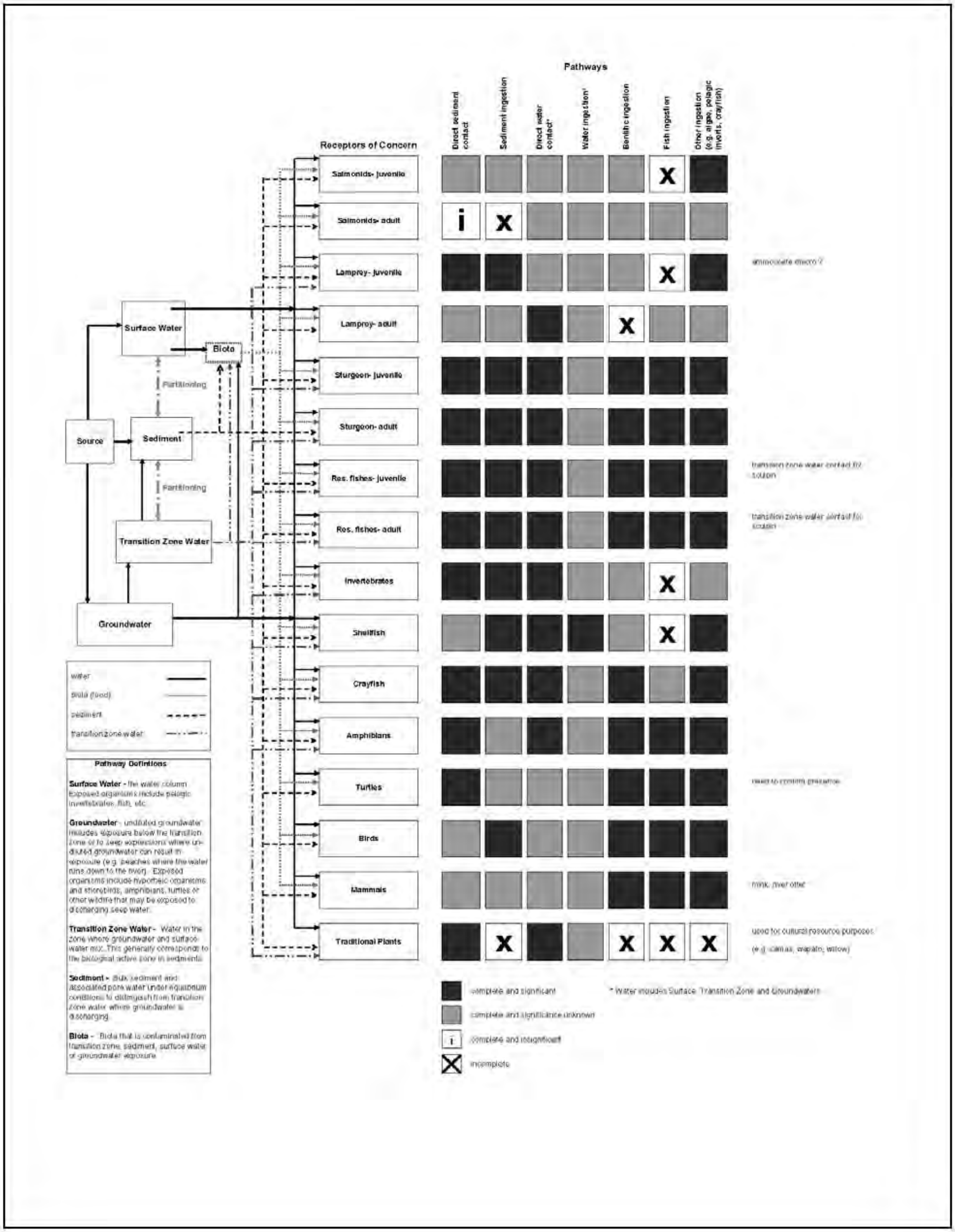

Figure 2. Matrix of the primary exposure pathways of contaminants to ecological receptors within the lower Willamette River.

B. Exposed areas

There are many natural resources moving through the site, and there is a footprint of contamination in sediment between RM 2 and 11 at the Portland Harbor Superfund site. The injury to natural resources is not necessarily limited to the extent of this footprint. The area exposed or potentially exposed to contaminants primarily includes, but is not limited to, the following:

1) A stretch of at least 11 miles of the lower Willamette River between RM 0 to 11, including upland areas around industrial facilities up to approximately 0.5 miles inland, and Swan Island Lagoon at RM 8;

2) The Multnomah Channel from its initiation point at RM 3 of the Willamette River to its mouth on the Columbia River; and

3) A stretch of the Columbia Slough at about RM 1 as a result of tidal reversals moving contaminants up into the slough.

C. Exposed water estimates

The entire main stem of the lower Willamette River from RM 0 to 11 has been exposed to contaminants released from the site. This area includes 11 miles of river length of the Willamette River and associated nearshore habitat, and riparian habitat along the Columbia Slough and Multnomah Channel. It is likely that contaminants from various facilities and outfalls have been released upstream of RM 11 as well.

D. Estimates of concentrations

Numerous contaminants have been documented in abiotic and biotic samples from the lower Willamette River, and the Portland Harbor section contains some of the most elevated contaminants compared to the river's upper reaches. Various studies have documented metals such as mercury and arsenic, polycyclic aromatic hydrocarbons (PAHs), volatile and semi-volatile organic compounds, organochlorine pesticides (including DDT and its metabolites DDE and DDD), polychlorinated biphenyls (PCBs), dioxins, and furans in water, sediment, and fish tissue within the Portland Harbor area and immediately up- and downstream from the harbor (Curtis et al. 1993, Oregon Department of Environmental Quality 1994, Bonn et al. 1995, Harrison et al. 1995, Sethajintanin et al. 2004, Integral 2004, 2005a,b, 2006a). Known or potential injuries to trust resources in the Portland Harbor area resulting from elevated contaminant concentrations include, but are not limited to, consumption advisories issued by the Oregon Department of Human Services for resident fish and crayfish, listing of the lower Willamette River as water quality limited for various contaminants on the State 303d list as required under the Clean Water Act, exceedances of water quality criteria established for the protection of aquatic life in freshwater, impacts on growth and mortality of benthic invertebrate communities from contaminated sediment, direct impacts to fish from accumulated contaminants or from dissolved contaminants impeding anadromous fish passage, and reproductive injuries from trophic transfer of bioaccumulative contaminants to species higher in the food chain.

Contaminant concentrations in specific media within Portland Harbor (as reported by recent evaluations) and some effects to trust resources resulting from exposure to the contaminated media are presented below.

Surface water

Concentrations of many groups of contaminants have been found in surface water in the Portland Harbor site. Recent sampling reported by Integral (2005a, 2006a) to characterize water quality during various flow conditions was conducted during the early rainy season in the fall (November 2004), during winter high flow corresponding to release of amphibian egg masses (March 2005), and during low flow conditions in summer (July 2005). Water samples were collected using solid-phase cartridges (XAD-2 resin) and high volume methods at the following locations: three integrated water column transect stations at RM 4, 6.3, and 11; four single point, near bottom stations at Willamette Cove; near a discharge pipe from the Rhone-Poulenc property; near the Arkema/Atofina property; and at Swan Island near Cascade General. These stations indicated a wide range of contaminants present in both dissolved and particulate fractions of surface water within the harbor.

Dioxins and furans were sampled at only five stations, including the three transect stations and two single point stations. Total polychlorinated dioxins and furans ranged from 16.7 to 163 pg/L during the three sampling events. The highest concentration was documented at the Willamette Cove station in the summer sampling event, although high concentrations (over 80 pg/L in the fall event) were observed near the Rhoune-Poulenc outfall as well. There were only four detections of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in the particulate fraction ranging from 0.005 to 0.26 pg/L (the higher concentration was a field replicate at Willamette Cove with undetected concentrations in the parent sample). The higher concentration was greater than the total maximum daily load established for the lower Willamette and Columbia Rivers for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin of 0.013 pg/L. All whole water samples contained 2,3,7,8-tetrachlorodibenzofuran ranging from 0.008 to 0.619 pg/L. Higher chlorinated dioxins and furans were more commonly detected than the lower chlorinated isomers and were predominantly associated with the particulate fraction of the water samples.

Similar to the dioxins and furans, most detected organochlorine pesticides and PCBs were associated with particulate matter. DDT and DDE concentrations were detected in all whole water samples during all seasons ranging from 1.34 to 3,862 and 16.4 to 663 pg/L, respectively. DDT at the higher concentrations exceeded Oregon’s acute water quality criteria of 1,100 pg/L established for the protection of freshwater aquatic life, and all detectable DDT concentrations exceeded the 1 pg/L chronic criteria. Concentrations of DDT and DDE were relatively similar across sites, although the highest concentrations of these compounds were found at the Rhone-Poulenc discharge pipe and Arkema/Atofina. Total PCBs reported as the sum of congeners ranged from 3,340 to 12,000 pg/L and were highest at the Willamette Cove station, although the Rhone-Poulenc, Arkema/Atofina, and Swan Island locations also exhibited relatively high concentrations of dissolved and particulate PCBs. Most detected PCB concentrations exceeded Oregon’s acute and chronic water quality criteria of 2,000 and 14 pg/L, respectively.

Total PAHs were detected at all stations during all sampling events. Whole water concentrations ranged from 6.13 to 231 ng/L. The highest concentrations were found at Rhone-Poulenc discharge and Arkema/Atofina stations. In contrast to the organochlorine compounds, PAHs were found predominantly in the dissolved phase of the water samples. Total PAHs in these samples exceeded the State water quality criterion of 2.8 ng/L for protection of human health, and this section of the lower Willamette River is listed as water quality limited.

Numerous metals, collected by peristaltic pump and not with XAD resins, were commonly detected in water samples. Arsenic was detected at all stations and ranged from 0.33 to 0.75 µg/L from all three sampling events. In contrast, neither total nor dissolved mercury or hexavalent chromium were detected in any of the sampling events.

Groundwater

Groundwater discharging into Portland Harbor is currently being assessed to further evaluate the transport pathway for chemicals migrating from upland groundwater plumes to transition zone water, sediment, or surface water, and to assess remobilization of chemicals in bulk sediment or transition zone water through physical, chemical, or biological processes (Integral 2006b). Nine high priority sites have been identified for further characterization of groundwater contamination in Portland Harbor. These sites include the following facilities: Kinder Morgan Linnton Terminal, ARCO Terminal 22T, ExxonMobil Oil Terminal, Gasco, Siltronic, Rhone-Poulenc, Arkema (Acid Plant and Chlorate Plant areas), Willbridge Bulk Fuels Terminal, and the Gunderson site. Discharge of upland groundwater contaminants to Portland Harbor has either been confirmed or is reasonably likely at these sites (Integral 2006b).

Results from 70 seepage meters deployed in all sediment types at these sites primarily indicated a positive discharge to the river, and showed an average daily groundwater discharge rate of 1.48 cm/day (minimum of -18.90 cm/day at ExxonMobil and a maximum of 14.20 cm/day at ARCO) (Integral 2006b). Contaminant sample results are available from 117 transition zone water samples (including replicate samples) at depths 0 to 30 cm below the sediment-water interface, and 38 transition zone water samples (including replicates) from depths of 90 to 150 cm below the sediment-water interface (Integral 2006b). Preliminary results indicated that transition zone water samples collected at Gasco have the highest concentrations of PAHs ranging up to 3,491 µg/L in unfiltered samples, total petroleum hydrocarbons up to 6,100 µg/L in unfiltered samples, and benzene, toluene, ethylene, and xylene (BTEX compounds) over 700 µg/L. Groundwater contaminants in discharges from the Siltronic facility were the next highest for total PAHs (just under 250 µg/L in unfiltered samples) and total petroleum hydrocarbons (about 2,250 µg/L in unfiltered samples), while Arkema showed the highest concentrations for total volatile organic compounds (up to 1,300,000 µg/L), barium (2,760 µg/L in filtered samples), and manganese (66,200 µg/L in filtered samples). Relatively lower concentrations of volatile organic compounds, BTEX, PAHs, and total petroleum hydrocarbons were found in transition zone water at Kinder Morgan, ARCO, ExxonMobil, and Willbridge, although arsenic was the highest at these sites (Integral 2006b).

Other contaminants such as mercury, DDE, and DDT were detected in both unfiltered and filtered samples at some sites. In unfiltered samples, mercury was detected in 20 of 84 samples ranging from 0.08 to 0.5 µg/L, DDT was detected in eight of 14 samples ranging from 0.008 to 2.7 µg/L, and DDE was detected in eight of 14 samples ranging from 0.015 to 0.24 µg/L. In filtered samples, mercury was found in only five of 104 samples ranging from 0.08 to 0.36 µg/L, DDT was found in only one of 17 samples at 0.01 µg/L, and DDE was found in two of 17 samples from 0.004 to 0.008 µg/L.

Surface sediment

Sediment from the Portland Harbor site has been evaluated in a number of studies; the most recent and largest sampling effort was conducted to document the horizontal and vertical distribution of chemicals (Integral 2005b). Horizontal distribution was represented by surface sediment (0-30 cm) collected in November 2004 at 523 locations between RM 2 and 25 (515 locations between RM 2 and 11) with a total of 562 samples collected from all stations. Commonly detected contaminants, concentration ranges, and detection frequency (DF) are as follows:

- total mercury from 0.006 to 2.1 mg/kg in 562 samples with 100% DF;
- PCB Aroclor 1248 from <1.4 to 22,300 µg/kg in 200 of 520 samples or 38.5% DF;
- PCB Aroclor 1254 from <0.67 to 2,100 µg/kg in 216 of 520 samples or 41.5% DF;
- PCB Aroclor 1260 from <0.86 to 5,070 µg/kg in 389 of 520 samples or 74.8% DF;
- DDT from <0.05 to 12,000 µg/kg in 405 of 489 samples or 82.8% DF;
- DDE from <0.04 to 2,240 µg/kg in 483 of 508 samples or 95.1% DF;
- total PAHs from 0.91 to 7,950,000 µg/kg in 557 of 562 samples or 99% DF;
- 2,3,7,8-tetrachlorodibenzo-*p*-dioxin from <0.06 to 111 pg/g in 13 of 76 samples or 17.1 % DF; and
- 2,3,7,8-tetrachlorodibenzofuran from <0.012 to 423 pg/g in 43 of 76 samples or 56.6% DF.

Other compounds detected in surface sediment included volatile and semi-volatile organic compounds other than PAHs, higher chlorinated dioxins and furans (especially the heptachlorodibenzo-*p*-dioxins), total petroleum hydrocarbons, and four herbicides.

Exposure to contaminated sediment can affect the growth and survival of invertebrates and limit the habitat available for colonization. In addition, trust resources higher in the food chain are at risk from exposure to chemicals from eating contaminated invertebrates or from incidental ingestion of sediment.

Benthic invertebrates—Bioassays

To develop a predictive toxicity model that characterizes the relationship between sediment chemistry and benthic invertebrate toxicity in the lower Willamette River, 10-day sediment toxicity tests with *Chironomus tentans* and 28-day sediment tests with *Hyalella azteca* were conducted on 233 sediment samples collected within and upstream of the Portland Harbor Study Area (Windward et al. 2006). Assessment endpoints included growth and survival. NOAA evaluated these data using a methodology of classification based on the EPA National Sediment Inventory. Thus, each endpoint was classified into three categories (N, Tier II, Tier I) based on the test response normalized to the control. For survival, samples greater than or equal to 90 percent of control were classified as N (not different from control), between 75 to 90 percent of control as Tier II (slightly/moderately different from control), and less than 75 percent of control as Tier I (highly different from control). For the growth endpoint, between 70 to 90 percent of control were classified as Tier II and below 70 percent as Tier I. Note that these classifications did not include an evaluation of statistical significance of the difference from control.

To combine the results for the growth and survival endpoints for each test, the classification was based on the endpoint with the greatest response. If either survival or growth was classified as Tier I for *Hyalella azteca*, for example, then the sample was classified as Tier I. If neither endpoint was classified as Tier I, but one or both was classified as Tier II, then the sample was classified as Tier II. If the response for both endpoints was greater than or equal to 90 percent of the control, then the sample was classified as N.

The results from both tests (i.e., growth and survival for *Hyalella azteca* and *Chironomus tentans*) were combined using the same classification approach. Hence, if the survival or growth endpoint for either *Hyalella azteca* or *Chironomus tentans* tests was classified as Tier I, then the combined result was classified as Tier I.

Using this methodology, 21 percent (50/233) of all stations are classified as N (not different from control), 33 percent (76/233) as Tier II (slightly/moderately different from control), and 46 percent (107/233) as Tier I (highly different from control). Of the 233 stations, 18 were located upstream of the study area for reference purposes. NOAA's evaluation of these upstream reference stations indicates that 44 percent are classified as N, 39 percent as Tier II, and 17 percent as Tier I. A similar analysis of the 215 study area stations shows that 20 percent are classified as N, 32 percent as Tier II, and 48 percent as Tier I.

The results of these analyses, summarized below, indicate that responses in the study area are highly different from the control with much greater frequency than upstream of the study area. Hence, it is likely that benthic organisms in the study area experience higher rates of toxicity associated with exposure to contaminants in sediments than benthic organisms in the river reaches upstream of the study area. Reduced rates of survival and growth for benthic organisms in the study area likely constitute an injury to this resource. In addition, various species of fish and other organisms that feed on benthic organisms in the study area may be negatively impacted by reductions in their prey base and potentially through exposure to contaminants via uptake of benthic-dwelling biota.

	Tier I	Tier II	N
All Stations (233)	46 percent	33 percent	21 percent
Upstream Stations (18)	17 percent	39 percent	44 percent
Study Area Stations (215)	48 percent	32 percent	20 percent

Field-Collected Invertebrates

Samples of the Asian clam (*Corbicula fluminea*) and crayfish (*Pacifastacus* spp.) have been collected in Portland Harbor for chemical analysis. Asian clams collected between RM 2 and 10 accumulated various contaminants and reflected localized contamination from known sources within the harbor (electronic data made available by the Lower Willamette Group, Portland, Oregon). DDT and DDE in 31 composite clam samples ranged from 0.61 to 32 and 4.8 to 64 µg/kg, respectively. Total summed PCBs ranged from 50 to 2,660 µg/kg and total Aroclor PCBs (1254 plus 1260) ranged from 26 to 1,456 µg/kg. Although few of 29 clam samples contained detectable concentrations of 2,3,7,8-tetrachlordibenzo-*p*-dioxin, many samples did contain higher chlorinated dioxins and furans, which in some tissues are indicative of releases from facilities using or combusting wood-treating products (Elliott et al. 1996a, 1996b, Elliott and Norstrom 1998). Total PAHs in 29 clam samples averaged 637 µg/kg and ranged from 35 to 4,975 µg/kg, with the highest concentrations in clams collected from RM 6 to 8.6 where a number of petroleum sources are located. Similarly, concentrations of total high molecular weight PAHs in 27 composite crayfish samples were highest (up to 380 µg/kg) at RM 6.8 (Integral 2004). The elevated PAHs in samples indicates that clams are relatively good accumulators (or poor metabolizers) of PAHs. Many contaminants in clams were lowest at RM 10 and had much higher concentrations downstream. Clams and crayfish are important food sources for fish, waterbirds, and aquatic-dependent mammals, and these species may be impacted by consumption of clams and crayfish within Portland Harbor. Asian clams have been found to be an important component in the diet of white sturgeon captured in the lower Columbia River (Romano et al. 2002).

Juvenile chinook salmon

Contaminant concentrations in juvenile chinnook salmon collected at four locations (RM 4, 7, 10, and an upstream reference location at RM 18) indicate that subyearlings spend sufficient time rearing in Portland Harbor to bioaccumulate compounds at concentrations that represent local sources, based on data reported by Integral and Windward (2006). All subyearling chinook collected from the Portland Harbor site had concentrations of many contaminants at much greater concentrations than the upstream reference area.

Concentrations of DDT and DDE were greatest at RM 7 near a discharge area of a former pesticide manufacturer. Values in the RM 7 sample were 37 and 91 µg/kg for DDT and DDE, respectively, whereas the same compounds in the RM 18 sample were 1.7 and 6.9 µg/kg, respectively. Total PCBs (sum of congeners) ranged from 16.7 to 193 µg/kg, with the higher concentration representing a sample from a known PCB source (Fireboat Station). Lipid-normalized total PCB concentrations (ranging from 6.2 to 11 µg/g) at all three Portland Harbor sites (RM 4, 7, and 10) exceeded the lipid-normalized value of 2.4 µg/g above which wild juvenile salmonids would be expected to exhibit adverse sublethal effects (Meador et al. 2002). In contrast, the lipid-normalized concentration (0.9 µ/g) from the sample at the upstream location was well below the adverse effect value.

Total PAHs in whole-body tissue were similar in samples from RM 4, 7, and 10 (ranging from 13.8 to 15.4 µg/kg), whereas the reference sample concentration (7.4 µg/kg) was nearly half the downstream values. Total PAHs in stomach contents from Portland Harbor fish were as high as 2,460 µg/kg, indicating a contaminated food source. Studies conducted in urban estuaries in Puget Sound, Washington, have documented significant accumulation of PAHs in outmigrating juvenile chinook salmon or stomach contents, and have linked this accumulation in the salmon to altered immune responses (suppression of B-cell mediated immunity and immunological memory) and elevated levels of hepatic DNA adducts (McCain et al. 1990, Arkoosh et al. 1991, 1994, Stein et al. 1995). Compromised immune systems threaten the health and survival of these juvenile salmon.

The data indicate that subyearling chinook accumulate greater concentrations of contaminants depending on their location and residence time in Portland Harbor. Contaminant concentrations circulating in the bloodstream during this early development stage pose a potential risk of sublethal effects to these fish, including impacts to growth and maturation. Similar effects to outmigrating juvenile chinook from contaminant exposure in other estuaries in the Northwest have been documented (Meador et al. 2002). PCB concentrations in subyearling salmon from Portland Harbor exceed adverse effects values, and PAHs in prey items and whole-body tissues threaten immune system function, growth, and long-term survival of these individuals.

Resident fish

Earlier studies on resident fish within the lower Willamette River revealed that carp (*Cyprinus carpio*) and Northern pikeminnow (*Ptychoceilus oregonensis*) collected particularly between RM 6 and 8 contained median concentrations of DDT, DDD, DDE, and total PCBs that exceeded threshold values derived from EPA water quality criteria (Oregon Department of Environmental Quality 1994). Whole-body pikeminnow samples exhibited significantly higher 2,3,7,8-tetrachlordibenzo-*p*-dioxin and 2,3,7,8-tetrachlordibenzofuran concentrations from this area than from upper reaches, with mean values of composite tissues exceeding 1.3 and 16 pg/g wet weight for 2,3,7,8-tetrachlordibenzo-*p*-dioxin and 2,3,7,8-tetrachlordibenzofuan, respectively (Curtis et al. 1993). Common carp collected from Portland Harbor near RM 7 exhibited significantly more total cytochrome P450-1A1 in hepatic microsomes than in fish from upstream locations, indicating physiological evidence of exposure to aromatic hydrocarbons (Curtis et al. 1993).

More recently, resident fish sampled in 2004 from Portland Harbor and reported by Integral (2004) showed elevated concentrations of bioaccumulative compounds and some inorganic contaminants. Some contaminants were the same as those found in water, sediment, and invertebrates, indicating food chain transfer of bioaccumulative compounds to higher organisms. Whole-body concentrations of DDT and DDE in six composite largescale sucker (*Catostomus macrocheilus*) samples ranged from <17 to 245 and 79 to 185 µg/kg, respectively. PCB Aroclor 1260 ranged from 50 to 1,400 µg/kg, and mercury ranged from 0.05 to 0.09 mg/kg. In six composite carp samples, DDE ranged from 81 to 260 µg/kg and DDT was detected in only one sample (24 µg/kg). PCB Aroclor 1260 in whole-body carp ranged from 170 to 6,500 µg/kg, and mercury was found in seven composite samples ranging from 0.03 to 0.05 µg/kg. Dioxins and furans were also evaluated in whole-body carp tissue; 2,3,7,8-tetrachlorodibenzo-*p*-dioxin ranged from 0.46 to 1.1 pg/g, 2,3,7,8-tetrachlorodibenzofuran ranged from 1.62 to 2.34 pg/g, and total toxic equivalents (TEQs), representing toxic contributions from dioxins, furans, and planar PCB congeners, ranged from 7.9 to 50 pg/g. Based on six composite samples, pikeminnow, representing an upper trophic level fish species, had concentrations of DDE ranging from 82 to 545 µg/kg, DDT in only one sample (53 µg/kg), PCB Aroclor 1260 ranging from 220 to 1,800 µg/kg, and mercury ranging from 0.15 to 0.50 µg/kg. Mercury in some pikeminnow samples exceeded the value of 0.2 mg/kg estimated by Beckvar et al. (2005) to be protective for juvenile and adult fish.

Composite samples of sculpin (*Cottus* spp.) were also collected to represent contamination at more localized areas, especially in relation to sediment contaminants. Concentrations of organic contaminants in tissue samples tended to coincide with localized sources of contamination. DDT was detected in 21 of 26 samples and ranged from below detection to 1,700 µg/kg, and some samples exceeded the value 600 µg/kg estimated to be protective of juvenile and adult fish (Beckvar et al. 2005). DDE concentrations in sculpin were not detected as frequently as DDT;

DDE was detected in 19 of 26 samples up to 630 µg/kg. PCB Aroclor 1260 was detected in all 26 samples ranging from 62 to 2,300 µg/kg, and dioxin-like toxicity as represented by TEQs ranged from 7.03 to 54.1 pg/g in whole-body sculpin tissue. Mercury was evaluated in 27 samples and was relatively low, ranging from 0.03 to 0.09 µg/kg.

The section of river including Portland Harbor is listed as water quality limited in Oregon due to biological criteria and elevated chemicals such as DDT, DDE, aldrin, dieldrin, PCBs, and mercury in fish tissue (Oregon Department of Environmental Quality 2006). Research by Sethajintanin et al. (2004) also found levels of PCBs, DDT, and mercury in fish tissue from the area exceeding EPA's human health screening values. Currently, the Oregon Department of Human Services has issued consumption advisories because of elevated concentrations of organochlorine pesticides, PCBs, dioxins, and mercury in resident fish, and from elevated wood-treating chemicals in crayfish.

Birds and mammals

Previous studies have documented organochlorine contaminants in fish-eating birds and mammals in the lower Willamette River. Great blue herons nesting near Ross Island at about RM 15 had the highest concentrations of all measured organochlorine compounds in egg samples compared to colonies sampled in the lower Columbia River and reference areas (Thomas and Anthony 1999). Herons are commonly observed foraging within Portland Harbor and likely include birds from the Ross Island site. In 10 eggs sampled from the Ross Island colony, DDE ranged from 95 to 7,339 µg/kg, total PCBs ranged from 106 to 33,168 µg/kg, and dioxin-like toxicity measured as TEQs ranged from 11 to 163 pg/g (Thomas and Anthony 1999). Similarly, osprey eggs previously sampled by the U.S. Geological Survey within Portland Harbor in 2001 contained organochlorine compounds and other contaminants. Concentrations in four osprey eggs collected from nests between RM 1.8 and 15.5 ranged from 1,430 to 5,120 µg/kg DDE, 858 to 3,240 µg/kg for sum of PCB congeners, and 0.05 to 4.0 pg/g 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (Chuck Henny, U.S. Geological Survey, Corvallis, Oregon, unpubl. data).

Studies near the mouth of the Willamette River indicated river otter, a common fish and crayfish predator, were experiencing reproductive tract disorders correlated with a number of organochlorine contaminants (Henny et al. 1996). Some otters exhibited enlarged spleens, lack of testes, and other abnormalities associated with contaminants such as organochlorines that can disrupt the endocrine system. The highest concentrations of many organochlorines in otter livers were associated with the Portland-Vancouver area. More recently, otters sampled within Portland Harbor in the late 1990s showed elevated concentrations of organochlorine samples in liver samples (Grove and Henny 2005). Concentrations were ≤904 µg/kg DDE, ≤17.8 mg/kg mercury, ≤3,573 µg/kg for sum of PCB congeners, and ≤18.9 pg/g total dioxin-like TEQs (Grove and Henny 2005). These studies indicate that river otters and other mammals such as mink are exposed to bioaccumulative contaminants that could threaten their reproductive success.

Fish-eating birds and mammals are exposed to organochlorine compounds, mercury, and other contaminants by consuming fish from Portland Harbor which contain contaminants above protective levels. Concentrations in fish that are considered protective of fish-eating birds were exceeded in many fish samples collected from the harbor. Levels in fish considered protective of bald eagles along the lower Columbia River (U.S. Fish and Wildlife Service 2004) were 0.20

μg/g mercury, 40 μg/kg DDE, 60 μg/kg total PCBs, and 0.9 pg/g 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. Slightly higher values were derived for protection of fish-eating species in New York for DDE (200 μg/kg) and total PCBs (110 μg/kg) (Newell et al. 1987), and Eisler (1987) considered a value of 0.1 μg/g mercury in prey items would be protective for fish-eating birds. Contaminants in many fish from Portland Harbor exceed concentrations considered protective of reproductive success and health of fish-eating birds.

E. Potentially affected resources

The Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Grand Ronde Community of Oregon, Confederated Tribes of the Siletz Indians of Oregon, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, Nez Perce Tribe, U.S. Department of the Interior, National Oceanic and Atmospheric Administration, and the State of Oregon collectively have trusteeship over all natural resources that have been exposed to hazardous substances within Portland Harbor. The natural resources affected or potentially affected from releases or discharges of contaminants include, but are not limited to, the resources listed below.

Aquatic-dependent mammals such as mink and river otter and species they depend on as prey items

Migratory birds, including osprey, bald eagle, mergansers and other waterfowl, great blue heron, spotted sandpiper and other shorebirds, cliff swallow, belted kingfisher, and other species

Threatened and endangered species

Anadromous and resident fish

Reptiles and amphibians

Aquatic invertebrates

Wapato and other aquatic plants

Wetland and upland habitats

Groundwater

Surface water

The services that are provided by these natural resources include, but are not limited to, the following:

Habitat for trust resources, including food, shelter, breeding, foraging, and rearing areas, and other factors essential for survival

Resource use

Hunting and fishing

Non-consumptive uses such as wildlife viewing and photography and other outdoor recreation activities

Primary and secondary contact activities such as swimming and boating

Cultural, spiritual, and religious use

Option and existence values

Traditional foods

IV. PREASSESSMENT SCREEN CRITERIA

As indicated earlier, title 43 CFR Part 11.23(e) notes the five criteria that must be met before proceeding past the preassessment phase to a full natural resource damage assessment. The criteria and corresponding conclusions based on this preassessment screen are as follows.

1) **A discharge of oil or release of hazardous substance has occurred.** Releases of appreciable quantities of petroleum compounds, organochlorine pesticides, PCBs, volatile and semi-volatile organic compounds, solvents, metals, and other materials listed in this preliminary assessment are documented for the Portland Harbor Superfund site, and have been released over a long period of time.

2) **Natural resources for which a State or Federal agency or Indian Tribe may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the discharge or release.** Natural resources over which the State and Federal agencies and Indian Tribes may assert trusteeship have been and are likely to continue to be adversely impacted. Existing field data indicate that hazardous substance concentrations in sediment and tissue spatially coincide or are elevated near areas with known releases from industrial facilities or other documented sources.

3) **The quantity and concentration of the discharged oil or released hazardous substances is sufficient to potentially cause injury to those natural resources.** Tissue samples from Portland Harbor contain hazardous materials at concentrations that exceed concentrations associated with injury in sediment, water, fish, bird eggs, and other natural resources.

4) **Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost**. Data currently exist from the site that will be helpful and cost effective to use to further assess injury of natural resources at the site. Additional studies will be needed to better quantify injury and service losses for some resources, but these

data can be obtained at reasonable costs. The expected costs of resource restoration will exceed the costs of preparing the assessment.

5) **Response actions from Superfund remedial activities carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.** The trustees expect the remedial actions at the Portland Harbor site will, to a certain extent, minimize or eliminate exposure to hazardous substances. The full extent of such impact cannot be assessed until the remedial action is selected by EPA. However, even at this stage it is evident that the direction of the remedial investigation/feasibility study is not toward full restoration of likely injuries, and will not address lost services of resources which have been ongoing since the enactment of CERCLA. Thus, additional restoration, replacement, and rehabilitation of natural resources will ultimately be necessary.

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Table 1. Industrial facilities along the lower Willamette River and chemicals associated with discharges and releases from those facilities, and potential pathways for chemicals to reach ecological receptors. Data adapted from Table E-1 of Integral et al. (2004b).

				Potential Pathway				
Facility	**RM**	**Type of Industry**	**Chemicals of Interest**	Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
ACF Industries	4.0	Currently vacant; former lumber mill, railcar painting and repair, wood crate and pallet fabrication	PCBs, chlorinated solvents, PAHs, TPH, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, selenium, thallium, zinc	X	X	X		
Alder Creek Lumber Co., Inc.	3.0	Lumber	wood waste/debris	X				
Anderson Brothers Property	8.0	Current use unconfirmed; former trucking company hauling agricultural products, freight, and bulk oil and gas	petroleum products, solvents (toluene, mineral spirits), and paint wastes (DEQ reports)					
ARCO Bulk Terminal	5.2	Petroleum product storage and transfer	PAHs, BTEX, isopropylbenzene, n-propylbenzene, arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc	X		X	X	X
ARKEMA/ATOFINA Chemicals (formerly Penwalt Chemical, Elf Atochem)	7.5	Former chemical and pesticide manufacturing	DDT, DDD, DDE, chlorobenzene, chloroform, chlorinated solvents, chloral, 2-chlorophenol, hexavalent chromium, ammonia, monochlorobenzene	X	X	X	X	
Aventis Crop Science (Rhone-Poulenc)	7.3	Former herbicide, insecticide, fertilizer manufacturing	pesticides, herbicides, phenols, VOCs, PAHs, PCBs, arsenic, lead, mercury	X	X	X	X	
Babcock Land Co.	4.8	Log and lumber storage; rail and railroad material storage	unknown	X				
Burlington Northern Santa Fe/Portland Terminal Railroad Company and lessees below	9.5							

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway				
				Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
Northern Hub Center/Guild Lake Railyard		Switching yard, bulk petroleum storage, loading/unloading, locomotive refueling	TPH (diesel), PAHs, benzene, toluene, phenolic compounds, solvents (TCE), metals, possibly creosote	X		X	X	X
1) Kleen Blast (BNSF lessee)		Storage, packing, and distribution of copper slag media, spent abrasive grit blast	see above					
2) Eastman Chemical (current leasee)/McWhorter Technologies/McCloskey Corp.		Chemical storage	see above					
3) Gresham Transfer (BNSF lessee)		Transfer of bulk materials (soda ash, lime, coal, roofing grit, cement, talc, plastic beads, sand, cornstarch) from rail cars to tractor trailers	see above					
4) Vopak/Van Water and Rogers (BNSF lessee) subsidiary of Univar, formerly McKesson Chemical		Chemical supply; packaged and stored chemicals; distilled and recycled solvents	see above					
BNSF Willbridge Yard		Staging and loading rail tank cars with petroleum products	see above					
Cascade General (see Swan Island Shipyard)	8-9							
Christenson Oil - Plant No. 1	9.5	Bulk petroleum product storage and transfer	TPH, PAHs, BTEX, copper, lead, zinc	X			X	X
Chevron USA Asphalt Refinery	8.3	Asphalt refining	TPH, BTEX, PAHs, phenolic compounds	X		X	X	X
City of Portland BES Water Pollution Control Lab	6.0	Analytical testing laboratory; former lumber mill						
Columbia American Plating	9.0	Metal finishing and electroplating	cadmium, chromium, lead, cyanide, zinc, TCE			X		
Columbia River Sand and	4.8	Sand and gravel storage and	see Linnton Plywood					

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway: Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
Gravel - see Linnton Plywood		distribution; located on Linnton Plywood property						
Crawford Street Corp. (formerly Columbia Forge and Machine Works, TLS Steel, Lampros Steel	6.3	Metal forging, stamping, and fabrication; steel recycling and distribution	PAHs, PCBs, arsenic, cadmium, chromium, copper, lead, nickel, zinc	X		X		
Equilon Enterprises, LLC (see Texaco)		Bulk petroleum facility	TPH, BTEX, PAHs, MTBE, ethanol, lead	X				
Foss Maritime / Brix Maritime	5.7	Vessel dispatch, fueling, and maintenance	TPH, PAHs, BETX, VOCs, cadmium, chromium, lead	X		X	X	X
Fred Divine Diving & Salvage Co. (Marine Salvage Consortium, Inc.)	8.2	Storage and maintenance of boats and other marine salvage gear; vessel refueling; washing and storage of hazardous waste transportation equipment from 1989-1996	PAHs, bis(2-ethylhexyl) phthalate, bis(2-chloro-isopropyl) ether, arsenic, cadmium, copper, zinc	X			X	X
Freightliner	8.3	Truck parts manufacturing	toluene, ethylbenzene, xylenes, vinyl chloride, other solvents/thinners (TCE, PCE, DCE)			X	X	
Freightliner	8.3	Truck manufacturing	TPH, PAHs, solvents, antifreeze, phthalate esters, aryl phosphate esters, PCBs, methyl phenols, barium, cadmium, chromium, copper, lead, mercury, zinc					
Front Ave. LLP (Tube Forgings)	8.5	Pipe fitting manufacturing	TPH, VOCs, SVOCs, metals	X		X		
Front Ave. LLP (CMI/Hampton Lumber)	8.5	Lumber and construction material storage and loading	see above					
Front Ave. LLP/Glacier NW (former Lone Star NW)	8.5	Concrete batch plant	see above					
GASCO (Northwest Natural)	6.5	Liquid natural gas production; storage and distribution of creosote oil, coal tar pitch,	PAHs, phenols, naphthalene, BTEX, cyanide, arsenic, chromium, copper, lead,	X	X	X	X	X

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway: Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
		diesel, and fuel oil products; formerly oil gasification (Portland Gas & Coke Company)	nickel, zinc					
GATX/Kinder Morgan Liquid Terminals (formerly Helens Rd facility). Olympic Pipeline transfer corner of property Also Santa Fe pipeline	4	Bulk petroleum product storage and transfer	TPH, PAHs, lead, BTEX, MTBE, chlorobenzene, dichlorobenzenes		X	X	X	X
General Construction - See Transloader International								
Georgia-Pacific - Linnton Fiber Terminal	3.5	Formerly wood chip export terminal, lumber storage, sawmill, creosoting plant	TPH, PAHs; possibly arsenic and pentachlorophenol	X		X		X
Goldendale Aluminum Co.	10	Alumina off-loading, storage, and transfer	metals, possibly PAHs	X			X	X
Gould Industries	7.5	Battery manufacturing/recycling	lead					
GS Roofing Products (Genstar)	7.3	Asphalt roofing products manufacturing	fuel oil, asphalt, benzene, copper, zinc	X				X
Gunderson Inc. (former Schnitzer site, in part)	9.5	Ship dismantling, auto salvage	1,1,1-trichloroethane, PAHs, TPH, waste copper, mercury, nickel, zinc	X		X	X	
Hendren Tow Boats - See Marine Finance								
Kinder Morgan - see GATX								
Koppers Industries, Inc. (see GASCO)	7	Creosote and tar pitch distribution						
Lakeside Industries	8.5	No information on current use; former steel factory	unknown	X				
Linnton Oil Fire Training Grounds	4.0	No current use; formerly personnel training for extinguishing flammable fluid fires	TPH, PAHs, benzene, chlorinated solvents, arsenic	X				

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway				
				Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
Linnton Plywood Association (inc. Columbia R. Sand & Gravel)	4.8	Currently inactive; formerly plywood manufacture	TPH, PAH, phthalates, VOCs, PCBs, cadmium, chromium, copper, lead, zinc	X		X	X	
MarCom, Inc.	5.8	Ship repair, including machining, sandblasting, maintenance	TPH, PAHs, organotins, chlorinated solvents, PCE, arsenic, chromium, copper, lead, mercury, zinc	X		X	X	X
Marine Finance Corporation	6.0	Tug maintenance, storage, and houseboat and sailboat construction; formerly ferry landing, oil storage, and metal salvage	PAHs, TPH, VOCs, phenols, PCBs, phthalates, SVOCs, butyltins, metals	X		X	X	
McCall Oil & Great Western Chemical	7.5	Petroleum product storage and transfer	TPH, chlorinated solvents, metals	X		X	X	X
McCormick & Baxter Creosoting Company		Currently vacant; formerly wood treating facility	PAHs, pentachlorophenol, dioxins/furans, arsenic copper, chromium, cobalt, zinc	X	X	X	X	X
Mobil Oil Terminal	5.3	Petroleum storage and distribution	TPH, PAHs, BTEX, arsenic, copper, lead	X		X	X	X
Morse Brothers - see G-P Linnton								
Olympic Pipeline Co.	3.5-7.9	Petroleum products pipeline	PAHs, BTEX, TPH				X	X
St. Helens Road Petroleum Contamination		Soil and groundwater contamination; may be related to Olympic Pipeline leaks.	diesel, heavy oil, gasoline, PAHs, BTEX			X		
Oregon Steel Mills - Rivergate	3	Steel mill; steel plate and coil manufacturing	TPH, PCBs, VOCs, and metals			X	X	
Owens Corning - Linnton	4.2	Asphalt and roofing manufacturing; formerly wood treating and lumber-related uses	TPH, PAHs, arsenic, PCP					X
Portland Gas Manufacturing	12	Currently inactive; formerly coal/gas manufacturing	contaminants associated with other coal gas facilities (PAHs, TPH, BTEX, heavy				X	X

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway: Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
			metals, SVOCs)					
Portland General Electric - Harborton Substn.	3.5	Electrical substation	TPH, PAHs, unconfirmed chemicals: PCBs, BTEX, phthalates, PCP, herbicides			X		
Portland Shipyard - Swan Island	9	Ship repair, dry dock	PAHs, TPH, PCBs, VOCs, chlorinated solvents, metals, organotins	X	X	X	X	X
Port of Portland-Terminal 1 North	10.5	Multiple lessees: aluminum window assembly; warehousing of building products; service dock for tour boats; paper product, lumber and wood products storage	TPH	X		X	X	X
Port of Portland-Terminal 1 South	10.5	Multiple lessees: refractory brick manufacture, patrol boat moorage, laminated wood products manufacturing	TPH, PAHs, phthalates, metals, VOCs, herbicides, pesticides, PCBs, organotins	X		X	X	X
Port of Portland-Terminal 2	10	Cargo (steel, lumber, plywood, and pulp) and container shipping and handling	TPH, PCBs	X				X
Port of Portland-Terminal 4 - Slip 3	4.7	Marine shipping and handling	TPH, PAHs, BTEX	X		X	X	X
Port of Portland Terminal 4 - Toyota Motor Sales	5	Vehicle processing, shipping and unloading of automobiles	PAHs	X				
Port of Portland-Terminal 4 - Slip 1	4.3	Shipping terminal for grain, breakbulk cargoes, logs, minerals, liquid bulks	SVOCs, PAHs, cadmium, chromium, lead, mercury, zinc	X				X
Port of Portland-Terminal 5 (Blue Lagoon)	1	Currently grain terminal, bulk mineral shipping, and fiber optic submarine cable manufacture; formerly Oregon Steel Mill slag disposal site	iron and manganese in groundwater; metals and PCBs at low levels	X				
Port/Shaver Oil Sump	2.5	No current use; formerly oily bilge wastewater discharge into ponds	TPHs	X		X	X	X

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway: Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
RK Storage & Warehousing	4.5	Current use unknown; formerly log and lumber storage, also sand blast grit; West Coast Adhesives manufactured phenol formaldehyde glues on northern portion of property	TPH, formaldehyde, phenolics, phthalate esters	X		X	X	
Ross Island	15.4	Disposal of contaminated dredged material	PCBs, PAHs, petroleum, metals, pesticides, herbicides					
Santa Fe Pipelines (purchased by Kinder-Morgan)	7	Fuel pipeline	TPH, PAHs, BTEX	X			X	
Schnitzer Investment Corp. (North Burgard Site)	3.7	Multiple lessees						
Schnitzer Steel	3.7	Ship dismantling, scrap metal recycling, including automobiles	metals, PAHs, PCBs, TPHs, solvents	X		X		
Boydston Metal Works	3.7	Fabrication and painting of automobile transport trailers	metals, TPH, solvents, PCBs	X		X		
Cal Bag Metals	3.7	Staging area for recycling non-ferrous metals	diesel fuel storage on site	X			X	X
Morgan	3.7	Storage and distribution of urea and wood products for overseas shipment; historically used for log storage	fuel stored on site	X		X	X	
Northwest Pipe and Casing	3.7	Pipe manufacturing and coating	PCBs, oil, gasoline, PAHs, solvents	X		X		
Portland Blast Media	3.7	Sandblasting, manufacture of protective coatings for recycling containers	metals, solvents, paints	X		X	X	X
Portland Container Repair	3.7	Storage and maintenance of intermodal containers and chassis	oil, solvents, fuel	X		X		
Premier Edible Oils	3.7	Food grade product storage	TPH, PAHs, BTEX, chlorinated solvents	X		X		
Romar Transportation Systems	3.7	Warehousing	PCBs	X			X	
Ryerson Steel	3.7	Manufacture and distribution of	no data	X		X		

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway				
				Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
		structural steel products						
Jefferson Smurfit	3.7	Unknown	unknown	X				
Western Machine Works	3.7	Metal machining, fabrication for industrial parts (primarily pulp and paper industry)	TPH, PAHs, metals, solvents, waste oils and paints	X		X	X	X
Schnitzer-Doane Lake (Air Liquide American Corp.)		Acetylene manufacturing, disposal of auto shredder waste from other Schnitzer facilities.	calcium hydroxide, lead, arsenic, TPH, PCBs, chlorinated solvents (TCA, acetone, MEK, 1,1-DCA)	X	X	X	X	
Schnitzer-Moody Ave. site		Currently vacant; formerly ship dismantling, auto shredding, metals salvaging, process, pesticide manufacturing	DDTs, hexachloropentadiene, PCBs, TCE, acetone and other solvents, metals, PAHs	X		X	X	
Schnitzer-Kittridge site	8.5	No information						
Schnitzer-near NW Yeon (formerly Chase Bag, Great Western Chemical and Willard Storage Battery)		Former multi-wall bag construction, hardware wholesale, chemical manufacture, storage battery manufacture	chlorinated solvents (possibly PCE DNAPL), metals (particularly lead)	X		X	X	X
Shaver Transportation Co.	8.5	Tug dispatch, refueling and maintenance	materials handled on site include diesel fuel, paints, oils, solvents	X			X	X
South Rivergate Industrial Park - see Terminal 5, Oregon Steel Mills	<3.5							
Sulzer Bingham Pumps		Pump manufacturing	petroleum products, chlorinated solvents, including BTEX, zinc	X		X	X	
Texaco Portland Bulk Pipeline		Petroleum product transfer	TPH, PAHs, BTEX, MTBE, lead	X		X	X	
Texaco Portland Bulk Terminal (see Equilon)								
Time Oil-Northwest Terminal	3.8	Former bulk petroleum storage facility	TPH, BTEX, PAHs, PCP and other chlorinated phenols, dioxins/furans,	X		X	X	X

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway				
				Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
			metals, PCBs					
Time Oil-Linnton Terminal	5.5	Bulk petroleum storage facility	TPH (gasoline), PAHs, BTEX				X	X
Triangle Park LLC	7.5	Currently inactive; former lumber mill, petroleum pipeline, fuel storage, marine construction, hazardous waste storage from 1908 to 1984	metals, PCBs, chlorinated solvents, PAHs, pentachlorophenol, possibly dioxins	X		X		
Transloader Intl. Co. (aka: Marine Finance Corp; Hendron Tow Boat	6	Current use unknown; formerly log storage; no other information.	no upland data, sediments do not appear to be impacted					
Trumbull Asphalt Plant		Asphalt manufacturing	petroleum hydrocarbons, diesel fuel, asphalt distillate	X		X	X	X
U.S. Coast Guard - Portland Station	8.3	Docking, servicing and refueling of small boats; limited sandblasting	TPH, PAHs, metals (including mercury, tributylin), possibly solvents, herbicides	X			X	X
U.S. ACOE- Portland Moorings	6.2	Maintenance and repair of Corps vessels	TPH, PAHs, metals including TBT	X			X	X
Union Pacific Railroad-Albina Yard	10	Railroad yard, rail car painting and maintenance, locomotive refueling	TPH, PAHs, other SVOCs, VOCs, metals, butyltins, PCBs	X		X	X	
Union Pacific Railroad pipeline and St. Johns tank farm		Currently vacant; former bulk fuel facility; pipeline extends to Terminal 4 - Slip 3	TPH, PAHs, BTEX	X		X	X	X
Wacker Siltronics Corp.	7	Semiconductor manufacturing; site has been impacted by past disposal practices at GASCO and Olympic Pipeline that transits the site	PAHs, phenols, chlorinated solvents, BTEX, metals		X	X	X	X
Willamette Cove/St. Johns Riverfront	7	No current use; proposed greenbelt; formerly various industrial, including wood and lumber-related activities, dry dock, coal off-loading	TPH, PAHs, TBT, PCP, PCBs, solvents, metals	X		X	X	X

Facility	RM	Type of Industry	Chemicals of Interest	Potential Pathway				
				Storm-water	Waste-water	Ground-water	Spills/ Disposal	Product Handling/ Transfer
Willbridge Bulk Fuel Area (includes facilities listed below). Olympic Pipeline and Santa Fe Pipeline also cross facility.	7.8	Petroleum product storage and distribution; includes three separately-owned parcels	TPHs, PAHs, BTEX, chlorinated and non-chlorinated solvents, DDT	X		X	X	X
1) Kinder Morgan (formerly GATX, formerly Shell)		Historically, pesticide, nonchlorinated solvents, ammonia, ethylene glycol, asphalt products storage at GATX	see above					
2) TOSCO (formerly UnoCal)		Petroleum product storage and distribution	see above					
3) Chevron		Historically, naphtha solvents	see above					
Zidell	14	Ship dismantling, barge construction, tube forging	metals, PCBs, TPH, chlorinated solvents, TBTs, asbestos				X	X

APPENDIX 1

General Notice of Liability Letter Recipients

Portland Harbor Notice Letter Recipients

April 28, 2006

Name of PRP	**Recipient Contact Information**	**Facility Address**
ExxonMobil Refining & Supply Company	Brian J. Harrison, Major Projects Manager Global Remediation ExxonMobil Refining & Supply Company 607 ExxonMobil Road Billings, MT 59101	9420 NW St Helens Road Portland, OR 97231
Northwest Pipe Company	Brian W. Dunham, President Northwest Pipe Company 200 SW Market Street, Suite 1800 Portland, OR 97201	12005 N. Burgard Way Portland, OR 97203
Schnitzer Investment Corp.	Kenneth M. Novack, President Schnitzer Investment Corp. 3200 NW Yeon Avenue Portland, OR 97296-0047	12005 N. Burgard Road Portland, OR 97203 6529 NW Front Avenue Portland, OR 97210 9333 N. Time Oil Road Portland, OR 97227 9449 N. Burgard Way Portland, OR 97203 3720 NW Yeon Avenue Portland, OR 97210 4012-4350 NW Front Avenue Portland, OR 97210
Calbag Metals Company	Mr. Chuck Gleason, Director of Operations Calbag Metals Company 2495 NW Nicolai Street P.O. Box 10067 Portland, OR 97296-0067	4927 NW Front Ave Portland, OR 12005 N. Burgard Rd Portland, OR 2495/2550 N.W. Nicolai St. Portland, OR
ACF Industries, LLC	Roger Wynkopp, President ACF Industries, LLC 101 Clark Street St. Charles, MO 83301	12160 NW St. Helens Road Portland, OR 97321
ARCO in care of BP West Coast Products, LLC	Mr. Ralph J. Moran, Environmental Portfolio Manager Atlantic Richfield Company c/o BP West Coast Products 6 Centerpoint Drive, Suite 727 La Palma, CA 90623	9930 NW St. Helens Road Portland, OR 97231

Name of PRP	Recipient Contact Information	Facility Address
1) Brix Maritime Towing Co. 2) Foss Maritime Co.	Steve T. Scalzo, President Brix Maritime Towing Company, Inc. 660 W. Ewing Street Seattle, WA 98119 Frank Williamson, President Foss Maritime Company 660 W. Ewing Street Seattle, WA 98119	9030 NW St. Helens Road Portland, OR 97231
Christenson Oil	John Horstman Vice President of Operations Christenson Oil 3865 N.W. St. Helens Road Portland, OR 97217	3821 NW St. Helens Road Portland, OR 97231
Crawford Street Corporation	Robert W. Philip, President Crawford Street Corporation 3200 NW Yeon Ave Portland, OR 97296-0047	8424, 8504 and 8524 N. Crawford Street Portland, OR 97203
Front Avenue Corporation	Jay N. Zidell, President Front Avenue Corporation 3121 SW Moody Avenue Portland, OR 97239	4950, 5034 and 5200 NW Front Avenue Portland, OR
Gould Electronics	James F. Cronmiller, Director Corporate Environmental Affairs Gould Electronics, Inc. 35129 Curtis Blvd. Eastlake, OH 44095	5909 NW 61st Avenue Portland, OR 97210
CertainTeed Corporation	Lauren Alterman, Senior Counsel CertainTeed Corporation 750 East Swedesford Road Valley Forge, PA 19482	6350/6080 NW Front Avenue Portland, OR 97210
Hendren Tow-Boat Co., Inc.	Floyd G. Hendren Hendren Tow-Boat Co., Inc. 12751 NW Springville Road Portland, OR 97229	8444 NW St. Helens Road Portland, OR
Beazer East, Inc./Beazer Materials & Services, Inc.	Jill M. Blundon, President Beazer East, Inc./Beazer Materials & Services, Inc. 1 Oxford Centre #3000 Pittsburgh, PA 15219	10350 Time Oil Road Portland, OR 97203
Tube Forgings of America, Inc.	Jay N. Zidell Tube Forgings of America, Inc. 3121 SW Moody Avenue Portland, OR 97239	5200 NW Front Avenue Portland, OR
Shell Oil Company	Mr. William E. Platt III, Esq. Senior Manager, Environmental Claims Shell Oil Company 910 Louisiana, Suite 685 Houston, TX 77002	5880 NW St Helens Portland, OR

Name of PRP	**Recipient Contact Information**	**Facility Address**
Shaver Transportation Company	Steve R. Shaver, President Shaver Transportation Company 4900 NW Front Avenue Portland, OR 97210	14400 N. Rivergate Blvd Portland, OR 4900 NW Front Avenue Portland, OR 97210
McCall Oil and Chemical Corporation	James Charriere, President McCall Oil and Chemical Corporation 5480 N Front Street Portland, OR 97210	5480, 5540-5724 NW Front Street Portland, OR 97210
Mar Com Holdings, LLC	Tom R. Maples Mar Com Holdings, LLC 14815 NE 186th Street Brush Prairie, WA 98606	8940/9070 N. Bradford Street Portland, OR 97203
1) Langley-St. Johns Partnership 2) Brix Dearmond, LLC	Peter J. Brix Langley-St. Johns Partnership 14020 SE Johnson Road #201 Milwaukee, OR 97269 Peter J. Brix Brix Dearmond, LLC 14020 SE Johnson Road #201 Milwaukee, OR 97269	8940 N. Bradford Street Portland, OR 97203
Air Liquide America Corporation	Kevin Feeney Vice President and General Counsel Air Liquide America Corporation 2700 Post Oak Boulevard Suite 1800 Houston, TX 77056	6529 NW Front Avenue Portland, OR 97210
FMC Corporation	Andrea E. Utecht, Vice President, General Counsel and Secretary FMC Corporation 1735 Market Street Philadelphia, PA 19103 John F. Stillman, Environmental Counsel FMC Corporation 1735 Market Street Philadelphia, PA 19103	4012-4350 NW Front Ave. Portland, OR 97210 4850 NW Front Avenue Portland, OR 97210
NL Industries, Inc.	Robert D. Graham, Vice President, Secretary and General Counsel NL Industries, Inc. 5430 LBJ Freeway, Suite 1200 Dallas, TX 75240-2697	5909 NW 61st Avenue Portland, OR 97210