SUMMARY OF EXISTING INFORMATION AND IDENTIFICATION OF DATA GAPS TECHNICAL MEMORANDUM

Oakland Bay
Shelton, Washington

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
Southwest Regional Office

May 2008

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Toxics Cleanup Program
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Abbreviations and Acronyms

AST	aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
BTEX	benzene, toluene, ethylbenzene, and xylenes
cfu	colony forming units
CSL	cleanup screening level
COPC	constituents of potential concern
CWA	Clean Water Act
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DNR	Washington Department of Natural Resources
Ecology	Washington State Department of Ecology
HPAH	high molecular weight polycyclic aromatic hydrocarbon
kg	kilogram
L	liter
LPAH	low molecular weight polycyclic aromatic hydrocarbon
µg	microgram
mg	milligram
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OC	organic carbon normalized
PAH	polycyclic aromatic hydrocarbon
PBT	persistent, bioaccumulative, toxic chemical
PCB	polychlorinated biphenyl
ppb	parts per billion

ppm	parts per million
ppt	parts per trillion
PCP	pentachlorophenol
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SR	State Route
SVOC	semi-volatile organic compound
SWRO	Southwest Regional Office
TBT	tributyltin
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TDS	total dissolved solids
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UV	ultraviolet
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington Department of Health
WSDOT	Washington State Department of Transportation
WWTP	wastewater treatment plant

1.0 Introduction

Oakland Bay is one of seven bays identified as a priority for environmental restoration by the Washington State Department of Ecology (Ecology) as part of the Toxics Cleanup Program's Puget Sound Initiative. Ecology has identified Oakland Bay for focused investigation efforts, sediment cleanup if needed, and source control actions. Earlier environmental investigations throughout the bay, including the Shelton Harbor area, have indicated that chemicals have been generated by historical and current industrial and commercial activities around the bay. Previous sediment sampling in the area has indicated that chemicals in bay sediments and biota may pose a risk to the environment, with data that exceed the Sediments Management Standards (SMS), Washington Administrative Code (WAC) Chapter 173-204, and other established thresholds of environmental concern (USEPA 1998, Long & Morgan 1991, Long et al. 1995).

Ecology is directing sediment investigations, a human health and ecological risk assessment, and a sediment transport study of the bay focusing on the marine environment associated with terrestrial and aquatic sources. This study focuses on contaminated sediment and their toxic effects on the marine environment, not on water quality issues (including bacteria such as fecal coliform). This Summary of Existing Information and Identification of Data Gaps report has been prepared to support the development of a Sampling and Analysis Plan (SAP) for field investigations of the bay. The purpose of this report is to compile readily available information concerning sediment characterization (i.e., data from potential sources and activities relating to chemicals in sediments, results from earlier marine environmental investigations, etc.) and to identify data gaps that will be addressed by the SAP.

Information for the report has been gathered from the following sources:

- Relevant reference literature on earlier investigations
  - Reconnaissance Survey of Inner Shelton Harbor Sediments (Ecology 2000)
  - Oakland Bay TMDL Quarterly Progress Report (November 2004 through August 2005) (WDOH 2005)
  - Oakland Bay (Dye and Modeling) Study (Ecology 2004a)
  - Quality Assurance Project Plan – Fecal Coliform Bacteria TMDL for Oakland Bay-Hammersley Inlet and Tributaries (Ecology 2004b).
- Regulatory agency database search report obtained using Environmental Data Resources, Inc. (EDR), a commercial database service that searches U.S. Environmental Protection Agency (USEPA) and Ecology records

within a three-mile radius centered near Front Street and E. Railroad Avenue (EDR 2008);

- Ecology Southwest Regional Office (SWRO) Central Records - relevant Ecology site file information on sites with reported releases of hazardous materials as identified in the EDR database search report (file information dated from 1995 to the present);

- Ecology Environmental Information Management (EIM) Database System (http://apps.ecy.wa.gov/eimreporting/search.asp) – relevant sediment quality studies conducted in Shelton Harbor and Oakland Bay as identified in the EIM database including:

  - 1997-1999 PSAMPNOA – Puget Sound Assessment and Monitoring Program and the National Oceanic and Atmospheric Administration (NOAA) National Status and Trends Program.

  - 1989-1995 PSAMP HP – Puget Sound Assessment and Monitoring Program's historical sediment monitoring.

  - 1992 DNRREC92 – Washington Department of Natural Resources (DNR) Aquatic Lands Sediment Quality Reconnaissance.

- Washington Southwest Regional State Archives – relevant Ecology site file information on sites with reported releases of hazardous materials (file information dated from late 1960s to 1994);

- Ecology Facility/Site Identification System: http://apps.ecy.wa.gov/website/facsite/viewer.htm

- USEPA Envirofacts Warehouse: http://www.epa.gov/enviro/index.html

- Ecology Online Publication Archives: http://www.ecy.wa.gov/pubs.shtm

- Ecology Online Shoreline Aerial Photos: http://apps.ecy.wa.gov/shorephotos/index.html

- Washington State Department of Health (WDOH)

  - Shellfish Safety Information: http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1

  - 2003 Shoreline Survey of Oakland Bay (Berbells 2003).

- Washington Department of Fish and Wildlife (WDFW)
  - Steve Cuinnell (Fish Program) – fish tissue sampling studies coordinator (Cuinnell 2008)
  - Jim West (Fish Program) – fish tissue analysis (West 2008).
- The City of Shelton Public Works Department (City of Shelton 2008)
  - Storm Water System Map: http://www.ci.shelton.wa.us/documents/STORMMAP_000.pdf
  - Sewer System Map: http://www.ci.shelton.wa.us/documents/SewerMap_000.pdf.
- Historical Land Use Resources:
  - Property characteristics and ownership information obtained from the Mason County Assessor online database (Mason County 2008);
  - Sanborn Fire Insurance maps with coverage of the City of Shelton in 1910, 1923, 1929, 1944, and 1961 (UW 2008a);
  - Historical parcel maps of Mason County with coverage in 1925, 1935, 1941, 1955, 1969, and 1988 (UW 2008b)
  - Historical aerial photographs with coverage from the early 1940s through the early 2000s (UW 2008c);
  - Historical topographic maps with coverage in 1952 and 1981 (UW 2008d);
  - Historical nautical charts with coverage in 1905, 1934, 1938, 1947, 1957, 1968, 1969, 1970, 1973, 1985, 1989, 1991-1993, 1996, 1998, and 1999 (NOAA 2008);
  - Telephone directory and Polk's city directory of Shelton, Washington in 5-year intervals from 1947 to 1996 (UW 2008e);
  - Shelton: the first century plus ten (Thomas 1996);
  - Mason County Profile 2007 – a supplement to the Shelton-Mason County Journal (MCHS 2008)

- Mason County – Thumbnail History; Essay No. 7730 (HistoryLink.org 2008);

- Historical real property tax assessment records reviewed from the Washington Southwest Regional State Archives in Olympia, Washington.

2.0 Oakland Bay and Shelton Harbor

2.1. Study Area Description

Oakland Bay is a shallow estuary approximately 4 miles long and 3/4 of a mile wide, with water depths ranging between 10 and 35 feet (Figure 2-1). A large area of the foreshore (intertidal area between mean low water and mean high water) is exposed during low tides at the north end of the bay. This intertidal zone is predominately mud flats with narrow deep channels. Due to the restrictive nature of Hammersley Inlet, a long narrow waterway linking the bay to the Puget Sound Basin, the water in Oakland Bay has high refluxing, low flushing, and high retention rates (Ecology 2004a). Nine major creeks discharge into the bay: Deer, Cranberry, Malaney, Uncle John, Campbell, Johns, Shelton, and Goldsborough. The waters of Shelton Harbor and the northern portions of Oakland Bay are currently listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act (CWA) because of fecal coliform bacteria levels (Ecology 2004b).

2.2. Study Area History

Since the mid-1800s, a number of timber industries dominated the Shelton Harbor waterfront, including sawmills and plywood manufacturing, pulp and paper production, and insulation board and fiber board manufacturing. From the mid-1800s to the early 1930s, three sawmills operated along the Shelton waterfront (one operated by the Simpson Timber Company); a shingle mill also operated at Eagle Point (later changed to a plywood plant). A bulkhead was constructed in the mid-1920s to expand operations area along the shoreline. In the early 1940s, Simpson acquired the remaining two sawmills and the shingle mill, and redeveloped the Shelton waterfront into a large sawmill and plywood manufacturing complex that included a fiber and insulating board plant. Simpson installed a second bulkhead during the expansion of their waterfront plant between the early 1940s through the 1960s (Figure 2-2). In 1974, Simpson shifted shingle mill operations at Eagle Point (Olympic Plywood) to the north portion of Simpson waterfront plant.

From 1926 to 1957, a pulp and paper sulfite mill identified as the Rayonier Pulp Mill, operated on the south side of Shelton Harbor. Wood chips used to produce pulp were either supplied by the adjacent sawmills or brought in by barges or trucks. Sulfite waste liquor was a by-product generated during the pulping process. Initially, the liquor was released into the harbor during outgoing tides or conveyed through a five-mile long pipeline that ran east along Hammersley Inlet to be discharged at Mill Creek. Environmental impacts to shellfish in the bay and inlet occurred soon after release of the pulp mill liquor. Rayonier then redirected the waste to Goose Lake, located three miles inland to the west (early 1930s to the mid-1940s), or evaporated the liquor into a thick syrup that was then sprayed on roads in Shelton for dust control (1934 to the late 1930s). In 1945, Rayonier constructed a facility located on the hillside above the pulp mill

to dispose of waste liquor by burning it. The pulp mill and burn plant continued to operate until both facilities were shut down in 1957; both facilities were demolished by the mid-1960s.

From 1936 to 1995, the ITT Rayonier central chemical laboratory operated west of and adjacent to the Rayonier pulp mill to support production of rayon fibers and other specialty wood products, including cellophane, cellulose acetate, nitrocellulose used for explosives, and rayon tire cords (Figure 2-2).

The Manke Lumber Company purchased the pulp mill property in the 1960s and converted it into a sorting yard for logs brought in by trucks, which were then shipped out in rafts to Tacoma for processing (Figure 2-2).

Pilings had been installed in the harbor to support three over-water railroad spurs used for unloading logs from trains directly into the water; other pilings were installed across the harbor for stabilizing log rafts. Logs were stored in the water prior to processing. By the early 1970s, Simpson abandoned most log boom storage, and developed a dry log sort yard located inland about three miles west of Shelton. Some log rafting operations continued with log truck unloading shifted to the north end of the harbor next to the vessel haul-out and marine railway facility (Figure 2-2).

A bulk fuel storage marine facility operated at the north end of Shelton Harbor (Standard Oil/Evergreen Fuel) from the early 1900s to late 2005. In addition to Evergreen Fuel, three other bulk fuel storage facilities also operated about a half mile northeast of Shelton along the west shore of Oakland Bay (Union Oil, Shell, and ARCO), from the early 1930s to the mid-1980s.

Other businesses that developed within the city of Shelton west of and adjacent to the Simpson plant since the late 1920s include gasoline service stations; automotive, truck, and heavy lumber equipment maintenance and repair services; dry cleaning facilities; and other urban businesses.

The Shelton Yacht Club marina has operated at the northeast corner of the inner harbor since 1974.

The Squaxin Island Tribe has harvested shellfish from Oakland Bay for several centuries. Commercial shellfish harvesting has been important since the 1880s (Kenny 2007). Pollution associated with sulfite waste liquor discharged by the Rayonier pulp mill is believed to have lead to declining commercial oyster production by the mid-1940s (Shaffer 2003). Re-populating with oysters and other shellfish in the northern portions of Oakland Bay, including Chapman Cove, and developing a second-generation of shellfish production began in the late 1960s. Over the last 40 years, water quality impacts to Oakland Bay appear to have shifted from industrial effluent to non-point source pollution, including low dissolved oxygen (DO), chlorine from sewage outfalls, sedimentation and siltation, and herbicides, which may have contributed to recent closures of shellfish harvesting in portions of the bay (Shaffer 2003). Fecal coliform contamination from excessive inflow and infiltration to the city's aging sewer and stormwater collection systems, onsite septic systems, and surface water runoff from small farms, may also have contributed to recent closures of shellfish harvesting in portions of the bay.

Figure 2-1. Vicinity map of Oakland Bay in Mason County, Washington.

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Figure 2-2. Site map of Shelton Harbor, Shelton, Washington.

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As of 2007, the City of Shelton has an estimated population of 8,895 people (MRSC 2008). Shelton Harbor and Oakland Bay have received discharges from the city sewer and stormwater collection systems, wastewater treatment plant (WWTP) discharge outfalls, urban and industrial stormwater outfalls associated with timber industries, septic systems in various stages of maintenance outside Shelton City limits, and non-point source runoff from stormwater (City of Shelton 2008, Brown & Caldwell 1988, Michaud 1988). Organic wastes remaining in sediments in the cove from the sources discussed above may be contributing to low levels of DO, in addition to the natural oceanographic characteristics of the bay. The first sewer lines were installed in downtown Shelton in the early 1900s using vitrified clay pipe intentionally left open to drain away groundwater and rainwater induced infiltration. In 1950, the city constructed a WWTP on Pine Street next to the railroad embankment north of the Simpson plant to replace the old sewage disposal pump station that stood on Front Street near Goldsborough Creek (Thomas 1996). This plant provided primary treatment, including grit removal, sedimentation, single-stage digestion, and chlorination (Shelton-Mason County Journal 1950) and discharged into Oakland Bay. In 1979, the Pine Street plant was replaced by a secondary WWTP constructed at Eagle Point that discharges effluent through a 1,250-foot long outfall extending into Hammersley Inlet. The end of the discharge pipe is positioned approximately 45 feet below mean sea level to ensure dispersal of the effluent.

Land use throughout the study area adjacent to Oakland Bay consists of rural residential, commercial forest, and agricultural, with some industrial and commercial development along the west and south sides of the bay. Approximately 100 small farms are located within the watershed (Berbells 2003). Septic systems are used to treat waste throughout most of the study area.

2.3. Constituents of Potential Concern (COPCs) in Marine Sediments

COPCs to Oakland Bay sediments and biota were identified based on known chemical associations with historic and current land uses and activities, as well as from earlier sediment investigations conducted within the study area. The following chemicals are identified as COPCs, some of which have Washington State SMS criteria:

- Polychlorinated dibenzo-p-dioxins (dioxins) and polychlorinated dibenzofurans (furans)
- Polychlorinated biphenyls (PCBs)
- Chlorinated pesticides
- Semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs), phenols, pentachlorophenol (PCP), cresols, and phthalates

- Petroleum products (gasoline-, diesel-, and lube oil-range hydrocarbons)
- Tributylin (TBT)
- Heavy metals
- Wood waste (resin acids, guaiacols, ammonia, sulfides).

Many of these chemicals are known to be persistent in the environment, potentially bioaccumulative, and toxic (PBTs), including dioxins/furans, PCBs, and PAHs. The following sections describe the type of processes that produce each of the COPCs listed above.

2.3.1. Dioxins and Furans

Dioxins and furans are byproducts produced from the combustion of organic compounds with chloride present and from pulp bleaching processes. Combustion sources include the incineration of municipal and medical wastes, boilers and industrial furnaces, diesel heavy-duty trucks, sintering plants, automobiles using leaded gasoline, oil-fired utilities, lightweight aggregate kilns that combust hazardous waste, petroleum refining, crematoria, and drum reclamation (USEPA 2006). Dioxin source assessments conducted in Washington indicate that incinerators, hog fuel (wood waste) boilers, bleached pulp and paper mills, cement kilns, kraft black liquor boilers, tire combustion, and sewage sludge incineration are other potential sources of dioxin production (Ecology 1998). Burning salt-laden hog fuel (wood waste from logs rafted on saltwater) has been implicated in the production of dioxins (Ecology 1998). Because PCP is typically contaminated with low concentrations of dioxins, PCP wood treatment facilities are also a concern (Ecology 1998).

2.3.2. PCBs

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs were domestically manufactured from 1929 until their manufacture was banned in 1979. They have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including:

- Transformers and capacitors
- Other electrical equipment including voltage regulators, switches, reclosers, bushings, and electromagnets
- Oil used in motors and hydraulic systems
- Old electrical devices or appliances containing PCB capacitors

- Fluorescent light ballasts
- Cable insulation
- Thermal insulation material including fiberglass, felt, foam, and cork
- Adhesives and tapes
- Oil-based paint
- Caulking
- Plastics
- Carbonless copy paper

PCBs have been demonstrated to cause cancer, as well as a variety of other adverse health effects on the immune system, reproductive system, nervous system, and endocrine system (ATSDR 2001c).

2.3.3. Chlorinated Pesticides

Organochlorine insecticides were commonly used in the past, but many have been removed from the market due to their health and environmental effects and their persistence. Dichloro-diphenyl-trichloroethane (DDT) is an organochlorine insecticide once widely used in the U.S. before being banned in 1972. Dichlordiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD) are breakdown byproducts of DDT that contaminate commercial DDT preparations. All three compounds are highly persistent and have similar chemical and physical properties; these compounds together are known as total DDT. DDT, DDE and DDD magnify through the food chain, with apex predators such as raptors having a higher concentration of these chemicals stored mainly in body fat than in other animals sharing the same environment. DDT is also highly toxic to aquatic species, including sea shrimp, crustaceans, and many species of fish. In addition to acute toxic effects, DDT may bioaccumulate significantly in fish and aquatic species, leading to long-term exposure to high concentrations (ATSDR 2002).

2.3.4. SVOCs

SVOCs are a class of compounds that include PAHs, phenols, PCP, creosols, and phthalates.

PAHs are a group of over 100 chemicals that primarily form by incomplete combustion of carbon-containing fuels, including wood, coal, and gas, garbage, and other organic substances. PAHs are usually found as a mixture consisting of two or more chemicals. They are found in coal tar, crude oil, creosote, roofing tar, and products used to make dyes, plastics, and pesticides (ATSDR 1995c).

Phenols are a class of widely distributed chemicals that are both manufactured and occur naturally. Phenols are used primarily in the production of phenolic resins, the manufacture of synthetic fibers, disinfectants, antiseptic products, algaecides, and fungicides (ATSDR 2006b).

PCP is a manufactured phenolic chemical that does not occur naturally. It has been widely used as a pesticide and wood preservative and is still used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings (ATSDR 2001b). Creosols are methylphenols and are one of the chemicals that, along with PAHs, are in creosote, which is created from the high temperature treatment of wood, coal, or from the resin of the creosote bush. Creosote has been used as a wood preservative in marine lumber applications (e.g., dolphins, pilings) for over 100 years. Creosote-treated pilings and remnants have been identified as a continuous source of marine pollution, as they leach creosols and PAHs to marine waters and sediments (MRC 2008).

Phthalates are widely-distributed synthetic compounds, primarily used as a plasticizer in the production of flexible polyvinyl chloride (PVC) products, in ethyl cellulose and nitrocellulose lacquers, resin solvent, paper coatings, adhesives, as a solvent and fixative in perfumes, and in insecticides (ATSDR 2001a).

2.3.5. Petroleum Products

Petroleum products, such as gasoline, fuel oil (including diesel fuel), and mineral-based crankcase motor oil, are distilled from crude oil and are refined to meet specifications for each use.

Gasoline is a mixture of over 150 compounds, including benzene, toluene, ethyl benzene, and xylenes. Organic lead compounds were added to gasoline as anti-knock agents prior to the mid-1980s. Gasoline is used exclusively for internal combustion engines in automobiles and other vehicles (ATSDR 1995b).

Fuel oils are mixtures of aliphatic and aromatic petroleum hydrocarbons, and may also contain small amounts of nitrogen, sulfur, and other elements as additives. Six types of fuel oil include:

- Fuel oil No. 1 – kerosene, range oil, coal oil, and jet fuel
- Fuel oil No. 1-D – diesel fuel
- Fuel oil No. 2 – home heating oil, No. 2 burner oil, and gas oil
- Fuel oil No. 2-D – No. 2 diesel
- Fuel oil No. 4 – heavy residual fuel oil, marine diesel fuel, and diesel fuel oil No. 4
- Fuel oil Nos. 5 and 6 – Bunker C fuel oil

Fuel oils have many commercial and military uses, including jet fuel; home heating oil; diesel fuel for diesel engines in trucks and heavy machinery; as a vehicle for insecticides and fungicides; space and water heating; road oils; pipeline pumping; and gas compression (ATSDR 1995a).

Mineral-based crankcase motor oil consists of aliphatic and aromatic hydrocarbons, or PAHs, that are distilled from crude oil. Various additives may be included in motor oil to improve performance. Metals such as aluminum, chromium, copper, iron, lead, manganese, nickel, silicon, and tin, are found in used motor oil derived from engine parts as they wear down. Motor oil is used as fuel in boat engines, furnaces and oil burners for domestic and industrial power plants, industrial steam boilers, municipal incinerators, and rotary cement kilns (ATSDR 1997).

2.3.6. Tributyltin

TBT is a highly toxic compound used as an anti-fouling agent in marine paints applied to the bottom of boats and can be released to marine sediments during the practice of scraping vessel hulls. NOAA's Mussel Watch Program, a long-term status and trends program that monitors contaminants in sediments and mussels, includes TBT as an important monitored contaminant (NOAA 2007).

2.3.7. Metals

Metals such as inorganic arsenic, cadmium, chromium, copper, lead, mercury and zinc occur naturally from geologic processes, and are also used extensively in manmade products. Common sources of these metals from processes include:

- Arsenic – wood preservative (chromated copper arsenate or CCA) in utility poles, building lumber, and pilings; herbicides and pesticides (ATSDR 2007a; Lewis 1997)

- Cadmium – nickel-cadmium batteries, pigments used in plastics, ceramics, and glasses; stabilizers for PVC; coatings on steel and some nonferrous metals; components in various specialized alloys; and fungicides (ATSDR 1999; Lewis 1997)

- Chromium – alloying and plating element on metal and plastic substrates for corrosion resistance including high temperature industrial furnaces and cooling towers; pigments; and wood preservative (ATSDR 2000; Lewis 1997)

- Copper – electroplated protective coatings; anti-fouling paints; car brake dust; incineration; chemical and pharmaceutical machinery; corrosive-resistant piping; insecticides; and electrical wiring, plumbing, heating, roofing, and building construction materials (ATSDR 2004b; Lewis 1997)

- Lead – lead-acid batteries; gasoline additive; lead alloys used in bearings, brass and bronze, and some solders; radiation shielding; cable covering; chemical resistant linings; ammunition; and pigments in glass making, ceramic glazes, plastic stabilizers, caulk, and paints (ATSDR 2007b; Lewis 1997)

- Mercury – cathodes for production of chlorine and caustic soda; catalysts for manufacture of certain polyurethanes; electrical apparatus; instruments (thermometers, barometers, etc.); amalgam; mercury vapor lamps; mirror coating; boilers; and fungicide in paint (banned since 1990) (ATSDR 1999d; Lewis 1997)

- Zinc – alloys; galvanizing iron and other metals; white pigment; fertilizers and animal feed as trace element and disease-control agent; manufacture of rayon (as a crenulating agent), in paper bleaching and glue; wood preservative; catalyst; waterproofing agent; and in fungicides (ATSDR 2005b; Lewis 1997).

2.3.8. Wood Waste

Wood waste is created by deposition of bark, wood chunks, wood chips, and sawdust within the marine environment. These wood products decay over time and can have a variety of physical and chemical adverse impacts on aquatic life, including:

- Organic enrichment of sediments

- Oxygen depletion in the water column

- Alteration of benthic communities to more pollution tolerant species

- Leaching of toxic chemicals such as phenols, methylated phenols, benzoic acid, benzyl alcohol, terpenes, and tropolones

- Physical alteration of the benthic substrate.

The severity of wood waste toxicity depends on the physical form (i.e., size), degree of water flushing, and type of wood it is generated from.

COPCs associated with wood waste include resin acids, guaiacols, ammonia, and hydrogen sulfide. Resin acids and guaiacols are naturally occurring organic chemicals found in wood, hardwood tar, and pulp and paper mill processes. Guaiacols also may be derived from creosote and are present in wood smoke, resulting from the chemical decomposition of lignin (Malcolm Pirnie 2006).

Ammonia occurs naturally throughout the environment in air, soil, water, and in plants and animals. It is an important source of nitrogen that is needed by plants and animals. The largest and most significant use of ammonia and ammonia compounds is the agricultural applications of fertilizers. The small proportion of commercially produced ammonia not incorporated into fertilizers is used as a corrosion inhibitor, in the purification of water supplies, as a component of household cleaners, and as a refrigerant. It is also used in the pulp and paper, metallurgy, rubber, food and beverage, textile, and leather industries (ATSDR 2004a).

Hydrogen sulfide is a poisonous, flammable, colorless gas with a characteristic odor of rotten eggs. It occurs both naturally and from man-made processes. Hydrogen sulfide is a component of gases associated with volcanoes, sulfur springs, swamps, stagnant bodies of water, and in crude oil and natural gas. It is also associated with municipal sewers and WWTPs, manure-handling operations, and pulp and paper operations. Hydrogen sulfide is released primarily as a gas and disperses in the air; however, in some instances, it may be released in the liquid waste of an industrial facility or as the result of a natural event. It can change into sulfur dioxide and sulfuric acid, and is soluble in water (ATSDR 2006a).

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3.0 Potential Sources of Aquatic Sediment Contamination and Data Gaps

3.1 Former Rayonier Pulp Mill / Manke Lumber Company / ITT Rayonier Research Laboratory

3.1.1. Historical Operations – Former Rayonier Pulp Mill

The former Rayonier sulfite pulp mill occupied over 10 acres of land along the southwest end of the Shelton Harbor. The mill produced pulp and paper from 1926 to 1957. A former burn plant occupied approximately six acres of land on the hillside above the mill, which burned sulfite liquor waste from 1945 until 1957. Both sites are currently owned by the Manke Lumber Company, who has operated a log sorting yard across the former mill site and a headquarters office on the former burn plant since the late 1960s (Figure 3-1).

3.1.1.1. Pulp Production

Limited operations information indicates that the acid sulfite process was used at the Shelton pulp mill to produce pulp from wood chips. Information on this process was obtained from the process description for a similar Rayonier pulp mill in Port Angeles (Malcolm Pirnie 2006). Both mills were owned and operated by the same company during the same time period using the sulfite pulp production process. This pulp process required a large amount of wood chips, acid digestion tanks, blow pits, screening tanks, hog fuel boilers and stacks, landfill disposal staging areas, and a storage facility for new and spent digestion chemicals. Wood chips for the Shelton mill were obtained either from the adjacent sawmills or brought in on barges, railcars, or trucks. Barges loaded with wood chips were moored in the harbor adjacent to the pulp mill. The Shelton pulp mill started generating its own wood chips onsite in the early 1950s (Thomas 1996).

3.1.1.2. Bleaching and Paper Production

Based on available information, paper production occurred from 1926 to 1930, and to a limited extent after 1930 when the mill began producing pulp for manufacturing rayon and other specialty wood products. In general, the bleaching process consisted of subsequent treatments of pulp using chlorine, caustic soda, sodium hypochlorite, and chlorine dioxide, with multiple washing stages. Bleached pulp was then transported to a drying machine where water was removed. The pulp was then pressed and dried, and the resulting material made into large rolls.

3.1.1.3. Disposal of Sulfite Waste Liquor

The main difference between the Shelton and Port Angeles pulp mills was the handling and disposal of the sulfite waste liquor, the end liquid by-product of the acid digestion process for producing pulp. The liquor consisted of dissolved lignin, sugars, and other organic constituents. Starting in 1926 through the early 1930s, the spent liquor was either released to the harbor during

outgoing tides or it was conveyed in a five-mile long pipeline that ran east along Hammersley Inlet to be discharged at Mill Creek (Thomas 1996). The locations of discharge points into the harbor from the mill are unknown. Environmental impacts to the shellfish industry in Oakland Bay and Hammersley Inlet occurred soon after the pulp mill began production. To mitigate the impacts, Rayonier constructed a three-mile long pipeline that ran inland from the mill to Goose Lake located near the airport (Thomas 1996). The liquor was pumped and discharged into the lake to settle and eventually evaporate; it was later discharged nearby to two diked disposal ponds. At the pulp mill site, liquor was temporarily stored in five aboveground storage tanks (ASTs) located east of and adjacent to the mill before being pumped to the lake.

In the mid- to late 1930s, Rayonier attempted other methods for disposing the waste liquor, including treatment of roads in Shelton for dust control and producing other specialty products such as linoleum paste and plywood adhesives.

By the early 1940s, discharging the liquor to Goose Lake was discontinued due to evidence that it had seeped into groundwater and a nearby creek (Thomas 1996). In 1945, Rayonier constructed a burn plant with ovens and a 325-foot high stack on the hillside above the pulp mill to incinerate the liquor. The burn plant continued operations until the pulp mill shut down in 1957.

3.1.1.4. Aboveground Storage Tanks

A 15,000-gallon fuel oil AST surrounded by a three-foot high earth dike was present east of and adjacent to the pulp mill facility, along with the five ASTs containing spent liquor (discussed above). Four acid-containing ASTs used in pulp production were situated immediately west of the pulp mill facility. Both the fuel oil and the acid ASTs were present from the mid-1940s to the early 1960s, based on Sanborn fire insurance maps.

3.1.2. Historical and Current Operations – Manke Lumber Sort Yard

The Manke Lumber Company has operated an unpaved log sorting yard across the entire former pulp mill property since the late 1960s (Figure 3-1). A truck wash facility and a truck and heavy logging equipment maintenance facility exist on the property. No information was available regarding the use, storage, and disposal of hazardous materials by the log sorting company from the late 1960s through the mid-1980s. In 1985, oil reportedly discharged into a hand dug ditch in the vicinity of the maintenance facility, according to an Ecology water quality file. A substantial oil spill had occurred at the site (spill location not reported) in the previous year. A 660-gallon diesel fuel AST with no secondary containment was identified in the Spill Prevention, Control, and Countermeasure (SPCC) plan for the site. Floatable oil, solvent, and emulsified oil were reportedly used at the site.

Information regarding the Manke property during an Ecology bacterial investigation indicated that runoff had been very turbid with visible sheen on the water surface from oils and grease (Michaud 1988). The poor quality runoff water emanated from the unpaved log sort yard and truck wash facility. The company had installed a closed-loop truck wash system prior to 1988 to control some of the runoff; however, overland flow continued to discharge into the harbor east of

Figure 3-1. Location of discharge points surrounding Shelton Harbor, Shelton, Washington.

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the main building. Two stormwater runoff samples had fecal coliform bacteria concentrations exceeding discharge permit limits (Michaud 1988).

In 2000, Manke's oil/water separator that collects stormwater at the northeast corner of the building reportedly overflowed and discharged oily liquid onto the ground surface, which eventually plugged a neighboring drainfield. Some work was performed on the drainfield and best management practices implemented; Ecology concluded that no further action was required. During a 2007 inspection, Ecology noted floating oil in the final chamber of the oil/water separator. The 2007 inspection notes also referred to three ponds situated in a series that eventually discharge through an outfall structure into the Harbor when enough stormwater is generated at the site (no discharge was occurring at the time).

3.1.3. Historical Operations – ITT Rayonier Research Laboratory

The former ITT Rayonier Research Laboratory occupied approximately three acres of land located to the west of and adjacent to the former pulp mill at 409 East Harvard Avenue from 1936 to 1995 (Figure 3-1). The laboratory specialized in cellulose chemistry and silvichemicals produced from pulp and other wood pulp by-products. The laboratory initially tested samples of pulp to be spun into rayon for product quality control. Between the late 1930s and the mid-1940s, the laboratory tested pulp for manufacturing other specialty wood products, including cellophane film, cellulose acetate (a plastic used in fabrics or solid castings), nitrocellulose used for explosives, and rayon tire cords. Currently, the former laboratory building and property are used by the school district and other private entities (Mason County 2008).

Laboratory waste reportedly consisted of cellulose in caustic slurry and other unknown chemicals; no information was available regarding specific chemicals used. Waste generated in the late 1930s and 1940s was reportedly disposed of at Goose Lake, along with waste sulfite liquor from the pulp mill. No information was available regarding handling and disposal of laboratory wastes after the mid-1940s, when industrial wastewater from both the mill and the laboratory could no longer be discharged to lake.

In March 1987, the ITT Rayonier laboratory director compiled a list of chemicals and estimated the loss of these chemicals during normal laboratory operations as part of their National Pollutant Discharge Elimination System (NPDES) effluent discharge permit requirements. A letter sent by the ITT Rayonier laboratory director to Ecology listing chemicals used by the laboratory during normal operations and analytical results of sampled effluent reported on discharge permit forms are provided in Appendix A. An effluent sample was collected from the laboratory outfall pipe located adjacent to the former pulp mill and Manke log sort yard (Figure 3-1). A high fecal coliform concentration (27,000 colony forming units [cfu] per 100 milliliters) was found to exceed the permit discharge limit. Other constituents detected in the effluent that tested within discharge permit limits included: fluoride, phosphorus, sulfate, aluminum, barium, boron, iron, magnesium, molybdenum, manganese, copper, zinc, total phenols, methylene chloride, and di-n-octylphthalate. Further sampling of laboratory effluent for fecal coliform conducted in December 1987 and March 1988 found that concentrations significantly decreased due to bypassing an equalization tank in the discharge line (Michaud 1988).

According to a 1986 underground storage tank (UST) notification form, a single-walled 1,000-gallon diesel fuel tank was installed on the site sometime between 1966 and 1970. The tank reportedly was last used in 1986 and was closed in-place, filled with an inert material. No information was available regarding the location of the tank.

3.1.4. Previous Investigations

3.1.4.1. Reconnaissance Survey of Inner Shelton Harbor Sediments (Ecology 2000)

The objectives of this screening survey of Shelton Harbor sediment focused on evaluating metals and organic contaminant levels near 10 potential sources and estimating the distribution of wood waste in subtidal sediments. Three sediment samples were collected adjacent to the former pulp mill, existing Manke log sorting yard, and a stormwater drainage outfall associated with the former ITT Rayonier laboratory (Figure 3-2). Wood waste samples also collected in the area are discussed in the next section that addresses the Simpson Timber Company. Sediment samples were collected within the intertidal zone at the east end of the south shore sort yard (SCS-1), below the Manke machine shed (SCS-2), and below the south shore marine lab drainage outfall (SCS-3). Benzoic acid exceeded the cleanup screening level (CSL) criterion below the Manke machine shed; no other exceedances were found. Phenol was found at SCS-1 at a concentration above the sediment quality standard (SQS) criterion. Both benzoic acid and phenol are likely associated with decay of wood debris found in the area.

3.1.5. Contaminants of Concern

Based on the results of the above activities, the following contaminants of concern have been identified for the marine environment at and near the former Rayonier Pulp Mill / Manke Lumber Company / ITT Rayonier Research Laboratory:

- Heavy metals from the laboratory
- SVOCs (PAHs, phenols, phthalates) from the laboratory, produced from machinery and trucks associated with lumber storage, and also released during spills/leaks of petroleum-based substances such as hydraulic fluid and fuel
- Dioxins/furans associated with chlorine bleaching operations and the use of PCP
- Benzoic acid, phenol, sulfides, ammonia and TOC produced from wood waste degradation.

3.1.6. Potential Contaminant Pathways to the Aquatic Environment

Historic nearshore outfalls and overland flow provide the major pathways for contaminants to move from upland source areas. Wood waste has been deposited based on direct input from logs

Figure 3-2. **Previous investigation sample locations and transformer locations in Shelton Harbor, Shelton, Washington.**

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floating on the water surface, as well as from debris and sawdust associated with nearshore activities. Stack emissions from boiler and incineration activities also can be expected to contribute contaminants to the bay.

3.1.7. Data Gaps

Three sediment samples are known to have been collected along the south shore of Shelton Harbor. SMS exceedances for benzoic acid and phenol were identified at two of the three locations. Further sampling should be conducted at identified discharge points (discussed later in this report). Analyses should include the broad range of COPCs discussed for marine sediments in general, including bioassays to evaluate the effects of conventionals and contaminants without SMS chemical criteria.

3.2. Simpson Timber Company

3.2.1. Historic and Current Operations

The Simpson Timber Company occupied two properties in Shelton: the main waterfront facility and the Eagle Point plywood facility (Figure 2-2). The main Simpson sawmills and plywood manufacturing plant covers over 80 acres of the Shelton waterfront (Mason County 2008); the address to its main entrance is 421 South Front Street. The plant currently operates a sawmill (Sawmill #3), a particle board overlay plant, planing mills, an existing power plant with a steam generating boiler plant, a log yard, and rail and barge loading facilities (ORCAA 2005). Forest products currently produced by Simpson include dimensional green and kiln-dried lumber, wood residuals, and wood chips. A former Insulating Board plant, located where the current overlay plant is situated, manufactured fiberboard from the mid-1940s until 1974. In 1963, the plant began manufacturing water and fire resistant products. Simpson formerly operated the plywood mill at the north end of the waterfront facility, which has been owned and operated by Olympic Panel Products since 2003.

The Eagle Point facility housed the former Olympic Plywood plant at 1698-1700 Fairmount Avenue. Plywood was manufactured at this location between 1941 and 1974, when operations moved to the north end of the Simpson waterfront complex (Figure 2-2). It is unknown what activities took place on this property from the mid- to late-1970s; Simpson leased the property to Shelton Structures, a glue laminate beam fabrication plant from the late 1970s to the early 1990s. Currently, the Port of Shelton owns the property.

In the early 1920s, pilings were driven across the waterfront south of Goldsborough Creek to create a bulkhead and dredged sediment from the harbor was used as backfill to create approximately 30 acres of industrial land for two sawmills (existing Sawmill #3 and former Sawmill #4). The railroad log dump was constructed at this time, along with over 4,000 pilings driven in the harbor, many of which to provide moorings for log rafts. In the mid-1940s, Simpson developed the central tideflats across the waterfront north of Goldsborough Creek and built the Insulating Board plant, the plywood plant, the railroad roundhouse, and the machine

shops. From the 1950s to the early 1960s, Simpson expanded their waterfront plant further east on the north side of Goldsborough Creek to its present day bulkhead, and built the planing mill, the short lumber planing mill, and dry kilns.

3.2.2. Simpson Waterfront Facility

3.2.2.1. Former Hog Fuel Boilers and Power Plant

In 1926, a power plant was built between the sawmills south of Goldsborough Creek burning wood waste (hog fuel) to supply power for both sawmills and the former Rayonier pulp and paper mill (Figure 3-1).

The wood-fired power plant, located southwest of Sawmill #3, operated from 1926 until it was decommissioned and replaced with a new, more efficient salt-free wood burning power plant in 1986 (Figure 3-1; shown north of Goldsborough Creek as the existing power plant). Bark removed from logs and rejected wood chips and debris generated from the sawmills were burned in the hog fuel boilers; when necessary, fuel oil was used to supplement fuel demands. Air emissions were regularly discharged from the mill boilers as part of normal operations.

The old power plant contained seven boilers and two emission stacks, all of which operated without air emission controls between 1926 and 1976. In 1976, Simpson installed two banks of baghouses, including one between a high-pressure boiler and a short emission stack (125-foot high) and the other between a bank of six low-pressure boilers and a tall emission stack (244-foot high). Approximately 3,000 pounds per day of air emission residue from both stacks was produced when all boilers were operating. Residue consisted of 1/3 unburned and charred wood and 2/3 salts. From July to September 1976, September to December 1978, and July 1981 to February 1982, the baghouses were bypassed. A fire disabled the tall stack in September 1984 and the boiler to the tall stack was shut down in 1986; the short stack was shut down in 1986.

Residues from both baghouses were mixed into slurries and discharged to both the former WWTP on Pine Street (1976 to 1979) and to the existing plant at Eagle Point (1979 to 1984). Solids that had settled out at each WWTP were disposed of at two public landfills (the Shelton "C Street" Landfill and the Mason County Landfill) and at the Dayton wood waste landfill owned by Simpson. After 1984, all residues generated at the Simpson plant were disposed of at their Dayton wood waste landfill.

In 1986, Simpson began using the salt-free wood burning power plant (Thomas 1996). According to the 1998 state dioxin source assessment, hog fuel used at the Simpson plant consisted of 20 percent salt-laden hog fuel, with tire chips fuel used as an alternative fuel source (Ecology 1998).

3.2.2.2. Other Features and Operations

A septic system and drainfield, located at the extreme east end of the mill (location unknown), was no longer functioning in 1969. Simpson used a new sewer pipeline installed to discharge

sewage to the city WWTP. In 1993, Simpson obtained a Stormwater Baseline General Permit for its private storm-sewer system present onsite. No information was available as to whether this system is still in operation.

Non-contact cooling water associated with Simpson's power plant was discharged to the harbor, according to the 1974 - 1976 NPDES waste discharge permits issued for the power plant. Water from the blow pits was mixed with baghouse residues and discharged to the city WWTP (see the Hog Fuel Boilers and Power Plant section above). Handling of process wastewater that consisted of phenolic resin and wood chips was reportedly boiled down before going to the boiler plant to be burned in the early 1990s.

Four USTs associated with a fueling station located near the machine shops were removed in 1991, according to an Ecology UST site check form (Figure 3-1). Two tanks previously contained gasoline and the other two diesel fuel. It was reported on the UST site check form that no petroleum contamination was present during tank removal. No additional information was available regarding these USTs or site conditions.

A total of 29 electrical transformers were identified during a 1988 TSCA inspection conducted by USEPA. Of the 29 transformers, 13 contained PCBs at concentrations greater than 500 parts per million (ppm) and two contained concentrations between 50 and 499 ppm. The locations of the 15 transformers with PCB contents greater than 50 ppm are shown in Figure 3-2.

In 1991, Bunker C fuel was discovered in soil and groundwater during Simpson work on a drainage trench located between the Sawmill #3 building and Goldsborough Creek. The source of contamination was attributed to leaks and spills associated with two 13,000-gallon ASTs present from the 1920s to the mid-1940s. Simpson removed approximately 10 cubic yards of visibly contaminated soil from the source area; however, soil contamination was left in-place in proximity to a bulkhead along Goldsborough Creek, railroad tracks, and a metal frame tower. In 2001, Simpson reported to Ecology that no petroleum odors or contaminated soil was present during installation of a sheet pile bulkhead in the vicinity of the previous contamination. In 2007, Ecology concluded that further site characterization and removal of residual soil contamination was warranted.

Ecology visited the Olympic Panel Products site (occupied the plywood plant) for the Industrial stormwater NPDES general permit compliance inspection in February 2007. Two outfalls are being monitored, including the log yard and OF #11 (locations of these outfalls are unknown). Results of stormwater discharge samples collected from both outfalls in September 2005 and January 2007 indicated that BOD, turbidity, zinc, and copper exceeded their permitted discharge limits.

3.2.2.3. Process Chemicals and Reported Spills

Process chemicals used at the Simpson waterfront plywood and sawmill facilities, as reported to Ecology since the early 1980s, have included phenolic and urethane resins, urea/formaldehyde glues, fungicides, and waterproofing wax. Tanks containing resin and caustic chemicals

associated with the plywood plant were located at the northwest corner of the building near Shelton Creek.

A wood preservative dip tank (location unknown) was referred to in a 1981 Ecology file letter stating that approximately 9,400 gallons of dilute Permatox 200 wood preservative was removed and disposed of by spraying it across the Dayton dry log sort yard. According to the material safety data sheet (MSDS), the preservative contained chlorinated phenols and PCP.

Between 1980 and 2004, numerous spill incidents reportedly occurred, including accidental spills and discharges into the harbor and to Shelton and Goldsborough Creeks, as well as across upland portions of the facility. Most of the reported spills were petroleum products, including hydraulic oil, soluble or biodegradable lube oil, gear oil, and diesel. Other chemical spills included the following:

- Resin (1987 incident) and veneer waste water (1988 incident) were reportedly spilled and discharged to Shelton Creek from the plywood plant.

- In 1984, a PCB-contaminated oil spill to soil occurred within the electrical switchyard located west of and adjacent to the railroad roundhouse (Figure 3-2).

- In 1990, Simpson discovered that waste oil stored in two ASTs located within a diked area adjacent to the northwest corner of the plywood plant contained high concentrations of PCBs. The ASTs were located approximately 60 feet southeast of Shelton Creek (Figure 3-2). Ecology inspected the site and noted PCB-contaminated oil had pooled within the diked area surrounding the ASTs. The amount of oil spilled within the containment was not reported. Cleanup was conducted, including removing and disposing of PCB-contaminated oil from both tanks, as well as removing the concrete sump, asphalt floor, and plywood walls above the dike.

3.2.3. Eagle Point Plywood Facility

No information was available regarding process chemicals used or spills that may have occurred at the former Simpson/Olympic Plywood plant at Eagle Point, which operated between 1941 and 1974. Process chemicals used by Shelton Structures, who operated at the former plywood plant from the late 1970s through the early 1990s, included urea/formaldehyde glue and phenol-formaldehyde resin.

In 1980, Shelton Structures was fined by Ecology for illegally discharging phenolic wastewater to the harbor. Before 1985, Shelton Structures disposed of wash water contaminated with phenolic glues and caustic compounds generated from daily cleanup of equipment by

discharging it to a floor drain into a series of three tanks for settling solids. Untreated wash water was then drained to a storm drain that discharges to the harbor. After 1985, the facility recycled washwater in their manufacturing process and no longer discharged it to the harbor.

In 1991, Ecology responded to a complaint filed against Shelton Structures regarding possible soil contamination and runoff from water used to control burn piles containing beams with phenolic resins and formaldehyde. It was reported that no contamination was detected in soil samples collected from the burn piles.

In 1994, an abandoned 750-gallon gasoline UST was removed, along with 70 cubic yards of contaminated soil, from around the tank. The location of the tank is unknown.

3.2.4. Previous Investigations

3.2.4.1. 1984-1988 USEPA National Dioxin Study

Between 1984 and 1988, the USEPA conducted a National Dioxin Study to determine the extent of dioxin contamination in the United States and the associated risk to humans and the environment (CH2M Hill 1987). Simpson volunteered to have their wood-fired power plant tested as part of this study. The Simpson power plant was the only wood-fired boiler plant operating at the time of this study. Other wood-fired power plants and associated stacks that previously operated along the south shore of the harbor included the former Rayonier pulp and paper mill; the former Rayonier burn plant above the pulp mill, and the former Simpson/Olympic Plywood plant (Figure 3-2).

In 1986, samples were collected from Simpson facilities for dioxin and furan analyses, including the two baghouses and two boiler systems from the former power plant, and a multicyclone unit at the existing power plant. Soil samples from residential neighborhoods to the south (Hillcrest), to the north (Capitol Hill), and east across the bay (Shorecrest) were collected as likely areas of deposition from stack discharges. Composites of five discrete sediment samples were collected in the vicinity of the outfalls of both WWTPs. Soils from the three landfills accepting WWTP sludge and baghouse residues also were collected as part of the study. Maps showing the sample locations as described above, and tables summarizing the reported concentrations of dioxins and furans detected in each sample are provided in Appendix B.

Results of the dioxin study indicated:

- Baghouse residue contained up to 4,200 parts per trillion (ppt) of 2,3,7,8-tetrachlorodibenzo - p-dioxin (TCDD).
- Low concentrations of dioxins/furans were detected in the multicyclone of the existing power plant. None of the more toxic isomers of chlorinated dioxins/furans were detected. The detected dioxin concentrations were similar to amounts reported for woodstove and fireplace ash.

- -Dioxins and furans were either not detected or found at less than 1,000 ppt in soil collected from the three residential areas.

- No chlorinated dioxins/furans were detected in sediment samples collected from either WWTP outfall.

- A concentration of 170 ppt 2,3,7,8-TCDD was found, along with other dioxins and furans compounds, at the Shelton "C Street" Landfill (the landfill received sludge from the former WWTP containing residues generated from 1976 through 1979).

3.2.4.2. Reconnaissance Survey of Inner Shelton Harbor Sediments (Ecology 2000)

The objectives of this screening survey of Shelton Harbor sediment focused on evaluating metals and organic contaminant levels near 10 potential sources and estimating the distribution of wood waste in subtidal sediments. Two samples addressing potential contaminant source inputs to the harbor were collected adjacent to Simpson operations south of Goldsborough Creek (SCS-4 and SCS-5; Figure 3-2). CSL exceedances for benzoic acid, phenol, 4-methylphenol, and 2,4-dimethylphenol were identified, all of which can be associated with wood waste. Both samples exhibited mercury levels exceeding the SQS criterion; PCP exceeded the SQS criterion at SQS-5.

Since Simpson managed log storage across the harbor on a grand scale, all wood waste sample results are discussed here. The harbor was divided into nine areas (strata) from which 37 composite surface sediment samples were collected and evaluated for the presence of wood waste. Strata were defined based on log handling practices (e.g., rafting, storing, dumping) and water depth. Results indicated that mean wood content on a weight basis ranged from 5.1 to 18.5 percent. Wood waste was most predominant across the southern half of the harbor, with the highest concentrations near the Simpson and Manke property shorelines.

Chemicals associated with wood waste that exceeded SMS were found in three samples representing the south harbor and one sample near the marina, including benzoic acid, phenol, and 4-methylphenol.

3.2.5. Contaminants of Concern

Based on the results of the above activities, the following contaminants of concern have been identified for the marine environment at and near the Simpson waterfront facility:

- Heavy metals from the non-contact cooling water and as noted in recent NPDES monitoring; mercury, as found in both sediment samples exceeding SQS

- SVOCs (PAHs, phenols, phthalates) from plywood and laminate production, produced from machinery and trucks associated with lumber

storage, and also released during spills/leaks of petroleum-based substances such as hydraulic fluid and fuel

- PCBs associated with transformers located across the site
- PCP associated with wood preservation
- Dioxins/furans associated with chlorine bleaching operations and the use of PCP
- Benzoic acid, phenol, sulfides, ammonia and TOC produced from wood waste degradation.

Based on the results of the identified activities, the following contaminants of concern have been identified for the marine environment at and near the Simpson Eagle Point facility:

- SVOCs (PAHs, phenols, phthalates) from plywood and laminate production.

3.2.6. Potential Contaminant Pathways to the Aquatic Environment

Historic nearshore outfalls and overland flow provide the major pathways for contaminants to move from upland source areas. Both Goldsborough and Shelton Creeks have offered additional opportunities for wide-spread contamination across the harbor, due to their relatively high rate of flow. Wood waste has been deposited based on direct input from logs floating on the water surface, as well as from debris and sawdust associated with nearshore activities. Burning of hog fuel and supplemental fuel materials has resulted in wide-spread distribution of air contaminants with sources at both the waterfront facility and the burn plant up on the hill to the south.

3.2.7. Data Gaps

Two sediment samples are known to have been collected along the east shore of Shelton Harbor adjacent to the Simpson facility. SMS exceedances for benzoic acid, phenol, 4-methylphenol, 2,4-dimethylphenol, mercury and PCP were identified. Further sampling should be conducted at identified discharge points (discussed later in this report). Analyses should include the broad range of COPCs discussed for marine sediments in general.

3.3. Evergreen Fuel Company / Former Marine Railway / Shelton Marina

3.3.1. Evergreen Fuel Company

The former Evergreen Fuel Company petroleum bulk plant historically operated at the northeast corner of Shelton Harbor at 661 East Pine Street from 1913 until it was shut down in 2005

(Figure 2-2). The bulk plant consisted of an upland area and a tidelands/subtidal area. The upland area consisted of a small office building and warehouse surrounded by a gravel lot, nine ASTs, an overhead tanker truck fueling station, an oil/water separator, an over-water pipeline that ran from the bulk fuel plant to the dock, and a barge off-loading area. The upland area was used for storage, distribution, and sales of gasoline, diesel, stove/heating oil, kerosene, and other miscellaneous petroleum products. The north tank farm, located north across State Route (SR) 3 from the main facility, had four ASTs; the west tank farm located west of the main facility and above the shoreline had five ASTs. A wooden bulkhead separated the upland from the tidelands. The tidelands area consisted of eastward-sloping intertidal and marine mud and gravel, with deeper waters toward the east edge of the property. No information was found regarding use of the tidelands area by Evergreen Fuel Company.

Adjacent properties include the City Pine Street right-of-way, a defunct dock and tidal grid (accessed only from Evergreen Fuel property), and a former marine railway owned by Simpson to the south; SR 3 roadway and forested hillslope and railroad right-of-way owned by Burlington Northern Santa Fe to the west; the Shelton Yacht Club and Marina, owned by the Port of Shelton to the north; and aquatic tidelands owned by the Washington State DNR to the east.

Between 1973 and 2003, several petroleum spills to soil, groundwater and surface water into the harbor were reported. In 2003, approximately 400 gallons of fuel spilled into an AST containment area, releasing between 50 and 70 gallons into the harbor. An initial cleanup was conducted that consisted of removing approximately 150 tons of petroleum-contaminated upland soil from the tank site.

Between 2005 and 2007, a remedial investigation (RI) and remedial cleanup action were conducted pursuant to an Agreed Order. Cleanup activities conducted from December 2006 to June 2007 included:

- Removal of approximately 7,500 tons of soil contaminated with gasoline; diesel; benzene, toluene, ethylbenzene, and xylenes (BTEX); and cPAHs
- Groundwater treatment through enhanced aerobic bioremediation
- Groundwater monitoring.

Total petroleum hydrocarbon (TPH) contamination in soil was left in-place beneath the SR 3 roadway, beneath utilities located adjacent to SR 3, and near the bulkhead retaining walls. Residual TPH contamination in groundwater is still present, but TPH concentrations have decreased since cleanup activities were completed and compliance groundwater monitoring began in April 2007, based on results from the October 2007 monitoring event.

3.3.2. Former Marine Railway Facility

Southwest of and adjacent to the Evergreen Fuel site is the City Pine Street right-of-way. Features of the right-of-way include a short abandoned dock, a tidal boat grid, and an abandoned

sanitary sewer outflow pipe associated with the former Shelton WWTP located on Pine Street (this outflow pipe is discussed further below in Section 3.7.2 - Previous Wastewater Treatment Plant).

Located further southwest beyond the Pine Street right-of-way is a former marine railway property located at 655 East Pine Street, which is owned by the Simpson Timber Company. The Shelton Yacht Club operates the facility to haul boats out of the water for maintenance and repair activities. The former Simpson marine railway facility includes a vacant single-story wood-framed building supported by pilings, a small shed, and a boat cradle with two sets of launching rails that extend east from the building into the harbor. Simpson previously used the facility for sandblasting and cleaning log-boom boat bottoms (Ecology 2006). ASTs previously occupied an area west of the marine railway facility. No information was available regarding the number, capacity, or type of product stored in these tanks, or whether a site assessment was conducted to determine if a release had occurred.

A complaint was filed with Ecology in 1987 regarding Simpson personnel sandblasting their boats over water near the boat launching area. From the 1990s through 2005, a small log towing company (identified as Smith & Sons Log Boom Towing) operated at this facility, lifting logs from trucks or the platform using an electric hoist and lowering them into the bay.

3.3.3. Shelton Yacht Club and Marina

The Shelton Yacht Club and Marina are located east-northeast of and adjacent to the former Evergreen Fuel site at 659 East Pine Street (Figure 2-2). The marina is owned and operated by the Port of Shelton; the yacht club leases portions of the property from the Port. The marina, developed in 1974, includes docks and boathouses that extend over tidelands owned by CC Cole & Sons (Evergreen Fuel) and the DNR. Features at the marina include a former timber tidal boat grid located south of and adjacent to the main dock, timber docks with covered and uncovered slips for moorage of marine vessels, a single-story wood-framed building supported by pilings, and a gravel parking area. According to a NPDES boat yard permit issued for the marina in December 2005, no industrial vessels are moored at the marina. Services provided at the marina include vessel haul-out, vessel repair, pressure washing, and paint removal and application. Currently, all wastewater generated during pressure washing is collected and recycled back to a concrete wash pad. Storm water is discharged to the bay.

A complaint filed with Ecology in 1993 reported discharge of gray water and sewage waste from boats occupied by live-aboards at the marina. It was reported that the marina did not have any septic system for boaters at the time. No information was available in the site file as to whether a septic system or other means of disposal of sewage has been implemented at the marina.

Discharge monitoring is required for the NPDES boat yard permit. The results of a sample collected at the haul-out discharge point in January 2007 had a copper concentration (250 micrograms per liter [µg/L]) that exceeded the permit limit of 229 µg/L. Copper concentrations in samples collected since January 2007 were below the permit limit. No boats

reportedly had been hauled out or cleaned in the vicinity of the vessel haul-out area since October 2006.

Historically, the Port formerly owned and operated two USTs for fueling marine vessels at the docks. The tanks were located at the north side of the marina building. The total reported capacity of both tanks was 48 gallons, with one tank containing gasoline and the other diesel fuel. No site file information was available as to whether a site assessment was conducted to determine if a release had occurred from either tank.

3.3.4. Previous Investigations

3.3.4.1. Reconnaissance Survey of Inner Shelton Harbor Sediments (Ecology 2000)

Four surface sediment samples were collected in the vicinity of the Evergreen Fuel/former marine railway/Shelton Marine area (Figure 3-2). Wood waste samples also collected in the area are discussed in the previous section addressing the Simpson Timber Company. Sediment samples were collected from within the intertidal zone near the base of the launching rails at the vessel haul-out area (SCS-6), within the intertidal zone adjacent to a boat crib north of the marina (SCS-7), within the intertidal zone east of the former Evergreen Fuel site (SCS-8), and within the marina, approximately 600 feet east from the shoreline, and 14 feet mean lower low water (MLLW) (SCS-9).

Results of these samples indicated copper exceeding the CSL criterion near the vessel haul-out area (SCS-6) and adjacent to the boat crib (SCS-7) and benzoic acid exceeding the CSL criterion east of Evergreen Fuel (SCS-8). Other SQS exceedances were identified for bis(2-ethylhexyl)phthalate, fluoranthene, chrysene, PCP, and high molecular weight polycyclic aromatic hydrocarbons (HPAH).

Butyltin concentrations were generally low in sediment samples, except for SCS-6 collected near the base of the launching rails at the vessel haul-out area. Individual concentrations of mono-(1,300 micrograms per kilogram [µg/kg]), di-(4,100 µg/kg), and tri-(1,500 µg/kg) butyltin chloride all exceeded 1,000 µg/kg.

3.3.4.2. Remedial Investigation of the Evergreen Fuel Site (Farallon 2005, 2007)

Sampling was performed in both upland and sediment areas (sampling location map is provided in Figure 3-3). Ten surface sediment samples were collected for chemical analysis from the following locations:

- EFS-01 – Within the intertidal zone near the base of the launching rails of the former Simpson marine railway facility
- EFS-02 – East of the Pine Street right-of-way, within the intertidal zone near a former tidal boat grid and vessel haul-out area

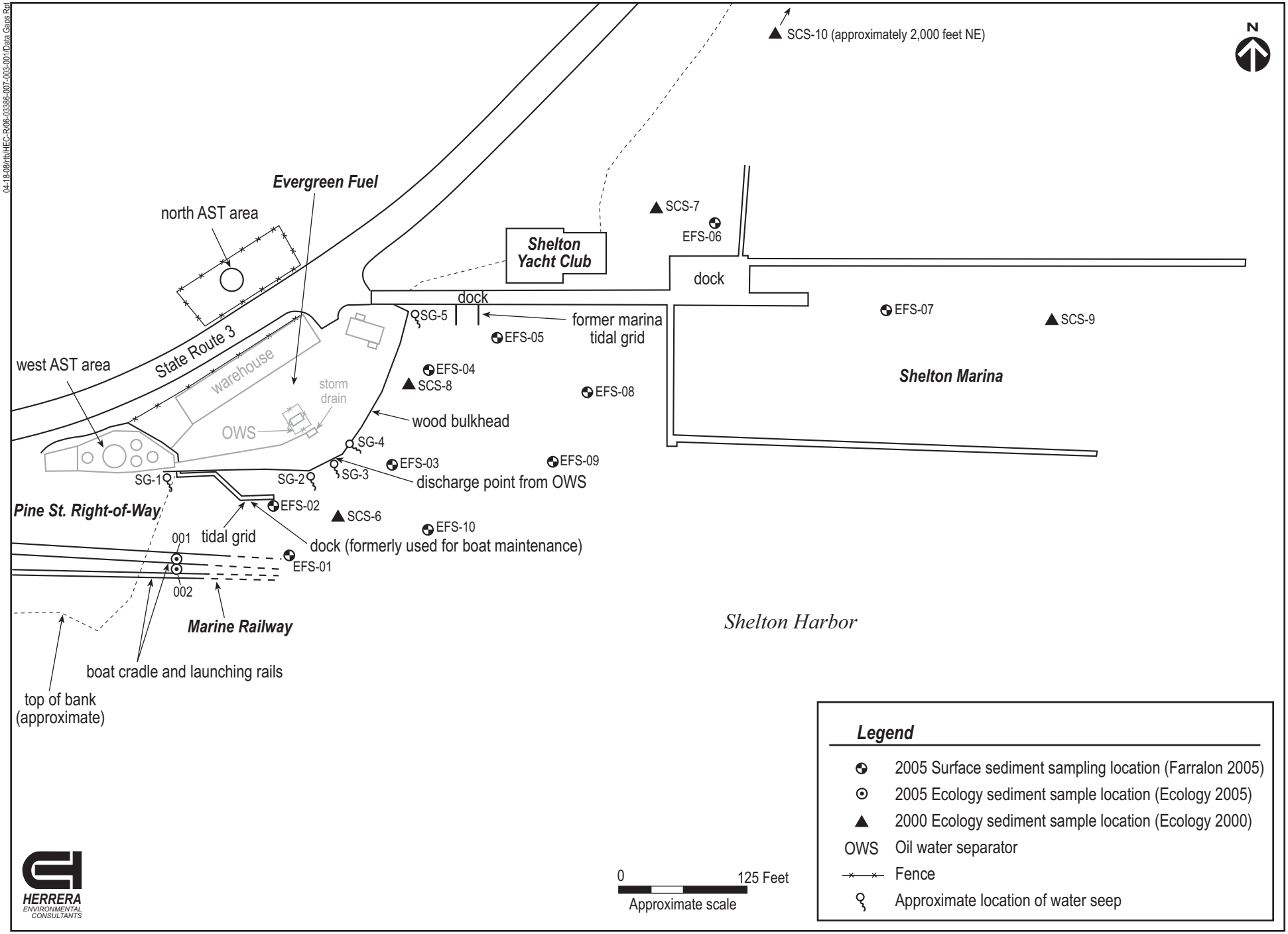

Figure 3-3. Site map of former Evergreen Fuel site, Shelton Yacht Club and Marina, and former marine railway, Shelton, Washington.

- EFS-03 – Within the intertidal zone near an oil/water separator discharge pipe.
- EFS-04 – Within the intertidal zone east of the Evergreen Fuel office and warehouse
- EFS-05 – Within the intertidal zone in the vicinity of the marina's remnant tidal boat grid
- EFS-06 – Within the intertidal zone north of the marina dock
- EFS-07 – In the subtidal zone within the marina to characterize former fuel loading
- EFS-08 and EFS-09 – Approximately 200 feet east and offshore the Evergreen Fuel site within the marina
- EFS-10 – Approximately 130 feet east and offshore from the Pine Street right-of-way, near Ecology (2000) sediment sample location SCS-6.

Results of these sediment samples indicated the following:

- A phenanthrene concentration that exceeded the SQS criterion was found at EFS-02SS collected within the Pine Street right-of-way.
- Concentrations of diesel- and/or lube oil-range hydrocarbons were detected in nine of the 10 sediment samples collected (no hydrocarbons were detected in EFS-09). Further evaluation of chromatograms from each of the nine samples indicated that TPH concentrations consisted entirely of PAHs that elute as TPH in the analyses (Farallon 2005). The PAH concentrations in all nine sediment samples (with the exception of phenanthrene in EFS-02) were below SMS criteria; the PAHs in these samples were interpreted by Ecology as likely associated with residual creosote from nearby treated timbers of the bulkheads and docks.
- No PCBs were detected above practical quantitation limits in either soil or groundwater samples collected during the RI from the upland portion of the site. However, low concentrations of total PCBs were detected at all ten sediment samples ranging from 0.84 to 4.77 mg/kg organic carbon normalized (OC); all concentrations were below SMS criteria.
- TBT in interstitial water was detected in two of the sediment samples: 0.888 µg/L at EFS-02 and 0.0326 µg/L at EFS-03. The PSDDA interstitial porewater criterion of 0.15 µg/L was used as a screening level

of concern for the site. No TBT was detected above practical quantitation limits in the remaining eight sediment samples.

- Two samples (EFS-08 and EFS-09) exceeded the SQS criterion for silver because the laboratory reporting limit was slightly above the criterion. However, silver was not detected at the method detection limit of 0.114 mg/kg, well below the SQS criterion of 6.1 mg/kg. All ten samples contained detected concentrations of arsenic, chromium, copper, lead, mercury, and zinc below their respective SMS criteria. Low concentrations of cadmium below the SMS criteria were detected in nine of the ten samples (no cadmium in EFS-01).

In addition to sediment samples, water samples at five seep locations in the intertidal area adjacent to the Evergreen Fuel site were sampled (Figure 3-3; SG-1 through SG-5). Based on results for specific conductance and other geochemical results, it appears that seep SG-1 is groundwater discharging from the site, while the other two seeps tested (SG-2 and SG-4) appear to be salt water that recharges into the site during high tides and discharges back to the bay as the tide goes out (Mercuri 2005). No COPCs associated with the Evergreen Fuel site investigation were found at concentrations above regulatory cleanup criteria in samples SG-3 through SG-5. Results for samples SG-1 and SG-2 indicated the following:

- Reddish-brown stained soil was observed above the mean higher high water line near the discharge point for seep location SG-1, located southeast and adjacent to the west AST area. Ecology expressed concern that the stained soil may be associated with petroleum product. Since cleanup of the site in 2007, no seeps have been identified.

- The seep sample collected at SG-2 near the bulkhead indicated the presence of PAHs that likely can be attributed to contact with creosote-treated pilings.

Ecology determined that photo-activated PAH compounds were present in sediment at three locations at concentrations warranting bioassay testing. In January 2005, Ecology conducted bioassay tests on sediment sample EFS-03 (split sample) using both the standard method (guidelines for conducted lab bioassays on Puget Sound sediments – Puget Sound Estuary Program [PSEP] 1995) and the ultraviolet (UV) exposure method (Ecology 2008a). The guidance for the UV exposure method cites several studies that suggest that photo-activation of certain PAH compounds can result in increased toxicity to organisms. Results indicated no substantial differences between the standard method and the UV exposure method in the 10-day and 20-day tests. In the 48-hour test, the mean individual growth rate for mussels using the UV method was substantially lower than that of the standard method. No further documentation was found in the site file.

3.3.4.3. 2005 Ecology Initial Investigation of the Simpson Marine Railway (Ecology 2005)

Ecology conducted further investigation of the former Simpson marine railway to follow-up on TBT found in sediment in the Farallon RI. Two surface sediment samples were collected and analyzed for the presence of TBT, metals, total organic carbon (TOC), SVOCs, and diesel- and lube oil-range hydrocarbons. Both samples contained mono- (180 and 580 µg/kg), di- (510 and 1,800 µg/kg), and tri- (1,100 and 2,400 µg/kg) butyltin chloride. To compare tributyltin chloride results to the PSDDA screening level, multiply the chloride results by 0.89 (Michelsen et al. 1996); this results in 979 and 2,136 µg/kg as TBT for the two samples, both exceeding the PSDDA screening level of 73 µg/kg. No information was available concerning other analytes of concern.

3.3.5. Contaminants of Concern

The following are potential chemicals of concern to the Harbor:

- PCBs, SVOCs, TBT, and heavy metals associated with industrial stormwater and boat cleaning/repair processes. TBT specifically found in boat hull paint.
- TPH/PAHs associated with gasoline and diesel spills, potentially leaking storage tanks, creosote pilings, and boat exhaust.

3.3.6. Potential Contaminant Pathways to the Aquatic Environment

The primary source of TBT in the marine environment is from sandblasting and use of anti-fouling paints on boats. Sandblasting and cleaning of log-boom boat bottoms occurred directly over water in at least one incident reported in 1987. Anything that was scraped or dropped into the water during boat maintenance and repair activities becomes a potential sediment contaminant source.

Boat exhaust, accidental fuel leaks, and spills from the fueling station and ASTs directly to the water surface are potential pathways for TPH and PAH contamination of the marine environment.

3.3.7. Data Gaps

Upland area activities can generate potential industrial stormwater runoff impacts. Improperly cleaned areas or improperly stored hazardous materials increase the chance of spills/leaks and loading of chemicals into stormwater. Contaminated groundwater discharging to surface water is another potential pathway.

A total of 16 surface sediment samples are known to have been collected from intertidal and subtidal areas adjacent to the former Evergreen Fuel, Shelton Marina, and former Simpson marine railway. TBT concentrations exceeding SMS criteria were detected in samples collected in the vicinity of the marine railway and in one subtidal sample collected within the marina. Other SMS exceedances detected in one or more samples included copper, benzoic acid, bis(2-ethylhexyl)phthalate, PAHs, and PCP. Low concentrations of PCBs below SMS criteria were also detected. Further sampling should be conducted to 1) further assess the extent of TBT in the intertidal area adjacent to the former Simpson marine railway and Evergreen Fuel site; 2) assess the vertical extent of COPCs in sediment in the vicinity of the discharge point for the oil/water separator; and 3) collect a tissue sample to assess effects on biota.

3.4. Bulk Fuel Facilities along West Shore of Oakland Bay

In addition to the Evergreen Fuel bulk fuel plant, three other petroleum bulk storage facilities have historically operated about 1/2 mile northeast of Shelton on SR 3 along the west shore of Oakland Bay (Figure 2-1). These facilities generally consisted of large ASTs containing petroleum products located on the west, uphill side of SR 3. Fuel was dispensed either by overhead tanker truck fueling stations or through underground piping that ran from the tanks to a barge off-loading dock on the shore. Based on Ecology Bulk Oil Handling Facility Inspection Reports compiled between 1973 and 1978, the following facilities were identified:

- Union Oil Company bulk plant (B&R Oil) operated from the early 1930s to the mid-1980s. The facility had five ASTs with a total capacity of 2,274 gallons; petroleum products included gasoline, diesel fuel, and stove/heating oil. Oil pollution hazards identified during inspections included inadequate containment structure surrounding the ASTs and additional catch basins required. No spills were reported for the site.

- Shell Oil Company (Gott Oil) operated from the early 1930s to the mid-1980s. The facility had five ASTs with a total capacity of 1,952 gallons; petroleum products included gasoline and diesel fuel. Oil pollution hazards identified during inspections included valve leakage, no containment structures surrounding the tanks, vulnerable storm drains, and inadequate catch basins. Approximately 294 gallons of diesel fuel reportedly spilled at the site in 1973 (spill location not reported). Approximately 50 gallons of lube oil or diesel fuel spilled at the site in 1978 (spill location not reported).

- ARCO (Evans) operated from the mid-1960s through the late 1970s. This facility consisted of four ASTs with a total capacity of 1,904 gallons; petroleum products stored at this site included gasoline, diesel, and stove/heating oil. Oil pollution hazards identified during inspections

included inadequate containment structures surrounding the tanks and vulnerable storm drains. No spills were reported for this site.

None of these facilities are listed on state or federal regulatory databases as a documented or suspected release site. No site assessments have been conducted to determine whether petroleum releases have occurred at any of the three former bulk fuel storage facilities. Manke Family Resources LLC has owned all three former bulk plant properties since the mid-1980s. Manke constructed a gravel barge loading and staging facility just north of the bulk plant sites for transporting finished aggregate by barge in 1997.

3.4.1. Contaminants of Concern

SVOCs (including TPH, low molecular weight polycyclic aromatic hydrocarbons [LPAH], and HPAH) and heavy metals from crude and refined petroleum products are the primary chemicals of concern associated with petroleum bulk plants and major fuel spills.

3.4.2. Potential Contaminant Pathways to the Aquatic Environment

Spills reported at the Shell Oil facility suggest that soil and groundwater are likely impacted by COPCs, with surface runoff and groundwater as potential routes of entry into Oakland Bay.

3.4.3. Data Gaps

No sampling has been conducted in sediment near any of the bulk fuel storage facilities. Initial screening of surface and subsurface sediment should be conducted to determine the need for potential further assessment. Analyses should include the broad range of COPCs discussed for marine sediments in general.

3.5. Wood-Treated Marine Lumber

Wood pilings and other wooden marine structures have been used in waters of the U.S. for over a hundred years. These structures are usually employed as structural supports, for anchoring log rafts, for vessel mooring stations (i.e., dolphins), and for bulkheads. Marine-use wood has been preserved with chemicals to prevent deterioration from wood-degrading marine organisms (e.g., boring clams and crustaceans). Creosote is the most commonly used chemical wood preservative worldwide (Stratus 2006). PCP is not resistant to marine borers, and therefore, used for pilings in freshwater or in saltwater splash zones (Stratus 2006).

Numerous support pilings for docks and log storage areas, mooring dolphins, and bulkheads have been driven throughout Shelton Harbor since timber industries began operating along the waterfront in the mid-1920s. It is assumed that the majority of marine wood structures within the harbor were treated with creosote. However, there is a possibility that PCP-treated wood

pilings and structures were also used in the harbor, based on low to moderate concentrations of PCP detected in nine of the ten chemical screening stations and in all wood waste strata composites collected within the harbor (Ecology 2000).

Other areas in Oakland Bay where support pilings and other marine structures had been used since the late 1930s (NOAA 2008) include the barge off-loading docks associated with the three former bulk fuel storage facilities, along the west shore of Oakland Bay, two large log-boom areas including one area west of Chapman Cove and the other area west of and adjacent to Munson Point, and four small and separated sets of pilings associated with the oyster reserves within the northern portion of Oakland Bay including three sets north of Bayshore Point and one set near the mouth of Deer Creek.

The condition of pilings and other marine structures throughout Shelton Harbor and Oakland Bay varies. Three large log raft-boom areas (a total of 92.7 acres) that Simpson leased from DNR (two areas of which Rayonier previously controlled) were reportedly cleared of pilings and sunken logs in 1973. Two of the three areas were located west of and adjacent to Munson Point (identified as Maple Beach 1 and 2; 61.1 acres); the location of the third area was not reported, but consisted of 31.6 acres of aquatic land.

3.5.1. Contaminants of Concern

Creosote is a distillate of coal tar and its compounds are derived from several chemical classes, including PAHs, alkyl-PAHs, tar acids/phenolics, O-heterocyclics/furans (e.g., benzofurans), and aromatic amines (e.g., aniline). The types of PAH compounds found in creosote include phenanthrene, naphthalene, acenaphthene, fluorene, 2-methylnapthalene, pyrene, anthracene, and chrysene. PCP is within the class of phenolic compounds.

3.5.2. Potential Contaminant Pathways to the Aquatic Environment

PAHs can leach from wood into both sediment and water. The rate at which PAHs leach from treated wood is a complex function of many factors, including water chemistry, temperature, and salinity, as well as wood type and age. PAHs in the aquatic environment are present in both dissolved form and adsorbed to particulate materials. Low molecular weight compounds dissolve more readily in water than the heavier PAHs. The higher molecular weight PAH compounds, creosote, and PCP tend to accumulate in sediment (Stratus 2006).

3.5.3. Data Gaps

Based on a review of available data, there is a general lack of information on the extent of creosote- and PCP- treated timbers present in Oakland Bay and their possible influence on sediments and biota.

3.6. Sites in Downtown Shelton

A total of 43 sites located within the first three city blocks west of Front Street are identified as historically or currently handling hazardous materials. These sites are located less than a 1/2 mile from the Shelton waterfront. Of the 43 sites identified, 39 are petroleum-related businesses, including gasoline stations, automotive repair, and fuel distribution card-lock stations. Only six of the 39 sites have had documented releases to soil and/or groundwater, four of which have been cleaned up. The four non-petroleum sites include one historic and two current dry cleaning facilities, and a historic sheet metal workshop. Based on their locations, these 43 sites are not considered significant sources of contamination to sediment in Shelton Harbor and Oakland Bay.

3.6.1. Contaminants of Concern

The two types of contaminants released from downtown sites include petroleum products and dry cleaning solvents.

3.6.2. Potential Contaminant Pathways to the Aquatic Environment

Releases to the environment from downtown sources appear generally to be into groundwater. Contaminant plumes identified at a few of the sites are not extensive; however, there is the possibility that affected groundwater may enter storm drain piping that discharges to the harbor, as discussed in the next section. This does not appear to be an important pathway, due to the volatile nature of the contaminants and the relatively low concentrations possible.

3.6.3. Data Gaps

No sampling has been performed to address the possibility of contaminant inputs from downtown sources; however, loading to the harbor is likely insignificant.

3.7. City of Shelton Municipal Sewage and Stormwater Systems

3.7.1. Shelton Wastewater Treatment Plant

Since 1979, the City of Shelton owns and operates a WWTP located on Eagle Point at 1700 East Fairmount Avenue. It discharges secondary treated and disinfected municipal wastewater through a deepwater outfall pipe that extends into Hammersley Inlet (Figure 3-1). A solids digester and other solids handling improvements were made at the facility in 2004. Treatment is accomplished through screening, grit removal, oxidation ditches, final clarification, and disinfection with chlorine (Ecology 2008b).

The existing wastewater collection system extends throughout the majority of the current city limits. The system consists of 4- through 24-inch diameter gravity sewer lines, three small cul-

de-sac pump stations and one main pump station, and a one and one-half mile force main (Ecology 2008b). Most of the existing sewer lines are very old; pipes within the downtown core were installed in the 1910s and 1920s; pipes in the southern part of the city were installed in the 1940s and 1950s; and pipes in the northern part of the city were installed in the 1950s through 1970s (Ecology 2008b). The collection system is constructed of wood stave, vitrified clay, and concrete (Brown & Caldwell 1988).

Based on discharge monitoring reports between 2002 and 2007, discharge of treated effluent exceeded permit required limits for one or more of the following parameters (the latest exceedances):

- Biochemical oxygen demand (BOD) – exceeded the limit of 2,200 pounds per day in October 2002; August through December 2006; and February through June, and November 2007 (2,419 pounds per day)

- Total dissolved solids (TDS) – exceeded the limit of 810 pounds per day in December 2006, January 2007, and March 2007 (1,083 pounds per day)

- Chlorine – exceeded the limit for average (0.27 milligrams per liter [mg/L]) and/or maximum discharge (0.39 mg/L) in September 2006, April 2006, May, June, and October 2007 (maximum discharge of 0.45 mg/L).

The collection system experiences excessive inflow and infiltration (I&I) during periods of heavy rainfall. Most of the I&I is associated with shallow groundwater that leaks into pipe cracks. Other sources of I&I include surface waters from pipes connecting roof or basement drains and flow into manholes (Ecology 2008b). The collection system overflowed several times in recent years, with wastewater surcharging through manholes located on Mill, Park, and First Streets. Fecal coliform results of surcharged wastewater during two separate events in December 2001 were too numerous to count. These overflows generally flow into Goldsborough Creek. The WWTP has also exceeded their design flow limit during periods of rain. Excessive I&I dilutes influent wastewater and reduces the efficiency of treatment processes to remove pollutants (Ecology 2008b).

Because of the excessive I&I, Ecology issued an administrative order (DE 97WQ-S182) to the City in 1998, requiring replacement of the collection system within the downtown area and installing flow monitoring equipment. Portions of the sewer lines within the downtown area had been replaced in 1998; work on other portions of the downtown area have been completed recently or are scheduled to start in 2008.

3.7.2. Previous Wastewater Treatment Plant

Between 1950 and 1979, the City operated a WWTP located on Pine Street; the plant was designed for primary treatment of sewage including grit removal, sedimentation, single-stage digestion, and chlorination (Shelton-Mason County Journal 1950). Disinfected effluent

discharged to an outfall pipe located at the east end of the Pine Street right-of-way on the north side of the harbor (Figure 3-1). Before 1950, sewer pipes conveyed untreated sewage directly into the harbor (Shelton 2006).

3.7.3. Eagle Point Community Wastewater Treatment Facility

A former Imhoff septic tank and drainfield was located near Eagle Point, west of and adjacent to the former Simpson/Olympic Plywood plant at 1698 East Fairmount Avenue. This system was designed to treat residential waste for approximately 500 nearby residences. The septic system consisted of an Imhoff tank adjacent to an abandoned sludge bed, four drainfields, and two water wells. The system was used from 1889 until 1992, when the city dismantled it. Residences previously connected to this system switched either to individual on-site septic systems or connected to the existing WWTP at Eagle Point. No industrial waste discharged into this system.

3.7.4. Sewer Outfalls and Stormwater Discharge Points

Various historical and current discharge points, their descriptions, and type of discharge (if known) identified along the Shelton Harbor waterfront are summarized in Table 3-1 and shown in Figure 3-1.

The City stormwater collection system was installed throughout the downtown area sometime between the late 1800s and early 1900s. According to the City's public work map of the system, untreated stormwater runoff flows through buried pipes and outfalls directly into Goldsborough and Shelton Creeks, and eventually into the harbor.

In 1989, a storm drain sediment study was conducted to establish a stormwater priority pollutant concentration baseline (Ecology 1990). Fine-grained sediment was collected at six locations in representative areas of the city. Samples were analyzed for TOC, percent solids, grain size, SVOCs (USEPA method 8270), pesticides and PCBs (USEPA method 8080), and metals (USEPA method 200 series). Because storm drains were cleaned each summer, data reflected accumulations of less than one year.

The results of this study indicated that three of the six samples collected had contaminant concentrations exceeding SQS criteria. The locations of these samples and contaminants of concern detected are summarized in Table 3-2.

Table 3-1. Summary of industrial, stormwater, and sewer discharge points along the Shelton Harbor waterfront.

Discharge Point Map ID	Description	Source
1	Former city WWTP outfall to Oakland Bay (in operation from 1950 to 1979)	Michaud 1988; Brown & Caldwell 1988
2	Former 1-foot diameter concrete outfall pipe for dryer cleaning effluent containing treatment chemicals to Shelton Creek from the plywood plant	Archives Ecology 1969-1988 Simpson Plywood 1972 map
3	Stormwater discharge outfall to Shelton Creek from overlay plant	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
4	Stormwater discharge outfall to Shelton Creek from west end of the plywood plant.	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
5	A 1-foot inside diameter concrete pipe for discharging compressor cooling water either from the plywood plant or the planing mill.	Archives Ecology 1969-1988 Simpson Plywood 1972 map
6	Former 1-foot diameter concrete outfall pipe of screened effluent from a pond saw.	Archives Ecology 1969-1988 Simpson Plywood 1972 map
7	Stormwater discharge outfall discharge to harbor from east log storage yard.	Archives Ecology undated map, assumed 1987
8	Discharge from the shops, the boiler plant, and the west side of the overlay plant (a clarifier may also be connected).	Michaud 1988; Archives Ecology undated map, assumed 1987
9	Stormwater discharge outfall on north side of Goldsborough Creek from the planing mill and dry kiln area.	Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
10	Stormwater discharge outfall on north side of Goldsborough Creek from boiler plant.	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
11	Stormwater discharge outfall on north side of Goldsborough Creek from west log storage yard and parking lot at main entrance	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
12	Stormwater discharge outfall on north side of Goldsborough Creek from railroad roundhouse.	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
13	Stormwater discharge outfall on south side of Goldsborough Creek from Simpson sawmill log storage yard.	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987

Table 3-1 (continued). Summary of industrial, stormwater, and sewer discharge points along the Shelton Harbor waterfront.

Discharge Point Map ID	Description	Source
14	Stormwater discharge outfall on south side of Goldsborough Creek from west end of Sawmill #3	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
15	Industrial stormwater discharge below Sawmill #3	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
16	Non-contact cooling water discharge plus stormwater discharge below Sawmill #3	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
17	City of Shelton 54-inch stormwater discharge culvert	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
18	Industrial stormwater discharge pipe below former Sawmill #4	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
19	Stormwater discharge outfall to harbor from north side of the former Sawmill #4	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
20	Stormwater discharge outfall to harbor from south side of the former Sawmill #4	Archives Ecology 1969-1988 Simpson Plywood undated map, assumed 1987
21	Former ITT Rayonier Research Laboratory effluent outfall pipe	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
22	Overland runoff from Manke Lumber Company property (former Rayonier pulp mill)	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
23, 24	Two outfalls west adjacent to the former Simpson/Olympic Plywood plant (possibly one outfall from the former Shelton Imhoff Tank treatment plant and the other outfall a stormwater discharge outfall). Unknown which pipe is which.	Michaud 1988; Archives Ecology 1969-1988 Simpson Plywood undated, assumed 1987
25	Outfall connected to the former Simpson/Olympic Plywood plant	Archives Ecology 1969-1988 Simpson Plywood, undated map assumed 1987
26	Existing City of Shelton WWTP (in operation since 1979)	Ecology 2008b

Refer to Figure 3-1 for the locations of these discharge points.

Table 3-2. Results of 1989 storm drain sediment study in the City of Shelton.

Sample Station ID	Location	Contaminants of Concern Exceeding SQS Criteria		SQS Criteria
SEGR	Intersection of Second and Grove Streets	Chromium	185 and 284 mg/kg	260mg/kg
		Lead	1,010, to 1,350 mg/kg	450 mg/kg
		Zinc	434 to 473 mg/kg	410 mg/kg
		Acenaphthene	21 mg/kg, OC	16 mg/kg, OC
		Fluorene	35 mg/kg, OC	23 mg/kg, OC
		Phenanthrene	158 and 204 mg/kg, OC	100 mg/kg, OC
		Indeno(1,2,3-cd)pyrene	58 mg/kg, OC	34 mg/kg, OC
		Benzo(g,h,i)pyrene	55 mg/kg, OC	31 mg/kg, OC
		Butylbenzylphthalate	28 to 284 mg/kg, OC	5 mg/kg, OC
		Total PCBs	3 to 13 mg/kg, OC	12 mg/kg, OC
		4-Methylphenol	22 mg/kg, OC	0.67 mg/kg, OC
FFRA	Intersection of Front and Railroad Streets at the main entrance to Simpson Timber	Zinc	489 mg/kg	410 mg/kg
		Butylbenzylphthalate	20 mg/kg, OC	5 mg/kg, OC
FITU	Just north of the intersection of First and Turner Streets, across from Kneeland Park	Butylbenzylphthalate	8 mg/kg, OC	5 mg/kg, OC

Note: SEGR sample was analyzed three times, as an environmental sample, a duplicate sample, and a replicate sample.

3.7.4.1. 2002 Geotechnical Study for City of Shelton Basin II Project

A 2002 geotechnical study was conducted in support of the city's sewer replacement lines through portions of downtown Shelton. A groundwater sample was collected from a monitoring well installed at the southwest corner of West Franklin and 12th Street, approximately 1 mile west from the Shelton waterfront. The sample was collected to evaluate disposal options should dewatering of groundwater be required. The sample was analyzed for the presence of total and dissolved metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, silver, and zinc) using USEPA method 6000/7000 series, and fats, oil, and grease using USEPA method 413.2. The results indicated that the total and dissolved concentrations of copper, mercury, and zinc exceeded state surface water criteria (Table 3-3); none of the remaining six metals (total and dissolved) exceeded their respective surface water criteria and no fats, oil, or grease were detected.

The monitoring well is located in a residential area; the source of these metals is unknown. Because shallow groundwater likely enters the sewer and stormwater collection systems throughout the downtown area, there is a possibility that groundwater exhibiting these characteristics represent a potential source of contamination for the harbor.

Table 3-3. 2002 metal results (µg/L) in groundwater collected from a monitoring well located at West Franklin and 12th Street, Shelton, Washington.

	State Surface Water Criteria [a]			
Metal Constituent	Marine Criteria	Freshwater Criteria [b]	Total Metal Results	Dissolved Metal Results
Copper	3.1	6.3	7.54	28.1
Mercury	0.025	0.012	0.825	0.075
Zinc	81	58	79.5	386

Notes:
Metal values are reported in micrograms per liter (µg/L).
Only the metals results detected that exceeded marine and/or freshwater criterion are shown in this table.
[a] Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC.
[b] Criteria calculated assuming a receiving water hardness of 50 mg/L.

3.7.5. Contaminants of Concern

Based on the results of various activities associated with the city's stormwater and sewer collection systems, including the Simpson waterfront facility, the following contaminants of concern have been identified for the marine environment near the shoreline:

- Heavy metals, potentially from the non-contact cooling water and noted in recent NPDES monitoring; mercury, found in two Ecology 2000 sediment samples exceeding SQS; and chromium, lead, and zinc, found in storm drain sediment exceeding SQS
- SVOCs (PAHs, phenols, phthalates) from plywood and laminate production; from machinery and trucks associated with lumber storage; from spills/leaks of petroleum-based substances such as hydraulic fluid and fuel; and from sediment and surface water runoff from roadways
- PCBs associated with transformers located across the Simpson waterfront facility, as well as throughout downtown Shelton
- PCP associated with wood preservation
- Benzoic acid, 4-methylphenol, and 2,4 dimethylphenol produced from wood waste degradation.

Based on the fact that some industrial waste was discharged to both the Pine Street and Eagle Point WWTPs, there is a potential for:

- SVOCs (PAHs, phenols, phthalates) and dioxins/furans from hog fuel boiler baghouse waste.

3.7.6. Potential Contaminant Pathways to the Aquatic Environment

Historic nearshore outfalls and overland flow provide the major pathways for contaminants to move from upland source areas. Numerous storm drains have discharged to both Goldsborough

and Shelton Creeks, offering additional opportunities for wide-spread contamination across the harbor. Both WWTPs have discharged effluent to Oakland Bay and Hammersley Inlet.

3.7.7. Data Gaps

Two sediment samples are known to have been collected along the east shore of Shelton Harbor adjacent to the Simpson facility and south of Goldsborough Creek. SMS exceedances for mercury, PCP, benzoic acid, phenol, 4-methylphenol, and 2,4-dimethylphenol were identified at these two locations. Further sampling should be conducted at identified discharge points. Analyses should include the broad range of COPCs discussed for marine sediments in general.

3.8. Sites near Oakland Bay

This section summarizes several sites identified as potential sources of contamination located distant from Shelton Harbor and near Oakland Bay or adjacent to creeks that drain into the bay (see Figure 2-2).

3.8.1. Johns Prairie Industrial Park

Johns Prairie Industrial Park consists of 270 acres of developed land used for over 40 years by forest product businesses, such as sawmills, wood chipping companies, wood-treatment facilities, and utility pole manufacturers (Port of Shelton 2008). The industrial park complex is situated on top of a large prairie approximately 3/4 miles northwest of Oakland Bay (Figure 2-1). Johns Creek is the nearest surface water stream that flows west to east toward Oakland Bay, and between 850 and 1,550 feet north of the industrial park.

The U.S. Navy historically used the land that is now the industrial park as a Naval supply depot in the 1940s. In 1965, a creosote wood treatment facility began operating in the area (Thomas 1996). The former D.H. Knudsen Pole Company manufactured wood pilings within the industrial park between the late 1960s through the early 1990s.

The former Olympic Wood Products Company treated wood in the north central portion of the industrial park from 1981 to 2003. From 1971 to 1981, Pacific Forest Products operated on the site. Permatox-1 (containing PCP), PQ-8 (a copper wood preservative), fungicides, and other wood treatment chemicals were used in a dip tank from the late 1970s to the mid-1990s. During a 2003 site investigation, soil and groundwater samples were collected and analyzed for the presence of petroleum products and PCP. Based on soil results, cleanup activities at this site were completed in 2004, which included removal of 452 tons of contaminated soil and removal of the dip tank. No groundwater contamination was found.

3.8.2. Shelton WSDOT Maintenance Facility

The Shelton Washington State Department of Transportation (WSDOT) maintenance facility is located west of State Route 3 on Johns Prairie County Road, approximately 1,800 feet west-northwest of Oakland Bay (Figure 2-1). Two USTs were decommissioned and removed, along with an oil house, in 1995. The tanks, installed in 1962, previously contained diesel and unleaded gasoline. During tank removal, oil contamination was present surrounding the tanks, as well as in an east-west drainage swale used to capture runoff with petroleum contaminants from pressure-washing trucks. Approximately 80 cubic yards of contaminated soil from the tank area and the drainage swale was removed from the site.

No groundwater was encountered during excavation and removal of the tanks. Depth to groundwater from a nearby well measured approximately 117 feet below ground surface, with assumed flow direction to the east-southeast toward Oakland Bay.

3.8.3. Bayshore Union 76 Gas Station – East 3841 SR 3

The Bayshore Union 76 gas station is located adjacent to Johns Creek at East 3841 SR 3, west of and adjacent to Bayshore Point (Figure 2-1). Johns Creek flows east and south through Bayshore Point and discharges into Oakland Bay. This gasoline station has operated at this location since the early 1970s. The station is listed in the Ecology UST database. One gasoline tank was closed in-place in 1989 (location unknown); three gasoline tanks are currently in operation (locations unknown). These tanks were installed in 1986 and upgraded with cathodic protection in 2006.

3.8.4. Calvin J. Moran Property – East 4483-4487 SR 3

The Calvin J. Moran property is located at East 4483-4487 SR 3 less than 300 feet of Oakland Bay (Figure 2-1). The Moran property is listed in the Ecology UST database. A concrete UST with a total tank capacity ranging between 600 and 750 gallons existed on the property, according to a 1986 UST notification form. The tank was used to preserve fence posts with Osmos; indicated on a form by the property owner to contain a high concentration of arsenic. The tank was reportedly between 21 and 30 years old and last used in 1960. It was also reported that the concrete tank overflowed during periods of heavy rainfall. The location of this tank is unknown.

3.8.5. Deer Creek Store – East 5881 SR 3

Deer Creek Store is a convenience store and gasoline service station located at East 5881 SR 3, approximately 2,300 feet northeast of the Oakland Bay shoreline (Figure 2-1). The gasoline station has operated at this location since 1970. In 1990, three USTs located in the south-central portion of the site were closed in-place, and three additional gasoline USTs were installed. In 1995, gasoline-contaminated soil was present during the removal of two of the three closed in-place tanks for installing a pump island canopy. Approximately 15 tons of contaminated soil

was removed from the site, but no confirmation soil samples were collected. Results from a 2002 site assessment involving probe sampling indicated gasoline, diesel, and BTEX at concentrations above MTCA cleanup criteria in soil and groundwater. Four groundwater monitoring wells were installed and monitored conducted from 2002 until March 2007, when Ecology issued a No Further Action (NFA) designation for the site based on groundwater results.

3.8.6. Sewage Discharge into Malaney Creek

In January 2004, the northern portion of Oakland Bay was closed for shellfish harvesting due to massive amounts of sewage solids illegally disposed of by a septic tanker on his property located adjacent to Malaney Creek (Figure 2-1), approximately 1.7 miles east-northeast of Oakland Bay on East 80 Halberg Road. Biosolids hauled from three Mason County-owned WWTPs were spread across the property over several months. It was also reported that biosolids had been disposed of on the property prior to 2002.

Water quality samples were collected on the property, in Malaney Creek, and in Oakland Bay by the Mason County Health Department, the Squaxin Island Tribe, and WDOH. Results of samples collected on the property indicated fecal coliform contamination ranging from 8 to over 1,600 cfu/100 ml. The result of a sample collected at the mouth of Malaney Creek had a concentration of 30 cfu/100 ml. Results of previous sampling of Malaney Creek and Oakland Bay conducted by the various agencies were also reviewed to determine if there was any correlation between various septic hauling dates and fecal coliform results. Based on quantity, location, and site observations during the inspection visit, WDOH concluded that any runoff from this site could provide an impact to the Oakland Bay shellfish growing area. Further monitoring was warranted.

3.8.7. Contaminants of Concern

- SVOCs associated with petroleum products associated with the Bayshore Union 76 gas station and Deer Creek store
- Arsenic (and possibly PCP) associated with the wood preservative concrete dip tank at the Moran property.

3.8.8. Potential Contaminant Pathways to the Aquatic Environment

Most of the sites identified with hazardous substance releases, or potential releases, are located far enough away from Oakland Bay so as to not pose a major concern from the perspective of overland flow. However, the bacterial impacts associated with the Malaney Creek release show that surface water is a viable transport pathway at distances of over a mile. There is the possibility that groundwater also can be a transport mechanism, although contaminants typically do not travel further than a few hundred feet.

3.8.9. Data Gaps

No samples have been collected and analyzed for hazardous substances near any of the identified discharge points along Oakland Bay. Sampling should be conducted at identified discharge points. Analyses should include the broad range of COPCs discussed for marine sediments in general.

3.9. Oakland Bay

This section covers three sediment quality studies conducted in Oakland Bay between 1989 to 1999, information regarding ownership of shellfish reserves in the northern portion of the bay, and bacterial contamination studies conducted in 1987/1988 and 2004/2005.

3.9.1. Sediment Studies in Oakland Bay

Three sediment quality studies conducted in Oakland Bay were identified in the Ecology Environmental Information Management (EIM) database. The locations of sediment samples collected from these studies are shown in Figure 3-4; the name of the study conducted and samples collected in Oakland Bay include the following:

- 1997-1999 PSAMPNOA – Puget Sound Assessment and Monitoring Program and the NOAA National Status and Trends Program. Six sediment samples were collected in Oakland Bay near Shelton Harbor and adjacent to Munson Point. The samples include PSAMP/NOAA-227, PSAMP/NOAA-228, PSAMP/NOAA-229, PSAMP/NOAA-230, PSAMP/NOAA-231, and PSAMP/NOAA-232.

- 1989-1995 PSAMP HP – Puget Sound Assessment and Monitoring Program's historical sediment monitoring program. This program was part of the Puget Sound Ambient Monitoring Program; the sediment component of this program was implemented in 1989 by Ecology. Four sediment samples were collected in Oakland Bay as part of this study, including two samples collected outside of Shelton Harbor and one sample near Chapman Cove (same area was sampled twice). The samples include PSAMP HP-50 (in 1989), PSAMP HP-70 (in 1992), and PSAMP HP-101R (in 1990 and 1993).

- 1992 DNRREC92 – Washington DNR Aquatic Lands Sediment Quality Reconnaissance. Two sediment samples were collected in Shelton Harbor, including DNREC92SHLT01XX and DNREC92SHLT02XX.

Analyses conducted on the sediment samples collected in the three studies included grain size, TOC, SVOCs, metals, PCBs, and pesticides (DNR samples were not analyzed for PCBs or pesticides). No samples exceeded SMS criteria.

Figure 3-4. Sediment sample locations in Oakland Bay from studies conducted between 1989 and 1999.

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3.9.2. Shellfish Reserves

Privately-owned portions of Oakland Bay include the following:

- Most of the northern portion of Oakland Bay north of Bayshore Point
- South of and adjacent to Bayshore Point, and extending south from Bayshore Point along the western shoreline of Oakland Bay
- Chapman Cove and extending south from Chapman Cove along the eastern shoreline of Oakland Bay
- Shelton Harbor and east of Eagle Point
- Southeast of Munson Point along the northern shoreline of Hammersley Inlet.

The remaining portions of Oakland Bay are owned by DNR (Appendix D).

Rayonier was identified as the owner of several large aquatic land parcels located within the northern portion of Oakland Bay in 1952. By the early 1970s, Taylor Shellfish Company acquired these lands to re-establish shellfish reserves.

In 1994, Barbare Brothers Inc. applied for a shoreline permit to operate a shellfish reserve within a former log boom area previously owned by Rayonier and Simpson. The former log boom area covers approximately 91 acres of aquatic land and is located in Oakland Bay west of Chapman Cove. Wood pilings associated with the log boom area were present during a 1991 survey of the area (Appendix E). The permit reviewer reported that sea lions and harbor seals had been seen within the former log boom area, and suggested that fecal coliform contamination may derive, in part, from the presence of marine animals.

3.9.3. 2004/2005 Fecal Coliform Bacteria TMDL

This study, conducted by the WDOH, involved bi-monthly sampling at 27 sites on 10 major tributaries draining to Oakland Bay and Hammersley Inlet, including: Mill, Goldsborough, Coffee, Shelton, John's, Cranberry, Deer, Malaney, Uncle John's, and Campbell Creeks. The water quality standard for fecal coliform bacteria in these Class A streams are that the geometric mean of samples cannot exceed 100 cfu/100 mL of water and the 90th percentile of samples cannot exceed 200 cfu/100 mL of water. In August 2005, Shelton Creek, Deer Creek, and Uncle John's Creek had sites exceeding the 90th percentile portion of the standard, but not the geometric mean.

All of Hammersley Inlet and most of Oakland Bay are classified as Class A waterbodies. The marine water quality standard for fecal coliform bacteria in these waterbodies are that the

geometric mean of samples cannot exceed 14 cfu/100 mL of water and the 90th percentile of samples taken cannot exceed 43 cfu/100 mL of water. Shelton Harbor is classified as Class B, with a water quality standard of 100 cfu/100mL for the geometric mean and 200 cfu/100mL for the 90th percentile.

In Shelton Harbor, two samples exceeded the 90th percentile portion of the water quality standard. In Oakland Bay, only at the mouth of Chapman Cove was the 90th percentile portion of the standard exceeded, with a 90th percentile value of 209 cfu/100ml. All Hammersley Inlet sites met the water quality standard.

In September 2004, the shorelines of Oakland Bay and Hammersley Inlet were surveyed for small drainages and/or discharge points in addition to the major tributaries that may contribute pollution to the marine water bodies (Appendix C). The 279 identified locations included storm water culverts, unnamed tributaries, and direct runoff points from agricultural activities. In February 2005, out of the 142 drainage points sampled (those conveying water), only 10 had fecal coliform concentrations greater than 100 cfu/100 ml. Two sites were located in the upper portion of Oakland Bay, one on the northwest shore and one near the mouth of Deer Creek; one site was located just south of Chapman Cove; and the remaining sites were located on the southern shoreline of Shelton Harbor and the southern shoreline of Hammersley Inlet.

4.0 Summary of Data Gaps

Analysis of existing information for Oakland Bay and Shelton Harbor has included a review of the historical and current industrial, commercial, municipal, and residential activities prevalent around the waterfront. This review has also used data from prior marine sediment and biological investigations throughout the area. Based on the available information, the most important data gaps and areas of concern include the following:

- The spatial extent and contaminant concentration of wood waste debris and by-products found in specific areas of Shelton Harbor have been identified by the Ecology 2000 study. These areas of wood waste are directly associated with pulp, paper, and lumber mill activities, and COPCs include dioxins/furans, resin and fatty acids, guaiacols, and TOC. Sediments, bioassays, and tissue analyses are needed. Areas extending into Oakland Bay need to be sampled as well to characterize potential sediment contamination associated with log rafting activities.

- Petroleum contamination of sediment needs to be assessed in likely areas of concern that have been associated with petroleum-based industry, machinery and vehicles associated with timber processing, boating, and stormwater runoff from roads. Areas of concern are along the entire Shelton Harbor shoreline, areas of sedimentation from Goldsborough and Shelton Creeks, and at the bulk fuel storage facilities north of Shelton Harbor on Oakland Bay.

- Further characterization and delineation of COPC concentrations in sediment and biota near discharge points along the Shelton Harbor shoreline, including the city's sewer and stormwater discharge points, is needed. Specifically, dioxins/furans need further spatial and vertical extent delineation across the harbor, while other COPC characterization needs to occur at specific discharge locations.

- Sediment and biota contaminant characterization and delineation of areas of Shelton Harbor that receive input from the two creeks These areas receive point and non-point source influences that may carry COPCs (SVOCs, pesticides, PCBs, metals, dioxins/furans) into the harbor.

- TBT characterization in sediments and biota from areas of concern directly influenced by the marina.

- Characterization of sediments in association with dense areas of intact, degrading, and/or submerged creosote pilings. PAHs and creosols are of particular concern with regard to creosote pilings.

- Sediment and biota characterization is needed where significant intertidal and shallow subtidal beaches are present, and where contact with human populations is increased.

The data gaps identified in this report will help guide the development of the SAP for the Oakland Bay Sediment Characterization Study.

5.0 References

ATSDR. 2007a. Toxicological Profile for Arsenic. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts2.html.

ATSDR. 2007b. Toxicological Profile for Lead. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts13.html.

ATSDR. 2006a. Toxicological Profile for Hydrogen Sulfide. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp114.pdf.

ATSDR. 2006b. Toxicological Profile for Phenol. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts115.html.

ATSDR. 2005a. Toxicological Profile for Tin and Tin Compounds. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: www.atsdr.cdc.gov/toxprofiles/tp55.pdf.

ATSDR. 2005b. Toxicological Profile for Zinc. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts60.html.

ATSDR. 2004a. Toxicological Profile for Ammonia. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp126.pdf.

ATSDR. 2004b. Toxicological Profile for Copper. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts132.html.

ATSDR. 2002. Toxicological Profile for DDD, DDE, and DDT. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts35.html.

ATSDR. 2001a. Toxicological Profile for Di-n-butyl phthalate. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp135.pdf.

ATSDR. 2001b. Toxicological Profile for Pentachlorophenol. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: www.atsdr.cdc.gov/toxprofiles/tp51.html.

ATSDR. 2001c. Toxicological Profile for Polychlorinated Biphenyls. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts17.html.

ATSDR. 2000. Toxicological Profile for Chromium Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp7.pdf.

ATSDR. 1999. Toxicological Profile for Cadmium. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/tfacts5.html.

ATSDR. 1999c. Toxicological Profile for Dioxins. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: www.atsdr.cdc.gov/toxprofiles/tp9-c5.pdf.

ATSDR. 1999d. Toxicological Profile for Mercury. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp46.pdf.

ATSDR. 1997. Toxicological Profile for Used Mineral-Based Crankcase Motor Oil. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp102.pdf.

ATSDR. 1995a. Toxicological Profile for Fuel Oils. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp75.pdf.

ATSDR. 1995b. Toxicological Profile for Gasoline. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: http://www.atsdr.cdc.gov/toxprofiles/tp72.pdf.

ATSDR. 1995c. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. ATSDR website: www.atsdr.cdc.gov/toxprofiles/tp69.pdf.

Berbells, Scott. 2003. 2003 Shoreline Survey of the Oakland Bay Shellfish Growing Area. Public Health Advisor for the Washington State Department of Health, Division of Environmental Health, Shellfish and Water Protection Office.

Brown & Caldwell. 1988. Infiltration and Inflow Control Program – City of Shelton. Report is available at the Washington Southwest Regional State Archives (Box 1080 [location: 06-A-259]; folder – Shelton STP, Water Quality Enforcement, 1989-1990).

Cuinnell, Steve. April 1, 2008. Personal communication (phone conversation with Diana Phelan, Herrera Environmental Consultants, Inc.) regarding marine fish tissue sample studies conducted in the Shelton/Oakland Bay area. Fishery Biologist (coordinates fish sampling studies), Washington Department of Fish and Wildlife, Fish Program.

CH2M Hill. 1987. Final Dioxin Study Report – Simpson Timber Company. Report was prepared for Simpson Timber Company. March 1987. The report is available at the Washington Southwest Regional State Archives (Box 519 [location: 02-A-207]; folder – Simpson Dioxin Study 1986, 1987).

Ecology. 1990. Shelton Storm Drain Sediment Study (1989) Results. Ecology Memorandum 90-e15. Prepared by Betsy Dickes, Washington Department of Ecology, Environmental Investigations and Laboratory Services Program, to Darrel Anderson, Ecology Southwest Regional Office. August 6, 1990.

Ecology. 1998. Washington State Dioxin Source Assessment. Washington State Department of Ecology, Environmental Investigations and Laboratory Services, and Hazardous Waste and Toxics Reduction Program. Publication No. 98-320. July 1998.

Ecology. 2000. Reconnaissance Survey of Inner Shelton Harbor Sediments – Chemical screening of nearshore sites and evaluation of wood waste distribution. Report was prepared by Dale Norton, Randy Cootz, and Katina Kapantais of the Washington State Department of Ecology, Environmental Assessment Program, Olympia, Washington. Ecology publication no. 00-03-014. May 2000.

Ecology. 2004a. Oakland Bay Study – a dye and modeling study in an enclosed estuary with a high degree of refluxing. Report prepared by S.L. Albertson, Washington Department of Ecology, Environmental Assessment Program in Olympia Washington. Ecology publication No. 04-03-020. May 2004.

Ecology. 2004b. Quality Assurance Project Plan – Fecal Coliform Bacteria TMDL for Oakland Bay-Hammersley Inlet and Tributaries. The QAPP was prepared by Anise Ahmed and Lawrence Sullivan, Washington State Department of Ecology, Environmental Assessment Program, Olympia, Washington. Ecology publication No. 04-03-111. September 2004. Available on Ecology website: http://www.ecy.wa.gov/pubs/0403111.pdf.

Ecology. 2005. Initial Investigation Field Report – Simpson Marine Railway. Washington State Department of Ecology, Environmental Report Tracking System (ERTS) no. 542245. Report was provided to Herrera Environmental Consultants by Cynthia Erickson of Ecology via email on April 11, 2008.

Ecology. 2006. Exhibit B – Draft Cleanup Action Plan, Evergreen Fuel Facility, 661 East Pine Street, Shelton, Washington. The draft Cleanup Action Plan was prepared in accordance with the requirements of Agreed Order No. DE 03TCPSR-5707 issued by the Washington State Department of Ecology, Lacey, Washington. Document available on Ecology website: http://www.ecy.wa.gov/programs/tcp/sites/evergreen_fuel/EV%20FUELS%20FINAL%20DRAFT%20CAP.pdf.

Ecology. 2008a. Sediment Sampling and Analysis Plan Appendix – Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards (Chapter 173-204 WAC). Washington State Department of Ecology, Toxics Cleanup Program. Publication no. 03-09-043. Revised February 2008.

Ecology. 2008b. Fact Sheet for National Pollutant Discharge Elimination System (NPDES) Permit WA0023345 – City of Shelton Wastewater Treatment Plant. Available on Ecology website: http://www.ecy.wa.gov/programs/wq/permits/permit_pdfs/shelton/sheltonfs.pdf.

EDR. 2008. Environmental Database Search Report for the Shelton/Oakland Bay, Front Street, Shelton, Washington, 98584, inquiry number 2155622.1s. Environmental Data Resources, Inc., Milford, Connecticut. March 6, 2008.

Farallon Consulting, LLC (Farallon). 2005. Final Remedial Investigation Report – Evergreen Fuel Facility, 661 East Pine Street, Shelton, Washington. Report was prepared by Farallon and Anchor Environmental, LLC for CC Cole and Sons, Inc., D.B.A. Evergreen Fuel Company and Chevron Corporation. November 30, 2005. The two volume report is available in central records of the Washington State Department of Ecology, Southwest Regional Office in Lacey, Washington.

Farallon. 2007. Compliance Groundwater Status Report, Former Evergreen Fuel Facility, Shelton, Washington, sent to Dom Reale, Washington State Department of Ecology, Southwest Regional Office, December 20, 2007.

HistoryLink.org. 2008. Mason County – Thumbnail History. Essay No. 7730. Visited History Link website on February 22, 2008: http://www.historylink.org/essays/output.cfm?file_id=7730.

Kenny, Stephanie. 2007. Oakland Bay Action Plan. Ms. Kenny is an Environmental Health Specialist with the Mason County Public Health. August 16, 2007.

Lewis, Richard J., Sr. 1997. Hawley's Condensed Chemical Dictionary. Thirteenth Edition. Van Nostrand Reinhold, division of International Thomson Publishing, Inc., New York, New York.

Long, E.R., and Morgan, L.G. 1991. The potential for biological effects on sediment-sorbed contaminants tested in the National Status and Trends Program: National Oceanic and Atmospheric Administration. Technical Memorandum NOS/OMA 52.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19(1), 81-97.

Malcolm Pirnie. 2006. Remedial Investigation for the Marine Environment near The Former Rayonier Mill Site, Prepared for Rayonier – Jacksonville, Florida. April 2006.

MRC. 2008. Whatcom County Marine Resources Committee Projects – Marine Creosote Log Remediation Project. Whatcom County MRC website: http://whatcom-mrc.wsu.edu/MRC/projects/restoration_creosote.htm.

Mason County. 2008. Property characteristics, sales history, and ownership information on properties located within the Shelton/Oakland Bay study area available online from the Mason County GIS map viewer website. Aerial photographs within the study area taken in 2005. Visited the Mason County Assessor website in February and March 2008: http://mapmason.co.mason.wa.us/website/mason/viewer.htm.

MCHS. 2008. Mason County Profile 2007 – a supplement to the Shelton-Mason County Journal. Historical information presented by the Mason County Historical Society on pages 36 through 54. Visited the Mason County website on February 22, 2008: http://www.masoncounty.com/.

Mercuri, Joyce. 2005. Draft Remedial Investigation Report, July 12, 2005 Evergreen Fuel, review of sediment and seep results, September 23, 2005, Department of Ecology site file.

Michaud, Joy P. 1988. Investigation of Bacterial Contamination of the Inner Harbor of Oakland Bay, 1987-1988 Winter Study. Segment No. 07-14-01. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Surface Water Investigations Section, Olympia, Washington. December 1988. Document available in archived Ecology files at the Washington Southwest State Archives (Box 1079, location 05-A-193, Water Quality File – Oakland Bay, 1987, 1988) and Ecology website: http://www.ecy.wa.gov/pubs/88e27.pdf. .

Michelsen, T., T. Shaw, and S. Stirling, 1996. Testing, Reporting, and Evaluation of Tributyltin Data in PSDDA and SMS Programs. Puget Sound Dredge Disposal Analysis Issue Paper and Sediment Management Standards Technical Information Memorandum.

MRSC. 2008. Population of the City of Shelton. Visited Municipal Research and Services Center website on March 26, 2008: http://www.mrsc.org/cityprofiles/cityprofile.aspx?id=208.

NAIP. 2006. 2006 aerial photograph coverage of Oakland Bay, Shelton Harbor, and surrounding area. U.S. Department of Agriculture, National Agriculture Imagery Program. The 2006 aerial photograph is used as a base map for the figures in this report.

NOAA. 2008. Historical nautical charts with coverage of Shelton Harbor, Oakland Bay, and Hammersley Inlet in 1905, 1034, 1938, 1947, 1957, 1969, 1970, 1973, 1985, 1989, 1991-1993, 1996, 1998, and 1999. Visited the National Oceanic and Atmospheric Administration, Office of Ocean Survey, Historical Maps and Chart Collection website in March 2008: http://historicalcharts.noaa.gov/historicals/historical_zoom.asp.

NOAA. 2007. Mussel Watch Status and Trends: Sampling for Coastal Trends, Contaminants Monitored List. National Oceanic and Atmospheric Administration website: http://celebrating200years.noaa.gov/datasets/mussel/welcome.html#con. January 30, 2007.

ORCAA. 2005. Final Technical Support Document (TSD) and Statement of Basis – Simpson Timber Company, Shelton Mill. Olympic Region Clean Air Agency. February 3, 2005. 22 pages. Visited ORCAA website: http://www.orcaa.org/programs/aop-pdfs/aop_TSDsimpson.pdf.

PSEP. 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments – Final Report. Puget Sound Estuary Program. Prepared for U.S. Environmental Protection Agency, Region 10, Office of Puget Sound, Seattle, WA, and Washington Department of Ecology, Olympia, WA.

Shaffer, J. Anne. 2003. Water Quality as a Contemporary Limiting Factor to Olympia Oyster (*Ostreola conchaphila*) Restoration in Washington State. Document from the 2003 Georgia Basin/Puget Sound Research Conference. Puget Sound Partnership website: www.psat.wa.gov/Publications/2003research/rc03_abstracts/oral_sessions/session_8f.htm.

Shelton, City of. 2008. General information on the city Public Works Department website regarding existing sewer and stormwater collection systems. Maps showing locations of underground sewer and storm drain lines in the city of Shelton. Visited the City of Shelton website in March 2008: http://www.ci.shelton.wa.us/public_works/index.php.

Shelton, City of. 2006. Infrastructure Task Force Report. Information regarding the City's stormwater, water, and sewer utilities, and other city infrastructures. Prepared by the City of Shelton Commission. City of Shelton Public Works Department website: http://www.ci.shelton.wa.us/pdf/public_works/infastructure_taskforce_report.pdf.

Shelton-Mason County Journal. 1950. Bids Called for Sewage Plant Job (July 20, 1950). New Sewage Disposal Plant (September 7, 1950). Each article on page 1. Shelton, Washington. The Shelton-Mason County Journal newspapers (May 8, 1941 to December 30, 2004) are available on microfilm (number A4509) at the University of Washington Microfilm and Newspaper Collections.

Shelton, Port of. 2008. General information regarding history and current use and tenants of Johns Prairie Industrial Park. Visited Port of Shelton website in April 2008: http://www.portofshelton.com/.

Stratus. 2006. Creosote-Treated Wood in Aquatic Environments: Technical Review and Use Recommendations. Prepared by Stratus Consulting, Inc. for NOAA Fisheries, Southwest Division. Visited NOAA website: http://swr.nmfs.noaa.gov/wood/Creosote_Report-final.pdf.

Thomas, Berwyn B. and Fredi Perry. 1996. Shelton: the first century plus ten. Mason County Historical Society, Shelton, Washington. The book is available at the University of Washington, Pacific Northwest, Special Collections Library (library call no. F899.S5 T46 1996).

USEPA. 2006. An inventory of sources and environmental releases of dioxin-like compounds in the United States for the years 1987, 1995, and 2000. National Center for Environmental Assessment, Washington, DC. Publication No. EPA/600/P-03/002F. USEPA website: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=159286.

USEPA. 1998. Risk-Based Concentration Table, Region III. U.S. Environmental Protection Agency, Office of RCRA, Technical, and Program Support Branch.

UW. 2008a. Historical Sanborn fire insurance maps covering the City of Shelton in 1910, 1923, 1929, 1944, and 1961. Scans of relevant Sanborn maps were obtained from microfilm at the University of Washington Microfilm Collection, Seattle, Washington in February 2008.

UW. 2008b. Historical parcel maps (Metsker's Atlas) of Mason County in 1925, 1935, 1941, 1955, 1969, and 1988. The parcel maps were reviewed at the University of Washington, Pacific Northwest, Special Collections in February 2008.

UW. 2008c. Historical aerial photographs covering the Shelton/Oakland Bay area taken in 1942, 1957, 1965, 1980, and 2003. Scans of relevant photographs were obtained from the University of Washington Map and Aerial Photograph Collection in Seattle, Washington in February 2008.

UW. 2008d. Historical 7.5- and 15-minute topographic quadrangle maps of Shelton, Washington in 1952 and 1981. The topographic maps were reviewed at the University of Washington Map Collection in Seattle, Washington in February 2008.

UW. 2008e. Telephone directories (coverage from 1947 to 1996) and Polk's city directories (coverage from 1960 to 1969) of Shelton and vicinity, Washington. The telephone and city directories were reviewed at the University of Washington Pacific Northwest, Special Collections in Seattle, Washington in February 2008.

WDOH. 2005. Interagency memorandum from Lawrence Sullivan of the Washington Department of Health, Division of Environmental Health, Office of Shellfish and Water Protection to Christine Hempleman of the Washington Department of Ecology, Shorelands and Environmental Assistance Program. Subject: Oakland Bay Total Daily Maximum Load (TMDL) Quarterly Progress Report (November 2004 through August 2005). October 19, 2005.

West, Jim. 2008. Personal communication (phone conversation with Diana Phelan, Herrera Environmental Consultants, Inc. regarding fish tissue sample studies conducted in the Shelton/Oakland Bay area). Fishery Biologist (conducts analyses on fish tissue samples), Washington Department of Fish and Wildlife, Fish Program. April 1, 2008.

APPENDIX A

ITT Rayonier Laboratory Chemicals

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ITT Rayonier Inc.

Research Center
409 E. Harvard Avenue
Shelton, Washington 98584
Telephone (206) 426-4461

March 30, 1987

Mr. Greg Cloud
Department of Ecology
Southwest Regional Office
Olympia Airport LU-11
Olympia, WA 98504-6811

SUBJECT: ESTIMATED CHEMICAL LOSS FROM ANALYTICAL TESTING

As you requested at our March 16, 1987 meeting I have compiled the estimated loss of chemicals to our NPDES effluent discharge as a consequence of analytical testing here at the Rayonier Research Center. Since the testing is all batch, each test was evaluated as to the quantity of chemicals used. From this, and the average number of tests run during normal laboratory operations an average daily quantity was calculated. The calculated effluent concentration [in part per million (mg/L)] was determined by dividing the weight of chemical loss by the average volume of water discharged during 9 hours (1,230,000 liters). The result of this exercise is contained in the attached Table I.

I have discussed the feasability of diverting these discharges to the local POTW. Our plant engineer believes it would be cost prohibitive. The laboratory installation never included any provision for such circumstances. You will note the chemicals in use are small in both number and quantity. The resulting concentrations are very low and in some instances chemically neutralize one another.

The results of our fecal coliform testing to date are:

Date	Discharge				"Ambient"			
	M-FC		M-TEC		M-FC		M-TEC	
	F.C.	Kleb.	E. coli	Kleb.	F.C.	Kleb.	E. coli	Kleb.
March 4	NT	NT	0	12,000	NT	NT	900	9,600
10	2,300*	NT	50*	6,200*	2,100	NT	1,500	700
18	1,000	20,000	0	15,000	100	4,700	0	5,200

*Includes some "ambient."

Sincerely yours,

ITT RAYONIER INCORPORATED
Research Center

Philip A. Hamlin

tar
Attachment

cc: R. L. Casebier, Director

Table I

Estimated Chemical Loss to NPDES Permitted Discharge of Rayonier Research Center[1]

Compound	Average Quantity (grams)/day	Average[2] Concentration (ppm, mg/L)
P058 Acetic Acid EHW(B)	13,580	11
F003 Acetone	1,011	0.82
Ammonium Hydroxide (30%)	4	0.003
Cupriethyenediamine	250	0.20
[Copper Content]	16	0.013
[Ethylenediamine]	32	0.026
Carbon Black	<2	<0.002
Clay	<2	<0.002
Cleaning Solution [Chromere]	24	0.02
[Initially potassium dichromate/sulfuric acid: Spent is predominantly chromium(III) sulfate, potassium sulfate, and sulfuric acid. → U032? EHW(C+EP)		
Ferrous Ammonium Sulfate	25	0.02
Gypsum (Calcium Sulfate)	<100	<0.08
Hydrochloric Acid	15	0.01
Isopropyl Acetate	200	0.16
Magnesium Sulfate	60	0.05
Methanol	10	0.008
U080 F002 Methylene Chloride (EHW (C+H))	60	0.05
Nitric Acid	70	0.06
Perchloric Acid	16	0.01
Sodium Chloride	20	0.02
Sodium Hyrdoxide	440	0.36
10% solution	60	0.049
18% solution	100	0.08
50% solution	15	0.012
Sodium Sulfate	20	0.016
Sulfuric Acid	125	0.102
Vanillin	10	0.008
Miscellaneous:		
Photo Developer	2	0.002
Film Developer	2	0.002
Fixer (Sodium Thiosulfate)	11	0.008

1. Summation of chemical losses resulting from chemical (analytical) testing and photography.

2. Concentration was calculated by dividing the weight of chemical loss by the volume of water discharged during a 9 hour laboratory day. [Effluent volume would be about 865,000/24 x 9 = 324,375 gal/9 hr (1.23×10^6 liters).]

36 thousand gal/hr.

Also perhaps Osmium Tetroxide if doing electron microscopy work.

no map showing location of stations in file

25 Feb '87 - Oakland Bay (Inner Harbor and Stream Sampling)

Station		Fecals	% KES
ITE1		90,000 (heavy bkgrd growth may have bleed over) ?	0
ITE2		72,000	0
5A		8 (heavy bkgrd)	0
5B		9	0
4A	Point Sources	900	8%
4B		240	0%
10A		18	0
10B		11	0
13		<1	—
7		11	25%
ShelSTPA		20	0
ShelSTPB		69	0
ITI1A		900	0
ITI1B		1200 (heavy bkgrd)	0
22	Inner Harbor	3	6
24		1	0
25		1	<1
Sl A		23	0
Sl B		71	6
Gold M		3	—
Gold 2	Streams	5	—
Shel 1A		15	0
Shel 1B		15	—
Shel M		1	—
Shel 2		1	—

Stormwater pipe? Chg loading facility

the ITT Rayonier lab

NOV 30 1984

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*

Form Approved. OMB No. 2000-0059 Approval expires 12-31-85

OUTFALL NO.

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (if available) (2) MASS	d. NO. OF ANALYSES	3. UNITS (specify if blank) a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand *(BOD)*	6.2	16.8					4	mg/L	pounds			
b. Chemical Oxygen Demand *(COD)*	ND						1					
c. [illegible] Organic Car[illegible] *(TOC)*	5.5	14.9					1	mg/L	pounds			
d. Total Suspended Solids *(TSS)*	0.35	0.9					4	mg/L	pounds			
e. Ammonia *(as N)*	0.35	0.9					1	mg/L	pounds			
f. Flow	VALUE 0.822		VALUE		VALUE 0.726			MGPD		VALUE		
g. Temperature *(winter)*	VALUE 19.0		VALUE		VALUE 14.5		Cont.	°C		VALUE		
h. Temperature *(summer)*	VALUE 18.4		VALUE		VALUE 16.0		Cont.	°C		VALUE		
i. pH	MINIMUM 3.0	MAXIMUM 11.4	MINIMUM 3.0	MAXIMUM 11.4			Continuous	STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. [illegible]LUTANT AND CAS NO. *(if available)*	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (if available) (2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)			ND						1					
b. Chlorine, Total Residual			ND						2					
c. Color			ND						1					
d. Fecal Coliform			27,000		10,274		1605		36	CFU/ 100 ml				
e. Fluoride (16984-48-8)			0.5 ppm	1.2					1	mg/L	pounds			
f. Nitrate-Nitrite *(as N)*			ND						1					

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X' a. BELIEVED PRESENT	2. MARK 'X' b. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (if available) (2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (optional) b. NO. OF ANALYSES
g. Nitrogen, Total Organic (as N)			ND						1					
h. Oil and Grease			ND						1					
i. Phosphorus (as P), Total (7723-14-0)			0.32	0.9					1	mg/L	pounds			
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) [redacted] 226, Total		X												
k. Sulfate (as SO_4) (14808-79-8)			75.0	2.03					1	mg/L	pounds			
l. Sulfide (as S)			ND						1					
m. Sulfite (as SO_3) (14265-45-3)			ND						1					
n. Surfactants			ND						1					
o. Aluminum, Total (7429-90-5)			0.025	0.031					1	µg/L	grams			
p. Barium, Total (7440-39-3)			0.003	0.004					1	µg/L	grams			
q. Boron, Total (7440-42-8)			0.05	0.061					1	µg/L	grams			
r. Cobalt, Total (74[redacted]-4)			ND						1					
s. Iron, Total (7439-89-6)			0.071	0.087					1	µg/L	grams			
t. Magnesium, Total (7439-95-4)			1.4	1.722					1	µg/L	grams			
u. Molybdenum, Total (7439-98-7)			0.001	0.001					1	µg/L	grams			
v. Manganese, Total (7439-96-5)			0.011	0.013					1	µg/L	grams			
w. Tin, Total (7440-31-5)			ND						1					
x. Titanium, Total (7440-32-6)			ND						1					

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER

Form Approved.
OMB No. 2000-0059
Approval expires 12-31-85

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	2. MARK 'X' b. BELIEVED PRESENT	2. MARK 'X' c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (optional) b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)				ND						1					
2M. Arsenic, Total (7440-38-2)				ND						1					
3M. Beryllium, Total, 7440-41-7)				ND						1					
4M. Cadmium, Total (7440-43-9)				ND						1					
5M. Chromium, Total (7440-47-3)				ND						1					
6M. Copper, Total (7440-50-8)				6.0	7.38					1	µg/L	grams			
7M. Lead, Total (7439-92-1)				ND						1					
8M. Mercury, Total (7439-97-6)				ND						1					
9M. Nickel, Total (7440-02-0)				ND						1					
10M. Selenium, Total (7782-49-2)				ND						1					
11M. Silver, Total (7440-22-4)				ND						1					
12M. Thallium, Total (7440-28-0)				ND						1					
13M. Zinc, Total (7440-66-6)				12.0	14.76					1	µg/L	grams			
14M. Cyanide, Total (57-12-5)				ND						1					
15M. Phenols, Total				8.0	9.84					1	µg/L	grams			
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

(cuprietheylenediamine) IT adsorbed 16 grams/day

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)				ND						1					
2V. Acrylonitrile (107-13-1)				ND						1					
3V. Benzene (71-43-2)				ND						1					
4V. Bis (*Chloromethyl*) Ether (542-88-1)			X												
5V. Bromoform (75-25-2)				ND						1					
6V. Carbon Tetrachloride (56[illegible])				ND						1					
7V. [illegible]orobenzene (108-90-7)				ND						1					
8V. Chlorodibromomethane (124-48-1)				ND						1					
9V. Chloroethane (75-00-3)				ND						1					
10V. 2-Chloroethylvinyl Ether (110-75-8)				ND						1					
11V. Chloroform (67-66-3)				ND						1					
12V. Dichlorobromomethane (75-27-4)				ND						1					
13V. Dichlorodifluoromethane (75-71-8)			X												
14V. 1,1-Dichloroethane (75-34-3)				ND						1					
15V. [illegible]-Dichloroethane (107-06-2)				ND						1					
16V. 1,1-Dichloroethylene (75-35-4)				ND						1					
17V. 1,2-Dichloropropane (78-87-5)				ND						1					
18V. 1,3-Dichloropropylene (542-75-6)				ND						1					
19V. Ethylbenzene (100-41-4)				ND						1					
20V. Methyl Bromide (74-83-9)				ND						1					
21V. Methyl Chloride (74-87-3)				ND						1					

CONTINUE ON PAGE V-5

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – VOLATILE COMPOUNDS *(continued)*															
V. Methylene loride (75-09-2)				17.0	20.91 grams I T calculated 60 grams/day					1	µg/L	grams			
V. 1,1,2,2-Tetra-loroethane 9-34-5)				ND						1					
V. Tetrachloro-hylene (127-18-4)				ND						1					
V. Toluene 08-88-3)				ND						1					
V. 1,2-Trans-ichloroethylene 56-60-5)				ND						1					
V. 1,1-Di-loroethane 1-55-6)				ND						1					
V. 1,1,2-Tri-loroethane 9-00-5)				ND						1					
V. Trichloro-hylene (79-01-6)				ND						1					
V. Trichloro-uoromethane 5-69-4)			X							1					
V. Vinyl hloride (75-01-4)				ND						1					
GC/MS FRACTION – ACID COMPOUNDS															
A. 2-Chlorophenol 5-57-8)				ND						1					
A. 2,4-Dichloro-henol (120-83-2)				ND						1					
A. 2,4-Dimethyl-henol (7-67-9)				ND						1					
A. 4,6-Dinitro-O-resol (534-52-1)				ND						1					
A. 2,4-Dinitro-henol (51-28-5)				ND						1					
A. 2-Nitrophenol 38-75-5)				ND						1					
A. 4-Nitrophenol 100-02-7)				ND						1					
A. P-Chloro-M-resol (59-50-7)				ND						1					
A. Pentachloro-henol (87-86-5)				ND						1					
0A. Phenol 108-95-2)				ND						1					
1A. 2,4,6-Tri-chlorophenol 88-06-2)				ND						1					

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POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	2. MARK 'X' b. BELIEVED PRESENT	2. MARK 'X' c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (optional) b. NO. OF ANALYSES
MS FRACTION — BASE/NEUTRAL COMPOUNDS															
Acenaphthene -32-9)				ND						1					
Acenaphtylene 08-96-8)				ND						1					
Anthracene 20-12-7)				ND						1					
Benzidine 2-87-5)				ND						1					
Benzo *(a)* thracene 5-55-3)				ND						1					
Benzo *(a)* rene, 2-8)				ND						1					
3,4-Benzo- oranthene 05-99-2)				ND						1					
Benzo *(ghi)* rylene 91-24-2)				ND						1					
Benzo *(k)* luoranthene 07-08-9)				ND						1					
B. Bis *(2-Chloro- hoxy)* Methane 11-91-1)				ND						1					
B. Bis *(2-Chloro- hyl)* Ether 11-44-4)				ND						1					
B. Bis *(2-Chloroiso- opyl)* Ether (102-60-1)				ND						1					
3B. Bis *(2-Ethyl- exyl)* Phthalate 117-81-7)				4.0*						1	µg/L				
4B. 4-Bromo- henyl Phenyl ther (55-3)				ND						1					
5B. Butyl Benzyl hthalate (85-68-7)				ND						1					
6B. 2-Chloro- aphthalene 91-58-7)				ND						1					
7B. 4-Chloro- henyl Phenyl Ether (7005-72-3)				ND						1					
8B. Chrysene (218-01-9)				ND						1					
9B. Dibenzo *(a,h)* Anthracene (53-70-3)				ND						1					
0B. 1,2-Dichloro- benzene (95-50-1)				ND						1					
Dichloro- 1-73-1)				ND						1					

POLLUTANT AND CAS NUMBER (if available) — FRAC

* Blank Indicates Contamination

CONTINUE ON PAGE V-7

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POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	2. MARK 'X' b. BELIEVED PRESENT	2. MARK 'X' c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (if available) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (optional) b. NO. OF ANALYSES
FRACTION -- BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)				ND						1					
23B. 3,3'-Dichlorobenzidine (91-94-1)				ND						1					
24B. Diethyl Phthalate (84-66-2)				ND						1					
25B. Dimethyl Phthalate (131-11-3)				ND						1					
26B. Di-N-Butyl Phthalate (84-74-2)				ND						1					
27B. 2,4-Dinitrotoluene (121-14-2)				ND						1					
28B. 2,6-Dinitrotoluene (606-20-2)				ND						1					
29B. Di-N-Octyl Phthalate (117-84-0)				8.0	9.84					1	µg/L	grams			
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)				ND						1					
31B. Fluoranthene (206-44-0)				ND						1					
32B. Fluorene (86-73-7)				ND						1					
33B. Hexachlorobenzene (118-74-1)				ND						1					
34B. Hexachlorobutadiene (87-68-3)				ND						1					
35B. Hexachlorocyclopentadiene (77-47-4)				ND						1					
36B. Hexachloroethane (67-72-1)				ND						1					
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)				ND						1					
38B. Isophorone (78-59-1)				ND						1					
39B. Naphthalene (91-20-3)				ND						1					
40B. Nitrobenzene (98-95-3)				ND						1					
41B. N-Nitrosodimethylamine (62-75-9)				ND						1					
42B. N-Nitrosodi-N-Propylamine (621-64-7)				ND						1					

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS *(continued)*															
33B. N-Nitrosodiphenylamine (86-30-6)				ND						1					
34B. Phenanthrene (85-01-8)				ND						1					
35B. Pyrene (129-00-0)				ND						1					
36B. 1,2,4-Trichlorobenzene (120-82-1)				ND						1					
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)				ND						1					
2P. α-BHC (319-84-6)				ND						1					
3P. β-BHC (319-85-7)				ND						1					
4P. γ-BHC (58-89-9)				ND						1					
5P. δ-BHC (319-86-8)				ND						1					
6P. Chlordane (57-74-9)				ND						1					
7P. 4,4'-DDT (50-29-3)				ND						1					
8P. 4,4'-DDE (72-55-9)				ND						1					
9P. 4,4'-DDD (72-54-8)				ND						1					
10P. Dieldrin (60-57-1)				ND						1					
11P. α-Endosulfan (115-29-7)				ND						1					
12P. β-Endosulfan (115-29-7)				ND						1					
13P. Endosulfan Sulfate (1031-07-8)				ND						1					
14P. Endrin (72-20-8)				ND						1					
15P. [illegible]				ND						1					

CONTINUED FROM PAGE V-8

EPA I.D. NUMBER (copy from Item 1 of Form 1) | OUTFALL NUMBER

Form Approved.
OMB No. 2000-0059
Approval expires 12-31-85

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION — PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)				ND						1					
18P. PCB-1242 (53469-21-9)				ND						1					
19P. PCB-1254 (11097-69-1)				ND						1					
20P. PCB-1221 (11104-28-2)				ND						1					
21P. PCB-1232 (111[redacted]6-5)				ND						1					
22P. PCB-1248 (12672-29-6)				ND						1					
23P. PCB-1260 (11096-82-5)				ND						1					
24P. PCB-1016 (12674-11-2)				ND						1					
25P. Toxaphene (8001-35-2)				ND						1					

APPENDIX B

National Dioxin Study Data

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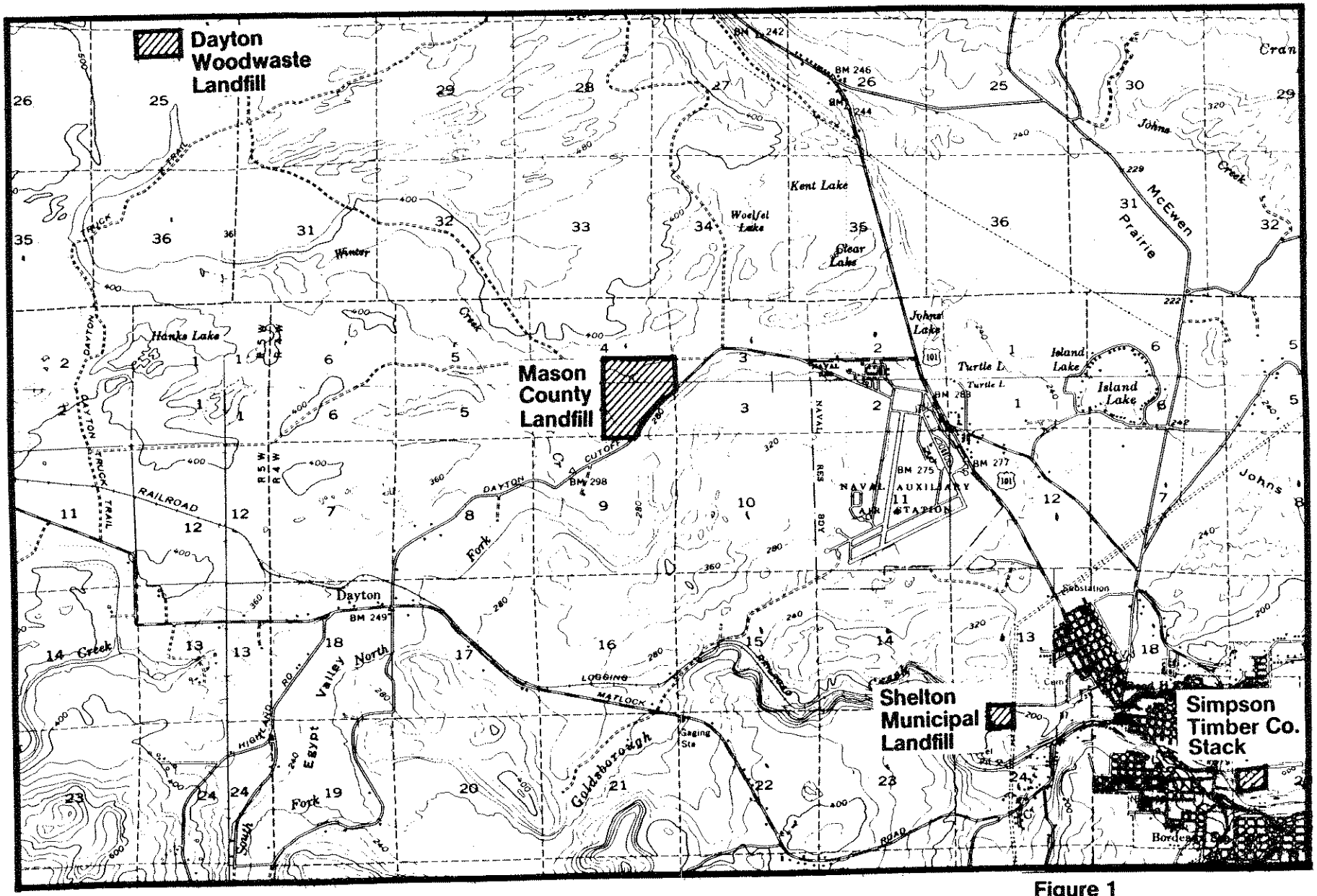
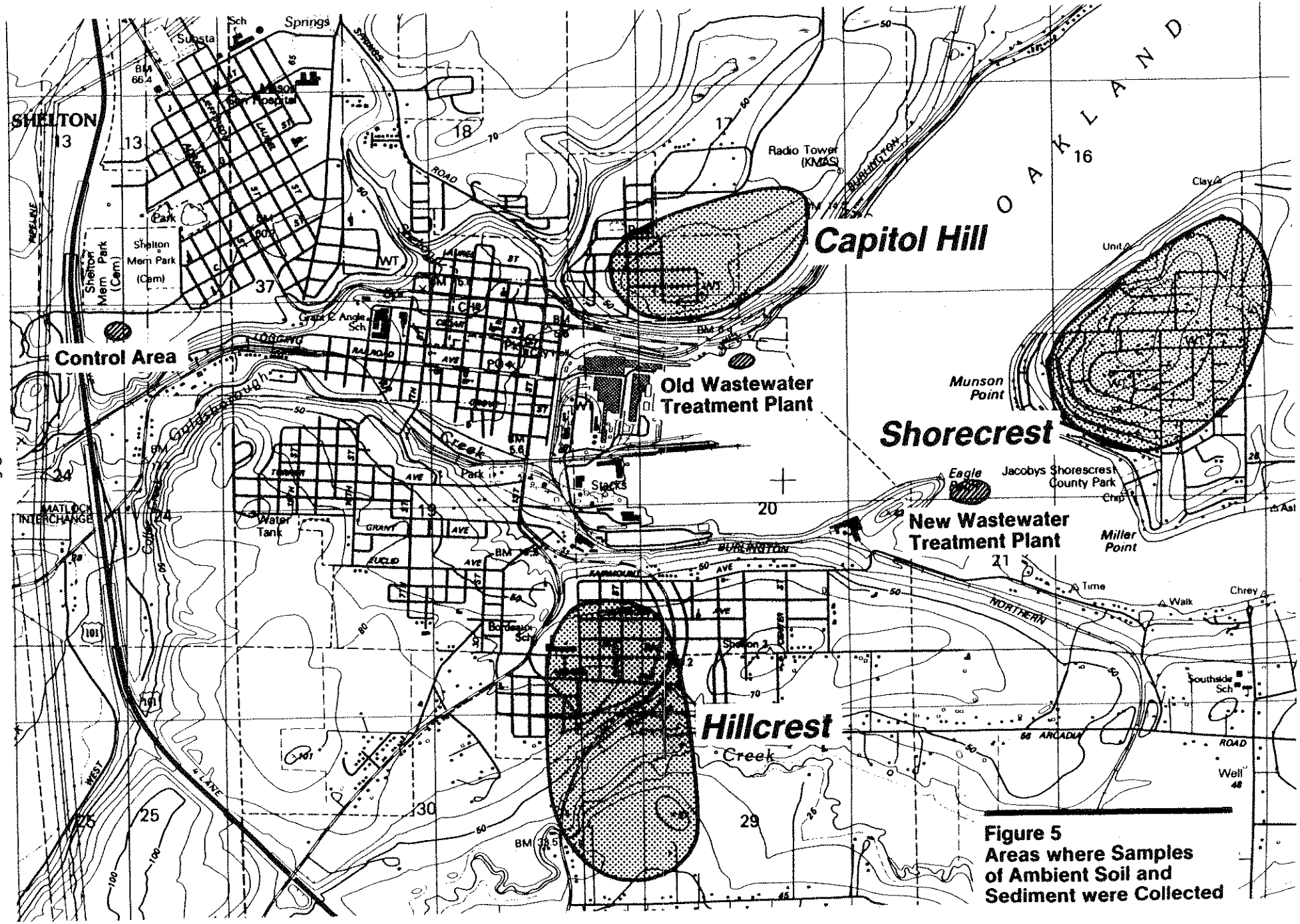


Figure 1
Simpson Timber Company
Waste Disposal Locations


SHELTON
Capitol Hill
Control Area
Old Wastewater Treatment Plant
Shorecrest
New Wastewater Treatment Plant
Hillcrest
Creek
Munson Point
Miller Point
Eagle
Radio Tower (KMAS)
Jacobys Shorecrest County Park
Goldsborough Creek
OAKLAND
Springs
Sch
Substa
Park
Shelton Mem Park (Cem)
Water Tank
Stacks
Time
Walk
Chrey
Southside Sch
Well
MATLOCK INTERCHANGE
BURLINGTON
NORTHERN
ARCADIA
ROAD
WEST
LANE
Figure 5
Areas where Samples of Ambient Soil and Sediment were Collected

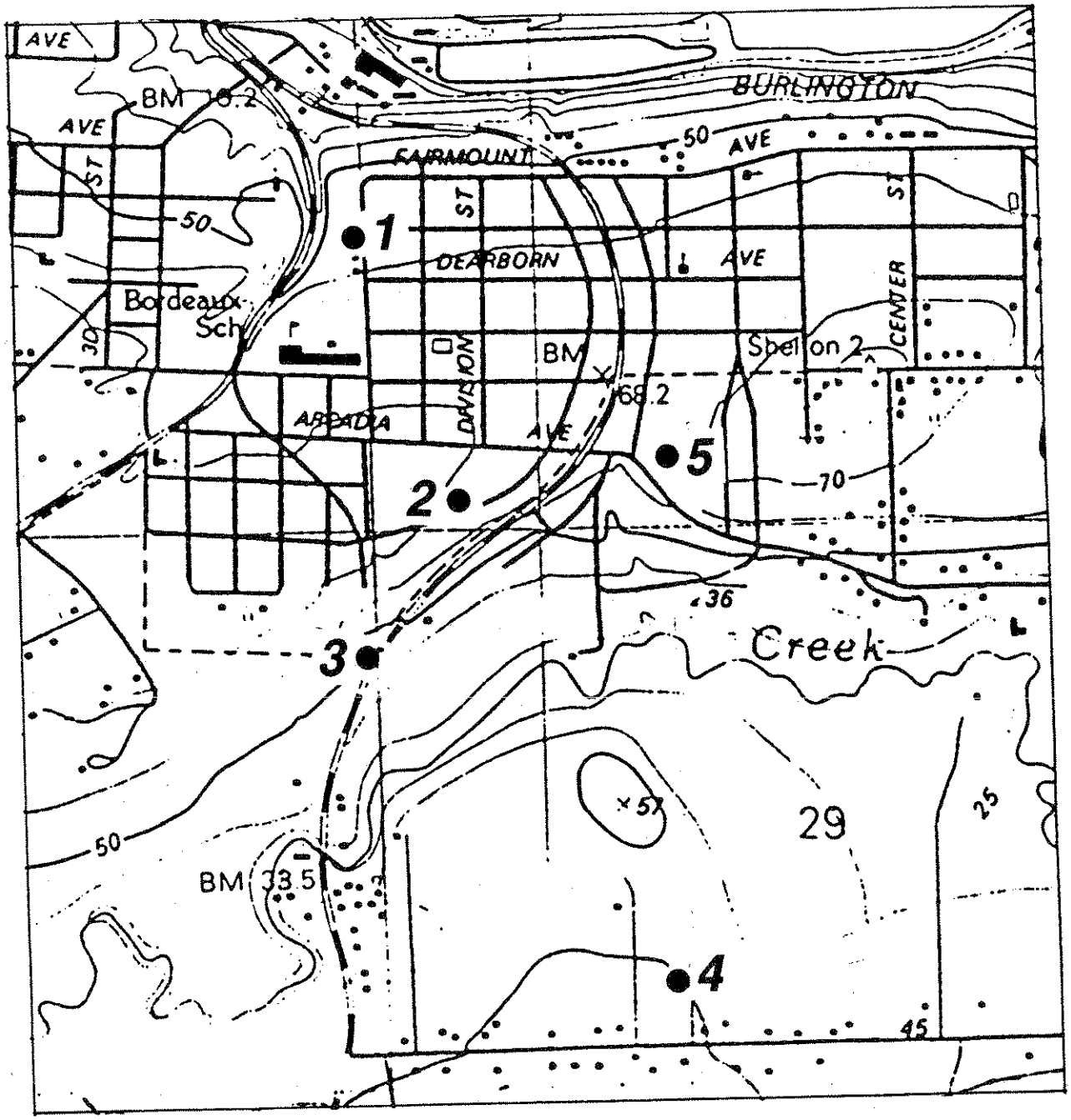


Figure 6
Locations Sampled
Hillcrest

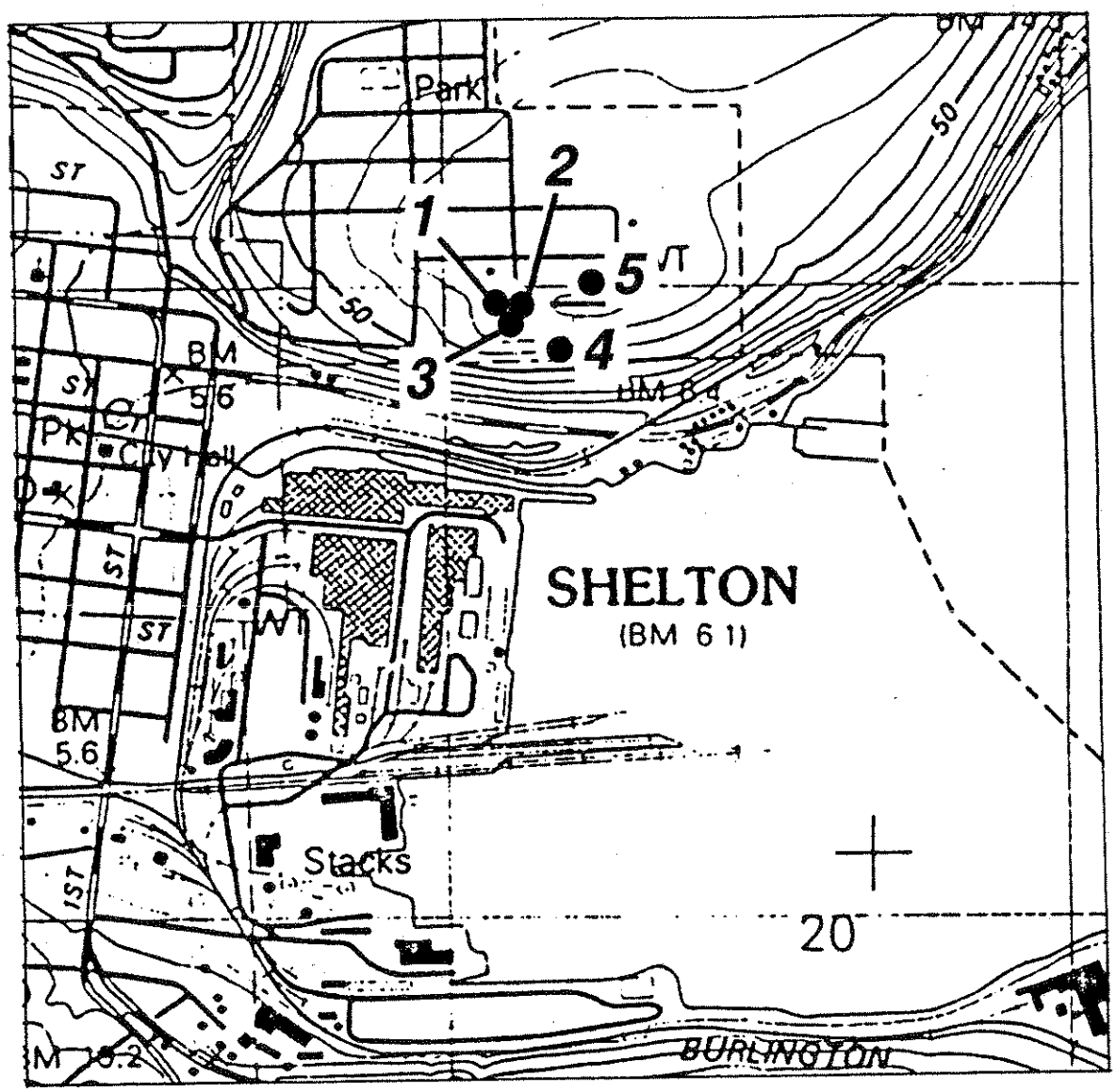


Figure 7
Locations Sampled
Capitol Hill

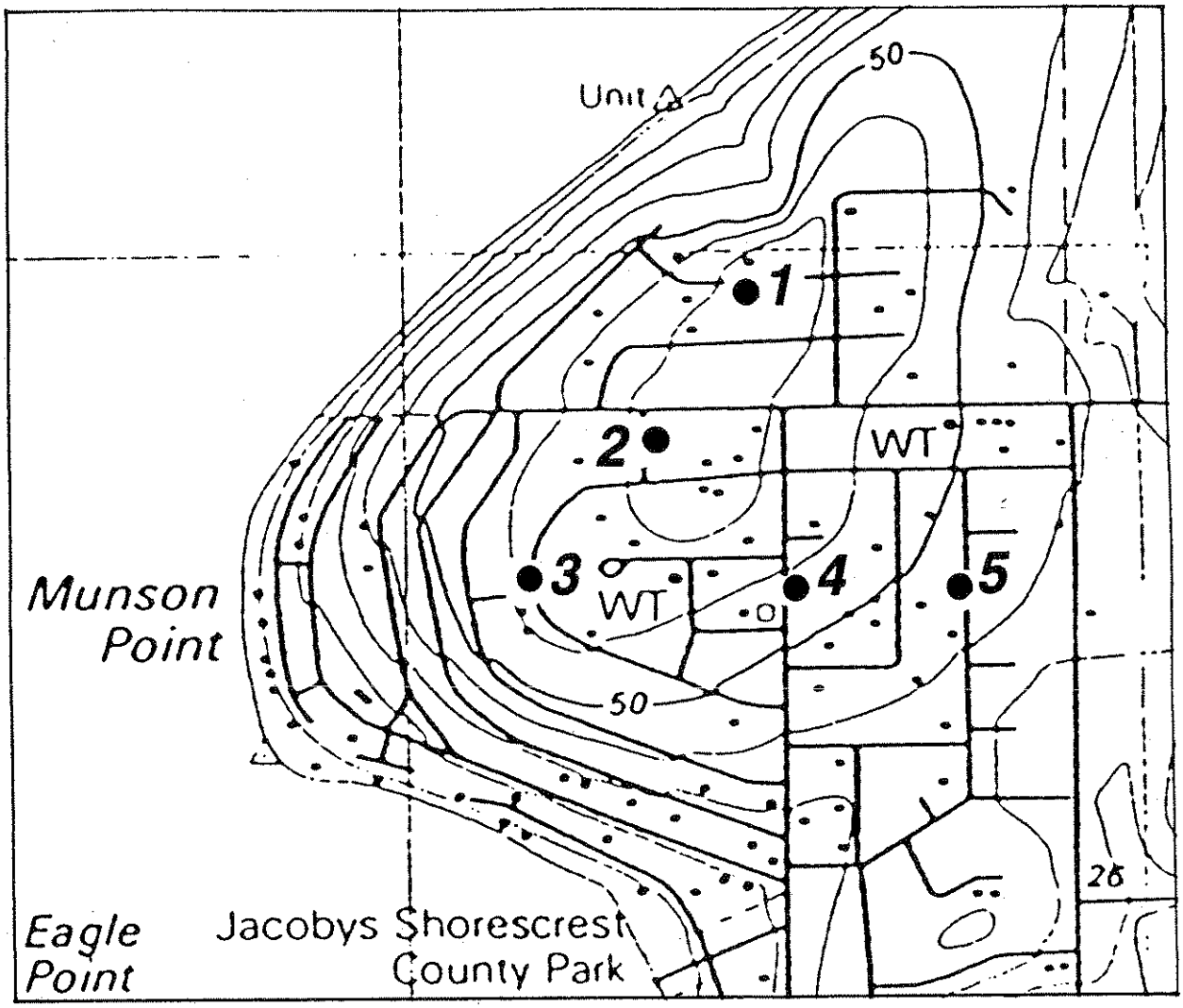


Figure 8
Locations Sampled
Shorecrest

TABLE 1 REPORTED CONCENTRATIONS (PARTS PER BILLION) OF CHLORINATED DIOXINS AND FURANS IN SAMPLES COLLECTED FROM STC FACILITIES AT SHELTON COMPARED WITH OTHER COMMON SOURCES

Homologue or Isomer	New Powerplant Cyclone Residue	Low Pressure Boiler Baghouse	High Pressure Boiler Baghouse	Low Pressure Boiler Composite	High Pressure Boiler Composite	EPA Results From High Pressure Boiler Baghouse[b] (Range)	Wood Stoves (Western (U.S.) (Range)	Fireplaces 25-Year Old	Fireplaces 12-Year Old
Tetrachlorinated Furans (Total)	0.43	118	9.2	7.6	0.16	135 - 170			
2,3,7,8 TCDF	0.078	10.5[c]	0.58	0.67	ND[a]	4.5 - 6.5			
Tetrachlorinated Dioxins (Total)	0.36	90	186	13.3	0.66	195 - 211			
2,3,7,8 TCDD	ND	4.2	ND	0.16	ND	0.8 - 1.2	0.0064 - 0.02		0.1
Pentachlorinated Furans (Total)	0.076	62	3.4	2.4	ND	71 -77			
1,2,3,7,8 PCDF	ND	7.2	0.37	0.34	ND				
2,3,4,7,8 PCDF	ND	6.9	0.33	0.22	ND				
Pentachlorinated Dioxins (Total)	0.24	161	226	9.9	1.7	236 - 273	0.093 - 9.22	3.7 - 25.0	ND - 0.89
1,2,3,7,8 PCDD	ND	14.0	0.61	0.34	ND				
Hexachlorinated Furans (Total)	ND	26.7	2.3	1.0	ND	44 - 59			
1,2,3,4,7,8 Hexa CDF	ND	3.3	0.25	ND	ND				
1,2,3,6,7,8 Hexa CDF	ND	4.0	0.18	ND	ND				
1,2,3,7,8,9 Hexa CDF	ND	ND	ND	ND	ND				
2,3,4,6,7,8 Hexa CDF	ND	2.6	ND	ND	ND				
Hexachlorinated Dioxins (Total)	0.83	169	190	8.0	1.3	283 - 348			
1,2,3,4,7,8 Hexa CDD	ND	10.8	4.6	0.38	ND				
1,2,3,6,7,8 Hexa CDD	ND	9.0	3.0	0.25	ND				
1,2,3,7,8,9 Hexa CDDD	----------	----------	Not Analyzed	----------	----------				
Heptachlorianted Furans (Total)	ND	4.8	1.4	0.21	ND	24 - 38			
1,2,3,4,6,7,8 Hepta CDF	ND	2.8	0.34	0.16	ND				
1,2,3,4,7,8,9 Hepta CDF	ND	ND	ND	ND	ND				
Heptachlorinated Dioxins (Total)	0.12	57.1	34.6	2.2	0.54	252 - 410			
1,2,3,4,6,7,8 Hepta CDD	ND	31.5	21.0	1.0	ND				
Octachlorinated Furans (Total)	ND	0.51	ND	ND	ND	2.3 - 3.0			
Octachlorinated Dioxins (Total)	0.27	14.1	5.5	0.78	0.49	44 - 72			

[a] ND = not detected. [b] From Table 5-22 of Keller, et al. (1986).

[c] Sum of 2,3,7,8- plus 1,2,6,9- plus 2,3,4,8-TCDF.

se5680/014/1

Table 2

PRELIMINARY[e] REPORTED CONCENTRATIONS (PARTS PER BILLION) OF CHLORINATED DIOXINS AND FURANS IN SAMPLES OF AMBIENT SOILS, SEDIMENT, AND SEWAGE SLUDGE FROM THE SHELTON AREA[a]

Homologue or Isomer	C3 Performance Sample[b]	C4 Field Blank[c]	C5 Capitol Hill	C6 City Landfill	C7 New STP Sediment	C8 Old STP Sediment	C9 Control Area	C9 Control Area (duplicate)	C10 Hillcrest	C11 Shorecrest
Tetrachlorinated Furans (total)	0.053	ND[d]	0.59	16.7	ND	ND	ND	ND	ND	ND
2,3,7,8-TCDF	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND
Tetrachlorinated Dioxins (total)	15.4	ND	0.28	59.8	ND	0.11	ND	ND	ND	ND
2,3,7,8-TCDD	8.0	ND	ND	0.17	ND	ND	ND	ND	ND	ND
Pentachlorinated Furans (total)	ND	ND	ND	9.8	ND	0.050	ND	ND	ND	ND
1,2,3,7,8-PDCF	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PCDF	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND
Pentachlorinated Dioxins (total)	5.2	0.80	0.34	155	0.046	0.80	ND	ND	ND	0.088
1,2,3,7,8-PCDD	0.42	0.23	ND	1.4	ND	ND	ND	ND	ND	ND
Hexachlorinated Furans (total)	1.1	ND	0.16	5.5	0.097	0.67	ND	ND	ND	ND
1,2,3,4,7,8-Hexa-CDF	ND	ND	ND	0.93	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-Hexa-CDF	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-Hexa-CDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-Hexa-CDF	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND
Hexachlorinated Dioxins (total)	181	5.6	0.30	152	0.65	0.98	0.086	ND	ND	0.12
1,2,3,4,7,8-Hexa-CDD	0.43	0.28	ND	2.7	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-Hexa-CDD	0.53	0.37	ND	4.8	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-Hexa-CDD	1.7	0.89	ND	2.8	ND	ND	ND	ND	ND	ND
Heptachlorinated Furans (total)	ND	ND	0.81	4.9	0.40	4.3	0.12	ND	ND	ND
1,2,3,4,6,7,8-Hepta-CDF	ND	ND	0.20	2.5	0.094	0.68	0.023	ND	ND	ND
1,2,3,4,7,8,9-Hepta-CDF	ND	ND	ND	0.49	ND	ND	ND	ND	ND	ND
Heptachlorinated Dioxins (total)	315	14.4	1.9	50.2	0.62	4.3	0.33	0.23	ND	0.36
1,2,3,4,6,7,8-Hepta-CDD	142	6.3	1.0	26.6	0.25	2.2	0.14	0.086	ND	0.17
Octachlorinated Furans (total)	0.30	ND	0.80	0.97	ND	6.2	ND	ND	ND	ND
Octachlorinated Dioxins (total)	178	86.8	6.4	19.3	1.4	13.8	0.85	0.56	ND	1.1

[a] See Figures 1 through 4 for location of sampling areas.

[b] EPA No. V58WQ02K1.

[c] EPA No. E19AD99R4.

[d] ND = not detected.

[e] Preliminary pending completion of EPA quality review.

se5685/050/1

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APPENDIX C

2004 Survey of Discharge Locations along Oakland Bay and Hammersley Inlet

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2004 Survey of discharge locations along Oakland Bay and Hammersley Inlet.

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APPENDIX D

DNR Aquatic Boundaries and Parcels

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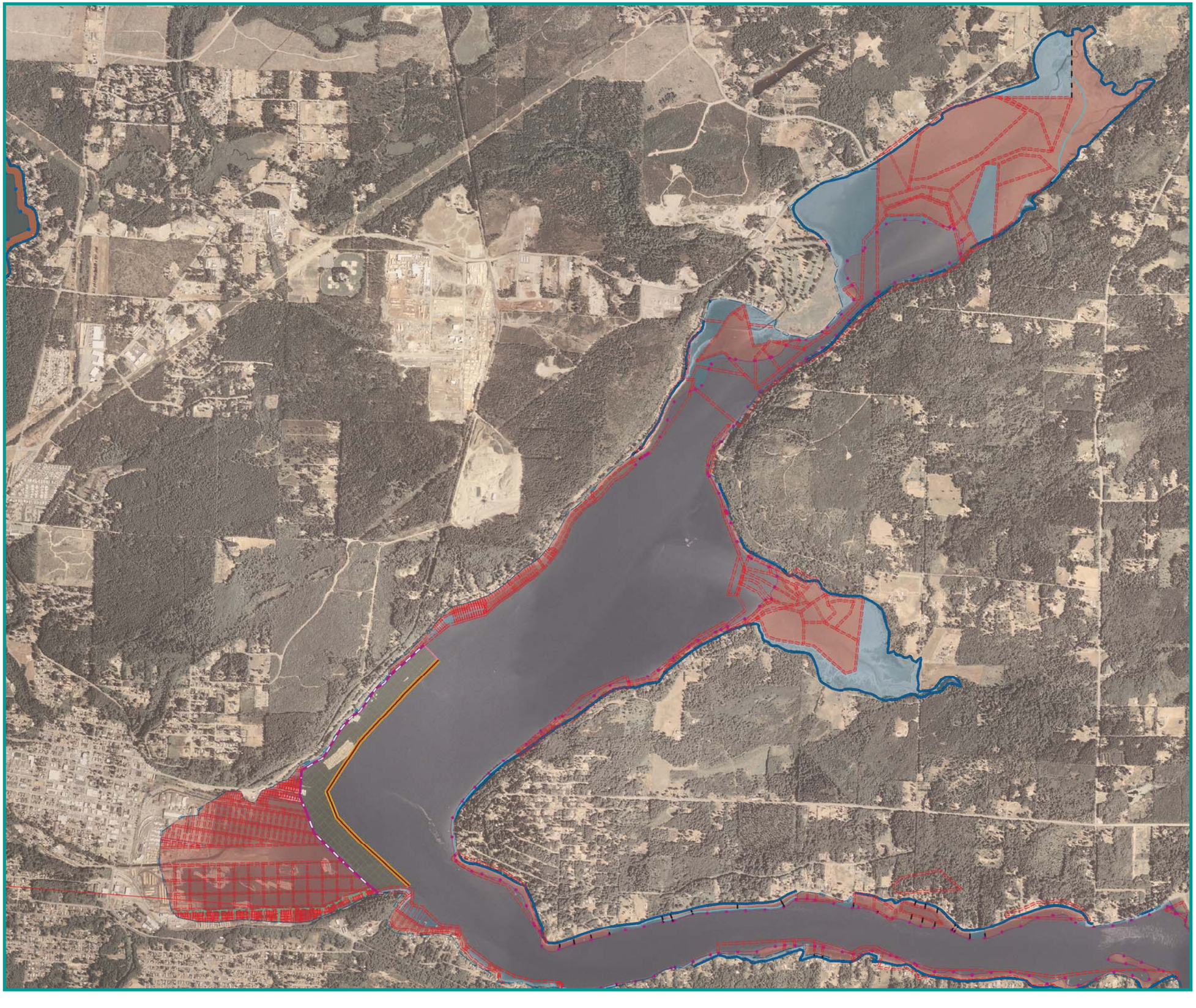

Aquatic Boundaries by Type of Boundary*

- 1/4 Mile From ELT
- 12 Mile Territorial Line
- 200 Mile EEZ Line
- 3 Mile State/Federal Line
- 6 Mile OCSLA Line
- Abandoned Shoreline
- Agreement Boundary
- City Boundary
- County Boundary
- Deed Line
- Degree of Latitude
- Degree of Longitude
- Depth of Water 70 Feet Below MLLT
- Established Line of Navigability
- Established Tidal Extent Line
- Estimated Line of Navigability
- Estimated Tidal Extent Line
- Extreme Low Tide
- Harbor Line Inner
- Harbor Line Outer
- Harbor Line Side
- Indefinite Boundary
- International Boundary
- Limit of Navigability
- Mean High Tide
- Mean Higher High Tide
- Mean Low Tide
- Mean Lower Low Tide
- Mean River Level
- Mean Sea Level
- Mean Tide Level
- Meander Line
- One Mile City Limit Line
- Ordinary High Water
- Ordinary Low Water
- Other PLS Line
- Platted Line
- Port Management Agreement Line
- Protracted Line
- Shoreline
- Tribal Reservation Boundary
- Two Mile City Limit Line

Aquatic Parcels by Type*

- Abandoned Bedland
- Abandoned Channel
- Abandoned Lake Shoreland
- Abandoned Marine Tideland
- Abandoned River Shoreland
- Abandoned River Tideland
- Canal
- Flooded Uplands
- Harbor
- Lake Bedland
- Lake Shoreland
- Marine Bedland
- Marine Tideland
- Not Applicable
- River Bedland
- River Shoreland
- River Tideland
- Unknown
- Waterway
- Private/Unknown

* Boundary and parcel legend items are listed for statewide classifications and there may be types listed, but not represented in regional maps

N W E S

Feet

0 660 1320 2640 3960

Washington State Plane South; NAD1983 HARN

Data Sources: Aquatic Boundaries and Parcels, DNR 2008; Orthophotos, NAIP (1 meter) 2006. 2008313tstr490

While every attempt has been made to use the best available data, this is a geographic representation of real world conditions with varying levels of uncertainty. As such it is not appropriate to use in place of an official survey or in legal proceedings

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

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APPENDIX E

Chapman Cove Piling
Lease Location Information

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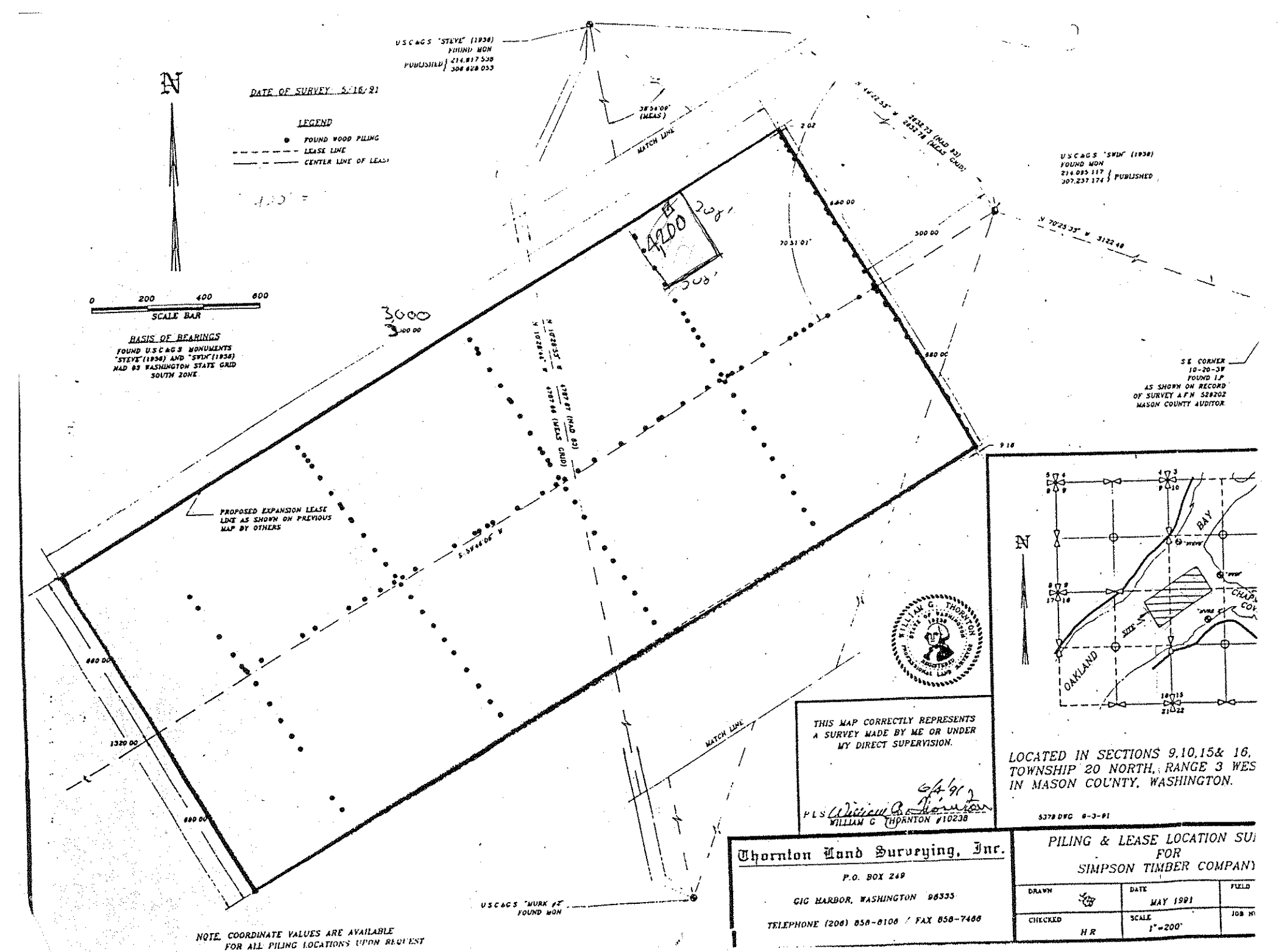

THIS MAP CORRECTLY REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION.

6/4/91

PLS William G. Thornton
WILLIAM G. THORNTON #10238

LOCATED IN SECTIONS 9,10,15& 16, TOWNSHIP 20 NORTH, RANGE 3 WES IN MASON COUNTY, WASHINGTON.

5378 DWG 6-3-91

Thornton Land Surveying, Inc.
P.O. BOX 249
GIG HARBOR, WASHINGTON 98335
TELEPHONE (206) 858-8106 / FAX 858-7466

PILING & LEASE LOCATION SU
FOR
SIMPSON TIMBER COMPAN

DRAWN	DATE	FIELD
	MAY 1991	
CHECKED	SCALE	JOB N
HR	1"=200'	

Chapman Cave
15-20-3