K Ply Site

Cleanup Action Plan

Issued by

Washington State Department of Ecology
Toxics Cleanup Program
Southwest Regional office
Olympia, Washington

May 19, 2015

FINAL

Table of Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

Acronym/ Abbreviation	Definition
AO	Agreed Order
ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
COC	Contaminant of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CPOC	Conditional point of compliance
CUL	Cleanup level
CY	Cubic yards
DNR	Washington State Department of Natural Resources
DRO	Diesel-range organics
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
ft/ft	Feet per foot
GRO	Gasoline-range organics
Harbor	Port Angeles Harbor
HAZWOPER	Hazardous Waste Operations and Emergency Response
ISCO	In situ chemical oxidation
ITT Rayonier	ITT Rayonier, Inc.
K Ply	K Ply Inc.
LNAPL	Light non-aqueous phase liquid

Acronym/ Abbreviation	Definition
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
MLLW	Mean lower low water
Mobil	Mobil Oil Corporation
MTA	Marine Trades Area
MTCA	Model Toxics Control Act
NRWQC	National Recommended Water Quality Criteria
ORC	Oxygen release compound
ORO	Oil-range orangics
OSHA	Occupational Safety and Health Act
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
Peninsula Fuels	Peninsula Fuels Company, Inc.
PenPly	Peninsula Plywood Company
PID	Photoionization detector
POC	Point of compliance
Port	Port of Port Angeles
RAO	Remedial Action Objective
RCW	Revised Code of Washington
RI/FS	Remedial Investigation/Feasibility Study
SEPA	State Environmental Policy Act
Site	K Ply Site
SWPPP	Stormwater Pollution Prevention Plan
TPH	Total petroleum hydrocarbon
UIC	Underground Injection Control
VOC	Volatile organic compound
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

Executive Summary

The K PLY Site is the location of a former plywood mill located in the industrial waterfront part of Port Angeles, Washington. The mill was built in the 1940s and operated continuously until 2007 under various owners. Leaks of hydraulic oil from several large presses within the mill contaminated the underlying soil and the leaks reached the groundwater table where it now forms a free phase product floating layer upon the groundwater table. In addition, leaks of gasoline from a petroleum pipeline that passed under the mill to an upgradient bulk fuel facility contaminated soil and groundwater under the mill building as well. Benzene-contaminated groundwater from the site flows into Port Angeles Harbor and presents a risk to the marine life in Port Angeles Harbor as well as humans that may eat contaminated seafood.

The location of these contaminants under an operating mill hindered a full investigation and cleanup. The mill closed permanently in 2011 and was demolished by the Port in 2013. Mill demolition was done as part of an Interim Cleanup Action funded by Ecology to allow for a more comprehensive RI/FS and cleanup action to be completed.

This document describes the background of the mill and the nature and extent of contamination across the entire mill Site, including the sediments in Port Angeles Harbor off-shore of the mill. The sediments were found to contain certain contaminants at levels similar to or lower than other parts of the harbor. Because these results didn't indicate a direct connection to the K Ply site, these contaminants in sediment off-shore of the mill will be addressed by Ecology as part of the larger Western Port Angeles Harbor sediment project.

The primary contaminants that will be addressed by this cleanup action plan are hydraulic oil and gasoline (petroleum hydrocarbons) that exist under a large portion of the former mill building. Smaller areas of fuel oil, dioxin-contamination and pentachlorophenol contamination of soil will also be addressed. Cleanup levels were established for all of the contaminants present in soil and groundwater. These cleanup levels are based on protection of human health from direct contact with soil, and protection of the groundwater that discharges to Port Angeles Harbor.

Four cleanup options were examined to achieve these cleanup levels, including 1) digging out the areas of free product only and treatment of the contaminated groundwater before it discharges to the Harbor; 2) digging out areas of free product only and chemical oxidation of the remaining contaminated soil; 3) excavation of all of the free product and all of the gasoline and hydraulic oil contaminated soil above cleanup levels from both the vadose and smear zones within approximately 200 feet of the bulkhead, and digging out all of the vadose contamination and the majority of the remaining smear zone contamination found greater than 200 feet from the bulkhead and 4) digging out all of the free product and all of the remaining hydraulic oil and gasoline contaminated soil in both the vadose and smear zones site wide. Post excavation bioremediation amendments would be applied to address residual contamination in both alternatives 3 and 4.

The selected cleanup action is Alternative 3 as it permanently removes the floating petroleum product and cleans up all contaminated soil site wide in the vadose zone and also addresses removal of the smear zone contaminated soils near the bulkhead and a large portion of the smear zone soils found further upgradient. This action, followed by the addition of bio-amendments (using infiltration galleries or in-situ via Geoprobe injections) to stimulate naturally-occurring bacteria will degrade residual contamination in both soil and groundwater to ensure protection of human health and the environment and attainment of cleanup levels. Following cleanup, site groundwater and areas of residual smear zone soil contamination will be monitored to demonstrate compliance with site cleanup levels. In addition, a restrictive covenant will be placed on the site requiring the use of the land remain industrial, identifing where areas of residual contamination are located and also requiring an assessment of the risk of vapor intrusion before construction of any new buildings. The effectiveness of the cleanup will be re-assessed every 5 years by Ecology.

1.0 Introduction and Site Background

This Cleanup Action Plan (CAP) describes the cleanup action selected by the Washington State Department of Ecology (Ecology) for the K Ply Site (Site). The Site is located at 439 W. Marine Drive in Port Angeles, Washington (Figure 1.1). It is Ecology's determination that the proposed cleanup action described in this document complies with Washington Administrative Code (WAC) 173-340-360 of the Model Toxics Control Act (MTCA). The CAP will be finalized pending consideration of public comment.

This CAP was developed using information presented in the Remedial Investigation/Feasibility Study (RI/FS) for the Site, which was prepared by Floyd|Snider on behalf of the Port of Port Angeles (Port). The RI/FS and CAP were prepared in accordance with Agreed Order (AO) No. DE 9546 between Ecology and the Port (Ecology 2012).

The Site is being cleaned up under the authority of MTCA, Chapter 70.105D of the Revised Code of Washington (RCW), administered by Ecology under the MTCA Cleanup Regulation, WAC 173-340. The Site cleanup will be conducted under a new AO between Ecology and the Port.

The objective of this document is to satisfy the MTCA requirements for CAPs set forth in WAC 173-340-380(1). Consistent with the requirement of that chapter, this CAP provides the following information:

- A description of the proposed cleanup action
- A summary of the rationale for the selection of the proposed cleanup action
- A summary of the remedial alternatives evaluated in the RI/FS
- Cleanup standards
- The schedule for implementation of the CAP and restoration time frame
- Institutional controls required
- Applicable state and federal laws for the proposed cleanup action
- A preliminary determination by Ecology that the cleanup action will comply with WAC 173-340-360

1.1 RELATION TO THE MARINE TRADES AREA SITE

Prior to 2012, the Site was included within the boundaries of the adjacent Marine Trades Area (MTA) Site. In 2012, the source and extent of the groundwater contamination at the Site was determined by Ecology to be distinct and separate from the contamination resulting from the former bulk plants that once occupied the western half of the MTA Site. In order to promote a more expeditious cleanup of both sites, the Port requested that the K Ply property be split off as a separate site. Ecology agreed to this division and the two sites were formally separated. Cleanups for each site will occur under separate AOs with the respective potentially liable parties.

1.2 SITE LOCATION AND DESCRIPTION

The Site is located on level ground directly west of downtown Port Angeles. It is bounded by West Marine Drive to the south, Port Angeles Harbor (the Harbor) to the north, the Valley Creek Estuary to the east, and the MTA Site to the west. To the north of the Site are approximately 4.7 acres of aquatic land (tidelands and filled tidelands) owned by Washington State Department of Natural Resources (DNR) and managed by the Port within the Port Management Agreement Parcel 2. Refer to Figure 1.2.

The Site is zoned as “Industrial Heavy” by the City of Port Angeles and is approximately 18.6 acres in size and entirely owned by the Port. The eastern portion of the Site is leased out for log debarking and storage. The western half is currently unutilized.

The limits of the Site were determined by the evaluation of the contaminant characteristics within the study area that defined the scope of the RI/FS. The word “Site” was defined in the RI and, as defined by MTCA, is where “contamination has come to be located.” The Site refers to the area where contamination has been well documented in both soil and groundwater. The study area for the RI included the larger area surrounding the Site where investigation activities occurred. This larger area included the sediments off shore of the mill, the log debarker operation to the east of the Site, and the now inactive Peninsula Fuels Company, Inc. (Peninsula Fuels) bulk plant located immediately upgradient of the former mill.

1.3 SITE HISTORY AND BACKGROUND

Between 1926, when the Site was first filled, and 1941, when the plywood mill was built, there was a small lumber mill that operated on the Site. After 1941, however, the primary historical operation at the Site was plywood manufacture. Site-wide operations to support this included plywood mill operations, log storage in the log yard and log pond, log rafting in the Harbor, hog fuel burning, log debarking, log peeling, pressing and gluing, steam drying, site maintenance, and other miscellaneous operations, including a plywood retail store located across W. Marine Drive. Various companies operated the plywood mill between its years of operation (1941 to 2011), including ITT Rayonier, Inc. (ITT Rayonier), K Ply Inc. (K Ply), and Peninsula Plywood Company (PenPly). The following table lists the mill owners and operators of the mill by year.

Mill Owners and Operators by Year

Date Range	Mill Owner/Operator
1941–1971	Peninsula Plywood Corporation (called PenPly)
1971–1989	ITT Rayonier/Peninsula Plywood Corporation (called PenPly)
1989–2007	K Ply Inc., a subsidiary of Klukwan, Inc. (called K Ply)
2010–2011	Peninsula Plywood Group LLC (called PenPly)

Site operations began in 1941 when PenPly leased 7.5 acres of land (later extended to 12 acres) from the Port and constructed the PenPly mill building. PenPly was an employee-owned company that operated the mill from 1941 to 1971. Mill construction began on May 20, 1941. By late summer 1941 the machine shop and the main mill building were finished. The first plywood was transported off-site via rail on November 24, 1941. PenPly had an initial plywood production goal of 6 million square feet per month. Because the opening of the mill coincided with the United States' entry to World War II, the mill was required to follow industry-wide controls for plywood production and distributions (Plywood Pioneers Association 2001). During the first year of production, 90 percent of the plywood produced was sold to the U.S. government.

In 1971, the mill was purchased by ITT Rayonier, which operated the mill as the Peninsula Plywood Corporation from 1971 to 1989 (Plywood Pioneers Association 2001). In 1989, the mill was purchased by Klukwan, Inc., an Alaskan Native-owned village corporation, who operated the mill as K Ply from 1989 to 2007. The mill was closed from 2007 until 2010 when the mill was reopened by the Peninsula Plywood Group LLC. The mill closed permanently in 2011 and was demolished in 2013.

Environmental contamination under the mill was first documented in the late 1980s with partial cleanup actions undertaken by ITT Rayonier, one of the prior mill owners. The presence of the mill building overlying nearly all of the known soil and groundwater contamination hindered efforts at both investigation and cleanup. The mill was permanently closed in 2011 and was demolished by the Port as part of an Interim Cleanup Action partially funded by Ecology to allow for a more comprehensive RI/FS and cleanup to be completed. A more thorough description of site background, prior operations, general history, previous investigations, and physical setting is provided in the RI/FS.

1.4 PENINSULA FUELS

The Peninsula Fuels site was formerly used as a bulk petroleum storage site, though few details are available concerning historical operations. Records indicate that the site was operated by the General Petroleum Corporation beginning in 1938. Fuel was delivered via a pipeline from the Port's Terminal 1 pier. The site was then operated by Mobil Oil Corporation (Mobil), a successor to General Petroleum, in the late 1960s. In about 1967, the U.S. Coast Guard ordered the Port to shut down use of Terminal 1 as a fuel terminal. In conjunction with the shutdown of Terminal 1, a 1967 Area Plan (Ryan & Hayworth Co. 1967) shows what appears to be Pipeline 8 leading from Terminal 1 to Peninsula Fuels. The Area Plan states that two pipes comprising Pipeline 8 were "to be isolated and abandoned."

Sanborn maps indicate that at least four aboveground storage tanks (ASTs) were present while the Peninsula Fuels site was operated by General Petroleum Corporation. The Peninsula Fuels site is assumed to have been serviced by Pipeline 8 from approximately 1938 until the apparent decommissioning of Pipeline 8 in approximately 1969. At this time, the petroleum pipeline[1] serving the site was transferred to a new east-west bearing pipeline, referred to as Pipeline 5 (Ryan & Hayworth Co. 1967). The historical Pipeline 8 ran underneath the K Ply mill from the Port's Terminal 1 to the former Peninsula Fuels facility directly south of the Site.

[1] Use of the term "Pipeline" in this document may refer to a series of two parallel 4-inch steel individual pipes collectively termed a "Pipeline."

2.0 Site Geology and Extent of Contamination

2.1 SITE GEOLOGY AND HYDROGEOLOGY

The primary geologic units at the Site generally consist of native beach deposits overlain by dredge fill. This dredged fill material consists of sand and silty sand in some areas with abundant shell fragments and occasional lenses of silt. The thickness of the dredge fill beneath the Site is generally in the range of 12 to 16 feet, and increases in thickness to approximately 20 feet at the shoreline bulkhead. The bulkhead consists of a historical railroad trestle that was filled and armored with a riprap slope. A well-graded gravelly sand structural backfill is present beneath the loading dock concrete pad structure. Native deposits underlying the dredged fill are visually similar to the overlying dredge fill and consist of unconsolidated, fine to coarse sand with variable amounts of silt and gravel, as well as interbeds of silt and fine sand, and occasional shell fragments.

A shallow, unconfined aquifer is present beneath the Site that first occurs in the dredged fill and beach deposits. Groundwater is generally encountered at approximately 10 feet below ground surface (bgs) in the vicinity of the former K Ply mill building and slightly lower in the area of the log pond and debarker operations. Groundwater elevation is highly variable along the shoreline due to tidal effects. The aquifer is thought to be recharged by groundwater from transmissive portions of the glacial deposits upgradient of the shoreline area to the south, and infiltrating precipitation. The overall groundwater flow direction is predominately northerly, toward the Harbor, with a horizontal gradient of approximately 0.005 feet per foot (ft/ft) in this direction. Mixing of groundwater with marine waters occurs within the riprap slope that armors the front of the Site and extends from ground surface to an elevation of -5 feet mean lower low water (MLLW).

Tidal influence is strongest on water level elevations near the shoreline and decreases in effect inland. The tidal influence, if large enough, can temporarily reverse the flow of groundwater to the Harbor but these effects are limited and do not impact the overall net horizontal gradient, which drives groundwater flow to the north into Port Angeles Harbor. During the RI, groundwater elevation measurements during a high tide of approximately +8 feet MLLW did not indicate such a groundwater gradient reversal at the shoreline. However, observations of petroleum contamination spread above and below the average water table as a “smear zone” suggest a strong influence of tidal fluctuation on shallow water levels. A slightly increased smear zone thickness of approximately 5 feet was observed in soil borings close to the shoreline, compared to a 2- to 4-foot-thick smear zone observed in soil borings farther inland.

2.2 NATURE AND EXTENT OF CONTAMINATION

The primary contaminants of concern (COCs) detected at the Site are gasoline and hydraulic oil, found in both soil and groundwater. Contaminant detections are generally limited to the footprint of the former K Ply mill building with some contaminant migration of benzene in groundwater west of the former mill footprint into S. Cedar Street that continues to the bulkead. There are also some localized and shallow areas of dioxin/furan and pentachlorophenol (PCP) soil contamination within the Site. An additional limited zone of gasoline and diesel contamination also exists within the Peninsula Fuels property, but this contamination is separate from the contamination at the Site and will not be addressed as part of this cleanup. Refer to Figures 2.1 through 2.5.

2.2.1 Soil

Within the Site, gasoline-range organics (GRO) have been detected in smear zone soil (i.e., soil within the range of water table flucuations) at concentrations up to 14,000 milligrams per kilogram (mg/kg). GRO contamination is extensive and extends continuously from the alley/loading dock concrete pad area north in a narrow zone to the bulkhead area (Figure 2.1). GRO was encountered in vadose zone soil as well, but is more localized, occuring primarily under the loading dock concrete pad. In that area, the depth to vadose contamination is approximately 3 feet below surrounding grade (equivalent to 8 feet below the raised concrete pad surface). This depth is also the approximate depth where Pipeline 8 was encountered. GRO concentrations in vadose zone soil near Pipeline 8 ranged from 3,400 to 17,000 mg/kg. Two smaller areas of vadose zone contamination were found closer to the bulkhead. Peak GRO concentrations in these areas are 860 and 791 mg/kg.

Occurring with the GRO is typically benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds, which are dominant constituents of gasoline. Of most concern is benzene, which presents the most risk to human health and the environment. Benzene is also fairly solube in water and volatile, so it can present a risk of vapor intrusion. Benzene concentrations in smear zone soil were generally greatest in the vicinity of Pipeline 8 under the loading dock concrete pad, where concentrations were generally greater than 10 mg/kg and ranged up to 210 mg/kg. Benzene occurs in vadose zone soil as shallow as approximately 3 feet bgs (8 feet under the surface of the loading dock concrete pad) in the vicinity of Pipeline 8 at concentrations ranging from 4.1 to 21 mg/kg. These elevated concentrations are found mostly in the soils under the loading dock, forming a benzene “hot spot” as represented by the 10 mg/kg soil concentration contour in Figure 2.1. This hotspot area appears to be the source area for the benzene observed in downgradient groundwater.

Elevated diesel-range organics (DRO) concentrations were also detected in soil in the vicinity of Pipeline 8 beneath the loading dock concrete pad and in the alley south of the mill (refer to Figure 2.2), with a maximum concentration of 24,000 mg/kg. DRO was reported at lower concentrations under the loading dock concrete pad to the east of Pipeline 8; however, these detections are thought to be false positives due to chromatographic overlap from high concentrations of GRO within the sample.

The highest concentrations of GRO, DRO, and BTEX in the smear zone were detected in samples from the area under the loading dock concrete pad close to Pipeline 8, in the area of pressure test failures for both 4-inch pipes.[2] The elongated distribution of gasoline in the smear zone downgradient of the loading dock concrete pad is consistent with a mechanism of movement in which petroleum products historically pooled at the water table surface as a light non-aqueous phase liquid (LNAPL) and migrated downgradient along the water table surface and were subsequently smeared across a thicker soil interval by water table fluctuations. This migration and smearing has greatly reduced the area of the Site where LNAPL still exists to an area near one well (PZ-6), which typically contains 0.5 feet of LNAPL thickness.

Hydraulic oil occurs as a distinct LNAPL phase up to 2 feet in thickness in wells near the former presses and is also found distributed in smear zone soils downgradient of the LNAPL area (refer to Figure 2.3). In the eastern portion of the Hydraulic Oil Area (discussed in Section 4.2), gasoline odors and GRO detections were noted in the smear zone soil. This area of

[2] A pressure test of Pipeline 8 was conducted during the RI to test the integrity of the two pipes. Details of the test are provided in the RI/FS.

commingled GRO and ORO contamination was found to extend to the north to the vicinity of Boring K-103 (refer to Figure 2.1).

During the RI, a number of other tests were done on the hydraulic oil and gasoline contaminants. Carcinogenic polycyclic aromatic hydrocarbons (cPAHs), lead, and volatile organic compounds (VOCs) were analyzed for in a subset of soil and groundwater samples with suspected GRO and DRO contamination, in accordance with MTCA Table 830-1. Lead and other metals including arsenic, barium, and chromium were detected in most samples analyzed, at concentrations typical of regional background soil concentrations. Detected metals concentrations did not exceed their respective MTCA Method A cleanup levels (CULs). Polychlorinated biphenyls (PCBs) were not detected in any soil samples. cPAH toxicity equivalency quotients ranged from non-detect to 0.25 mg/kg in most of these samples. Testing of the hydraulic oil during past investigations did not indicate the presence of PCBs (Landau Associates, Inc. 1989).

In the middle and south end of the Peninsula Fuels property, in borings located near former fill ports and AST pads, GRO and DRO were detected in the smear zone soil samples, indicating a release has occurred in this area. Closer to the alley, GRO was detected at lower concentrations. The localized extent of GRO and DRO contamination, lower overall GRO and DRO concentrations, and lack of groundwater contamination at the northern edge of the Peninsula Fuels property suggest that contamination in the middle and south end of the Peninsula Fuels property is not migrating across this property to the Site.

2.2.2 Groundwater

GRO contamination in groundwater is most concentrated at the south end of the Site in the vicinity of Pipeline 8 under the loading dock concrete pad, with a maximum detection of 53,000 micrograms per liter (µg/L) in October 2013. Elevated GRO concentrations were also observed in groundwater near the bulkhead at concentrations up to 6,500 µg/L during the same event. DRO and ORO were generally not detected or detected at low levels in site groundwater. Refer to Figure 2.4

Elevated benzene was detected in groundwater at concentrations greater than 5,000 µg/L in the vicinity of Pipeline 8. Benzene concentrations greater than 500 µg/L generally extend beneath S. Cedar Street and extend to the bulkhead to the north forming a northwest plume lobe. The distribution of benzene in groundwater is consistent with the overall observed primary groundwater flow directions to the north. Some attenuation of the benzene plume under S. Cedar Street is suggested, as data collected during the RI idicates that the plume in that area does not reach the monitoring well PP-19 just south of the bulkhead lying close to the Port's office at Terminal 1. Refer to Figure 2.5.

2.2.3 Sediment

Sediment samples were collected during the RI and the data indicate that the sediment chemistry, including dioxin/furan, polycyclic aromatic hydrocarbon, and PCB results for the sediment locations, are similar to sample results found in other areas of the Harbor (i.e., there is no obvious "hot spot" in sediment off of the Site). DRO and ORO were also detected in the three sediment samples that were collected off-shore of the Site. The detected concentrations of DRO and ORO in the sediment samples are similar to total petroleum hydrocarbon (TPH) results in sediment samples collected across the Harbor. Therefore, there does not appear to be an apparent connection between these DRO and ORO detections in sediment and the Site upland contamination. As such, no site-specific sediment concerns were identified due to the Site. The petroleum-contaminated groundwater discharges to surface water along the riprap slope that forms the Site shoreline, implying that contaminated groundwater does not encounter sediment prior to discharging to marine waters. Sediment quality in this area, however, may exceed certain risk-based screening thresholds and so will be further evaluated by the Western Port Angeles Harbor Group effort.

3.0 Cleanup Standards and Points of Compliance

Cleanup standards under MTCA consist of numeric CULs based on all applicable regulatory requirements and the points of compliance (POCs) where these CULs must be met. The following site-specific information was used to develop the cleanup standards for the Site:

- The Site is zoned heavy industrial and has been used exclusively for industrial purposes. Future use and redevelopment are expected to remain heavy industrial. For these reasons, standard MTCA industrial land use exposure assumptions are applicable when considering soil and vapor exposure scenarios.
- The groundwater at the Site is considered to be non-potable in accordance with MTCA requirements (WAC 173-340-720(2)) because it occurs in former aquatic tidelands that were filled by dredge sands. Shallow groundwater that currently discharges into the waters of the Harbor occurs in this fill material, and mixes with marine waters near the shoreline. This area is also served by the city water supply. Groundwater at the Site is not a current or potential future source of drinking water. The maximum beneficial use of water in the Harbor is, therefore, for the protection of aquatic life.

3.1 SOIL

3.1.1 Soil Cleanup Levels

The CULs for soil, presented in Table 3.1, were evaluated for BTEX, GRO, ORO, and DRO for the direct contact (ingestion) and soil-to-ground water pathways based on the exposure pathways described in the RI/FS and MTCA requirements. A terrestrial ecological evaluation conducted during the remedial investigation concluded the Site does not pose a substantial potential risk to terrestrial receptors due to its industrial land use and lack of available habitat.

Table 3.1
Soil Cleanup Levels

Contaminant of Concern	Maximum Detected Concentration[1] (mg/kg)	Protection of Groundwater MTCA Method A[2] (mg/kg)	Direct Contact to Soils MTCA Method C Direct Contact (mg/kg)	Proposed Cleanup Level[3] (mg/kg)
DRO	24,000	2,000	Not determined[8]	2,000
GRO	14,000	30[4]	Not determined[8]	30
ORO	32,000[5]	2,000	Not determined[8]	2,000
Benzene	120	0.3	2,400	0.3
Ethylbenzene	170	6	350,000	6
Toluene	180	7	280,000	7
Xylenes	600	9	700,000	9
Pentachlorophenol	230	NA	330	330
Dioxins/furans[7]	0.000222	NA	0.00059	0.00059

Notes:
1 Maximum detected value during the Remedial Investigation.

Contaminant of Concern	Maximum Detected Concentration[1] (mg/kg)	Protection of Groundwater: MTCA Method A[2] (mg/kg)	Direct Contact to Soils: MTCA Method C Direct Contact (mg/kg)	Proposed Cleanup Level[3] (mg/kg)

2 MTCA Method A is applied for these constituents (with the exception of benzene) because it is protective of all pathways including groundwater and surface water. Site use is expected to remain industrial, however.

3 Most conservative value chosen as the CUL.

4 Use this value when benzene is present in soil.

5 Greatest concentration detected historically at the Site is 107,000 mg/kg where ORO free product is present.

6 CUL based on three-phase rule calculation using proposed benzene CUL of 51 µg/L.

7 Includes ingestion and dermal contact pathways.

8 Not determined due to the specialized testing required. For TPH products, this site-specific determination typically results in a concentration that is significantly greater than the MTCA Method A concentration that is protective of groundwater and used as the CUL.

For the protection of groundwater, default MTCA Method A soil CULs for individual BTEX compounds are proposed with the exception of benzene, which was adjusted upward as described below. For DRO, GRO, and ORO, default MTCA Method A values are proposed. MTCA Method A CULs are proposed for the following reasons: (1) the MTCA Method A soil cleanup concentrations are conservative and, therefore, protective of all pathways, and (2) the MTCA Method A values for TPH consider the cumulative risk for all the individual substances such as BTEX and semivolatile organic compound present in petroleum. For benzene, the upward adjustment was made because the default MTCA Method A CUL of 0.03 mg/kg is overly conservative as it is based upon protection of groundwater to a level of 5 µg/L, which is based upon drinking water use (refer to Footnote C of Table 740-1 in WAC 173-340-900). Instead, the CUL for benzene in soil should be based upon the highest beneficial use of site groundwater, which is protection of marine waters. The MTCA three-phase rule was used to adjust the proposed benzene CUL for soil to 0.3 mg/kg which is protective of marine waters.

3.1.2 Point of Compliance for Soil

The POC for soil to protect groundwater is soil throughout the Site. For protection of the soil vapor pathway, the POC is from the surface to the groundwater table (approximately 8 to 10 feet bgs at the Site).

3.2 GROUNDWATER

3.2.1 Groundwater Cleanup Levels

Groundwater CULs were derived in accordance with WAC 173-340-720, as summarized below. Per WAC 173-340-720(1)(a), groundwater CULs are based on the highest beneficial use of groundwater and the reasonable maximum exposure expected to occur under current and future site use conditions. The maximum beneficial use of groundwater beneath the Site is discharge to the surface water of the Harbor. The reasonable maximum exposure scenario expected to occur is based on the discharge to surface water of the highest detected concentration of site COCs (refer to Table 3.2), and ingestion of aquatic organisms that accumulate COCs. Site groundwater meets the requirements for non-potable groundwater under WAC 173-340-720(2). Therefore, groundwater CULs were developed consistent with the requirements of WAC 173-340-720(6)(b), including the MTCA Method B site-specific risk assessment elements described in WAC 173-340-720(6)(c)(i) and consistent with WAC 173-

340-702 and 173-340-708. According to WAC 173-340-730 (3)(b), surface water CULs under MTCA Method B should be at least as stringent as applicable state and federal laws including the Water Quality Standards for the State of Washington, Clean Water Act, National Recommended Water Quality Criteria (NRWQC), and the National Toxics Rule.

Table 3.2
Groundwater Cleanup Levels

Contaminant of Concern	Maximum Detected Concentration[1] (µg/L)	Lowest Promulgated Federal or State Water Quality Standard[2] (µg/L)	MTCA Method A Groundwater (µg/L)	Proposed Cleanup Level (µg/L)
ORO	310	NA	500	500
DRO	2,300	NA	500	500
GRO	16,000	NA	800	800
Benzene	4,400	51	5[3]	51

Notes:

1. Maximum detected value during the Remedial Investigation.
2. Lowest of WAC 173-201A, National Toxics Rule, and National Recommended Water Quality Criteria.
3. The MTCA Method A CUL is based on groundwater consumption, which is not applicable to the K Ply Site. The highest beneficial use of site groundwater is discharge to surface water; therefore, the federal or state water quality standards apply.

In accordance with WAC 173-340-720(6)(c)(i), potential groundwater exposure pathways and groundwater uses were considered. There is no reasonable scenario under which groundwater would be consumed as drinking water. The potential pathway of concern is discharge of groundwater to the Harbor surface water at the K Ply bulkhead. CULs for groundwater are based on protection of the beneficial uses of this surface water body for all users, including recreational users. COC concentrations in groundwater must be protective of surface water and must meet surface water standards at the point at which groundwater discharges into surface water.

Refer to Table 3.2 for groundwater CULs. For compounds for which the federal criteria are available (e.g., benzene), the standard MTCA Method B CULs are based on the most protective of the federally promulgated, human-health-based criteria protective of surface water. For benzene, this value is 51 µg/L, a value promulgated under the NRWQC considering human ingestion of aquatic organisms[3] and protection of aquatic life. This concentration for benzene has been approved for use as a CUL and/or screening level at other MTCA sites being addressed as part of the Puget Sound Initiative. Federal or state water quality criteria do not exist for GRO, DRO, or ORO. According to WAC 173-340-730(3)(C), MTCA Method A concentrations for TPH are appropriate to be used for protection of surface water. Benzene is the “risk-driver” for the Site, as it is the only carcinogenic COC in groundwater and its concentration in shoreline wells exceeds the applicable most protective surface water CUL as listed in Table 3.2.

3.2.2 Groundwater Point of Compliance

MTCA states that the standard POC for groundwater CULs is throughout the Site to the outer boundary of the plume. However, Ecology may approve a conditional point of compliance

[3] For benzene, this is based on the same human health cancer risk (10^{-6}) and oral slope factor range as the MTCA Method B number.

(CPOC) where it can be demonstrated that it is not practical to meet the CUL within a reasonable restoration time frame. This condition of impracticability holds for the Site given the very large mass of source area soil. The CPOC must be located as close as possible to the source but not exceeding the property boundary and as close as technically possible to the point or points where groundwater flows into the surface water (WAC 173-340-720(8)(c)). In addition, the person responsible for undertaking the cleanup action shall demonstrate that all practicable methods of treatment are to be used in the Site cleanup. These practical methods of treatment were described in the FS.

Given that there is no potable use of site groundwater and the highest beneficial use of groundwater at the Site is discharge to surface water, a groundwater CPOC is appropriate for the Site along the bulkhead at the closest monitoring location to the point of discharge to surface water.

3.3 INDOOR AIR

Evaluation of the soil to vapor pathway is required at sites contaminated with VOCs to determine the potential for adverse impacts on the indoor air quality that may pose a threat to human health and the environment. Examples of when this pathway should be evaluated include at sites where soil TPH-G and/or other VOC concentrations are significantly higher than the cleanup levels derived for the protection of groundwater for drinking water beneficial use, or where soil TPH-D concentrations are higher than 10,000 mg/kg (WAC 173-340-740(3)(b)(iii)(C).

Currently there are no buildings over or in the vicinity of the contaminated soil and groundwater; however, the vapor intrusion pathway is a pathway of concern because it is likely buildings will be constructed on the site in the future. When building plans are available an assessment of vapor intrusion risk must occur consistent with Ecology regulation or guidance. To ensure that this assessment is performed, institutional controls in the form of an environmental covenant needs to be recorded against the property that includes this requirement as described later in this document.

Table 3.3 proposes indoor air CULs taken from Ecology's CLARC website that will be used to evaluate the risk of vapor intrusion in the future. Cleanup levels are based on industrial exposure. The COCs listed below are those that are considered volatile and associated with gasoline or diesel.

Table 3.3
Indoor Air Cleanup Levels

Contaminant of Concern	Proposed MTCA Method C Indoor Air Cleanup Level (µg/m^3)
Benzene	3.2
Toluene	5,000
Ethylbenzene	1,000
Xylenes	100
n-hexane	700
1,2-dichloroethane	0.96
MTBE	96

Contaminant of Concern	Proposed MTCA Method C Indoor Air Cleanup Level ($\mu g/m^3$)
Naphthalene	0.74
1,2,4-trimethylbenzene	7
APH [EC5-8 aliphatics] fraction[1]	6000
APH [EC9-12 aliphatics] fraction[1]	300
APH [EC9-10 aromatics fraction][1]	400

[1] Values not from CLARC but instead are guidance values taken from Table B-1, Ecology Publication no. 09-09-047, Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, October 2009

4.0 Remedial Action Objectives and Cleanup Areas

4.1 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are narrative goals for a cleanup action that address how the cleanup fits into the overall MTCA cleanup process. The following RAOs have been identified for the primary contaminants found at the Site:

1. Prevent gasoline-impacted groundwater from discharging to surface water at concentrations greater than appropriate CULs. This is necessary for protection of human health and the environment.
2. Remove, to the extent practicable, LNAPL accumulations on the water table. This is a minimum requirement under WAC 173-340-360(2)(c)(ii)(A), “treatment or removal of the source of the release shall be conducted for liquid wastes. This includes removal [sic] free product consisting of petroleum and other LNAPL from the ground water using normally-accepted engineering practices.”
3. Protect industrial workers from direct contact exposure to soil above MTCA Method C industrial soil CULs. This is necessary for protection of human health. (There were no exceedances of MTCA Method C industrial soil CULs for those COCs with cleanup level available in Ecology’s CLARC tables (i.e., BTEX, PCP, Dioxin/Furans). For those COCs without established CLARC values protective of the direct contact risk in industrial settings, (i.e., GRO, DRO, ORO), it is possible that some site TPH concentrations are currently at concentrations that would exceed a site-specific determination. However, these site specific determinations typically result in concentrations that are in excess of 10,000 mg/kg. Site soils contaminated at these levels are proposed for removal as part of the proposed cleanup action.)
4. Prevent inhalation exposure in potential future buildings constructed over soil or groundwater contamination with volatile COCs present at concentrations that may pose a risk for vapor intrusion. This is necessary because future redevelopment may involve construction of offices or other enclosed spaces over areas of contamination.

4.2 AREAS SUBJECT TO CLEANUP

The RI/FS identified six distinct cleanup areas at the Site including two primary cleanup areas and four minor cleanup areas. Refer to Figure 4.1. The primary cleanup areas include the Gasoline Area and the Hydraulic Oil Area. The Gasoline Area and the Hydraulic Oil Area are commingled in the northern portion of the Site. The minor cleanup areas include the Stack Area, the Hog Fuel Storage Area, the PCP Area, and the Log Pond Fill Area. Peninsula Fuels is not considered here, as its contamination is distinct and separate from that at the Site. The level of contamination found Peninsula Fuels is considerably less than levels found at K Ply and Peninsula Fuels is not considered a significant threat for recontamination of K Ply.

The two primary cleanup areas and how they correspond to each RAO, are summarized in the following table.

RAO	Applies to Cleanup Area(s)
1. Prevent COCs in groundwater from discharging to surface water at concentrations greater than CULs	Gasoline Area (GRO and benzene)

protective of surface water.	
2. Remove, to the extent practicable, LNAPL accumulations on the water table.	LNAPL under former presses in Hydraulic Oil Area and Gasoline Area (only found near PZ-06)
3. Protect industrial workers from direct contact exposure to soil above MTCA Method C industrial soil CULs.	Gasoline and Hydraulic Oil Areas (GRO, DRO, ORO)
4. Prevent inhalation exposure in potential future buildings with underlying soil contamination to indoor air with volatile COC concentrations greater than CULs.	Gasoline Area (primarily benzene in both soil and groundwater)

The four minor cleanup areas were identified as the areas with contaminated soil that are outside or otherwise distinct from the primary cleanup areas. These have all been designated "cleanup areas" even though some are small or do not have COC concentrations greater than industrial standards. The above RAOs do not apply to these areas. However, these are named as cleanup areas because contaminated soil in these areas is expected to be relocated during cleanup or development and such soil, once excavated, must be appropriately managed. Three of these areas are located on the east side of the Site, outside the area where the majority of the contamination is located. These minor cleanup areas include:

- The Stack Area consists of the area near the former mill stack where dioxins were detected in two surface soil samples but at concentrations less that the applicable MTCA Method C standard.
- The Hog Fuel Storage Area consists of the area where shallow DRO and GRO soil contamination was observed near the former hog fuel pile.
- The PCP Area consists of the area beneath the former mill where PCP was detected in surface soil but at concentrations less than the applicable MTCA Method C standard. This small area lies on top of gasoline-impacted soil within the Gasoline Area.
- The Log Pond Fill Area consists of the area of the former log pond bottom where ORO concentrations exceed the applicable standard. The contamination associated with the Log Pond Fill Area is limited to deeper soils representative of the bottom of the former log pond (refer to Boring K-101, in which ORO was detected at concentrations greater than applicable criteria in soil at a depth of 12 feet). These deeper soils are not expected to be excavated during redevelopment. The maximum potential extent of the Log Pond Fill Area, based on the historical outline of the former log pond, is shown on Figure 4.1. It is possible that contamination in the former log pond bottom is more limited in extent, but the existing data density is insufficient to demonstrate that.

5.0 Selected Cleanup Action

This section discusses the selected cleanup action for implementation at the Site. This section also justifies the selection and explains how the cleanup action complies with Site RAOs and associated applicable or relevant and appropriate requirements (ARARs).

5.1 SUMMARY OF REMEDIAL ACTIONS CONSIDERED IN THE FEASIBILITY STUDY

Four remedial alternatives were developed and evaluated in the FS. Each of these alternatives was developed to address the RAOs discussed in Section 4.0. These alternatives included the following:

- Alternative 1: This remedial alternative consisted of limited excavation to remove hydraulic oil LNAPL and soil contamination near the bulkhead (RAO 2,3), installation of an air sparge curtain to attain CULs at the bulkhead CPOC (RAO 1), institutional controls to address the potential future vapor inhalation pathway (RAO 4), and groundwater compliance monitoring. The minor cleanup areas would be addressed with a combination of institutional controls and limited excavation and relocation, treatment, or off-site disposal.
- Alternative 2: This remedial alternative consisted primarily of in situ chemical oxidation (ISCO) to treat soil and groundwater contaminated with GRO, DRO, ORO, and BTEX, followed by enhanced bioremediation, as needed, to attain the groundwater CULs at the CPOC (RAO 1,3). Compliance monitoring of groundwater would also have been conducted. Hydraulic oil LNAPL would be excavated and disposed of off-site (RAO 2,3). Areas where vadose zone soils would be left in place would be capped, and institutional controls would address the potential future vapor inhalation pathway (RAO 3,4). The minor cleanup areas would be addressed with a combination of institutional controls and limited excavation and relocation, treatment, or off-site disposal.
- Alternative 3: This remedial alternative was the selected remedy for the Site, and is described in detail below. This remedial alternative consisted of excavation of all vadose zone gasoline-contaminated soil site-wide that exceeds applicable CULs and a large portion of the underlying smear zone soil, excavation of the PCP Area, Hog Fuel Storage Area, and Hydraulic Oil Areas (RAOs 1,2,3 and 4). Follow-up treatment of groundwater with bioremediation amendments is included along with compliance monitoring of soil and groundwater and institutional controls in areas where soil or groundwater remains on-site at levels greater than CULs.
- Alternative 4: This remedial alternative consisted of excavation of the entire area of contaminated soil within the Gasoline Area (including into the alley) to applicable CULs, excavation of the PCP Area, excavation of the Hydraulic Oil and Gasoline Areas, and excavation of the Hog Fuel Storage Area (RAOs 1, 2, 3 and 4). This would have also included treatment of groundwater with enhanced bioremediation agents, compliance monitoring of groundwater, and institutional controls in areas where soil or groundwater remains on-site at levels greater than CULs.

5.2 EVALUATION AND COMPARISON OF ALTERNATIVES

The alternatives were evaluated relative to each other using the MTCA evaluation and disproportionate cost analysis (DCA) criteria. The complete evaluation is included in the K ply

Site Remedial Investigation/Feasibility Study Report (Floyd|Snider, March 2015) and a brief summary is included here. As provided in WAC 173-340-360(2)(a), the four alternatives met the threshold requirements for cleanup action including protection of human health and the environment, compliance with cleanup standards, compliance with applicable state and federal laws, and providing for compliance monitoring.

A disproportionate cost analysis, as outline in WAC 173-340-360(3)(e) was used to further evaluate which of the alternatives are permanent to the maximum extent practicable. The seven criteria used in the disproportionate cost analysis include protectiveness, permanence, cost, long-term effectiveness, management of short term risks, implementability, and consideration of public concerns. MTCA provides a methodology that uses these criteria to determine whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of the alternative above the next lowest-cost alternative. A detailed evaluation is included in the Remedial Investigation/Feasibility Study Report (Floyd|Snider, March 2015). A summary of the evaluation is presented in Table 5.2.

Table 5.1
Alternatives Evaluation Ranking Summary

Alternative	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Estimated Alternative Cost	$ 2.4M	$7.0M	$5.2M	$7.5M
Benefit Scoring[1]				
Overall Protectiveness	Moderate (3)	High (5)	Moderate to High (4)	High (5)
Permanence	Low to Moderate (2)	High (5)	Moderate to High (4)	High (5)
Long-term Effectiveness	Moderate (3)	Low (1)	Moderate to High (4)	High (5)
Short-term Risk Management	Moderate to High (4)	Moderate to High (4)	Moderate (3)	Moderate (3)
Implementability	Moderate (3)	Low (1)	Moderate to High (4)	Moderate to High (4)
Consideration of Public Concerns	Potentially Negative	Potentially Positive	Likely Positive	Likely Positive
Total Benefit Score	**15**	**16**	**19**	**22**
Cost per Unit Benefit Ratio[2]	**0.14**	**0.40**	**0.24**	**0.33**

Notes:

1 Higher scores equate to a higher level of relative benefit. Fewer short-term risks result in a higher score.

2 Cost per Unit Benefit Ratio calculated by dividing the total alternative cost (in millions) by the alternative Total Benefit Score. Lower value indicates the most benefit for the associated cost.

Abbreviation:

LNAPL Light non-aqueous phase liquid

Based on the evaluation, the alternatives ranked in order from most to least permanent are Alternative 4 ($7.5 million), alternative 2 ($7.0 million), Alternative 3 ($5.2 million), and Alternative 1 ($2.4 million). Alternative 4 is the most permanent solution identified and serves as the baseline against witch other, less permanent alternatives are compared.

Based on the large contaminant mass load in the soil and groundwater, the estimated minimum mass of oxidant that would be required to be introduced under Alternative 2 is 1.1 million pounds. This volume of oxidant is expected to require substantial time to deliver to the subsurface and require over a thousand closely spaced borings with a multi-year period of repeat injections and monitoring projected. There is too much source mass at the Site for Alternative 2 to be an effective solution site-wide.

Alternative 3 will result in a similar risk reduction as under Alternative 4. Both alternatives include a post-excavation groundwater treatment component that provides for continued remediation of the entire area of contaminated groundwater and both rely on source removal and enhanced aerobic biodegradation of contaminants. It is expected that CULs will be permanently attained at the groundwater conditional point of compliance within 5 to 10 years under both alternatives. Alternative 3 includes excavation of approximately 2/3 of the tonnage of contaminated soil. The smear zone soil that is not excavated under Alternative 3 will continue to undergo natural attenuation (with enhanced bioremediation as needed) until the soil achieves site CULs. Alternative 4 is estimated to cost about $2.3 million more than Alternative 3 yet will not achieve RAOs any faster. Alternative 4 provides a relatively small incremental benefit that is disproportionate to the added costs. The best combination of protectiveness, long-term effectiveness, and cost was determined to be Alternative 3.

5.3 DESCRIPTION OF THE SELECTED SOIL AND GROUNDWATER CLEANUP ACTION

The selected cleanup action for the Site is Alternative 3 from the RI/FS. The cleanup action is illustrated in Figure 5.1. In summary, the cleanup action will address the first three RAOs by excavation of all vadose zone gasoline-contaminated soil site-wide that exceeds applicable CULs and a large portion of the underlying smear zone soil within the Gasoline Area that is a source of groundwater contamination. In addition, excavation of the areas where LNAPL-containing soil exists will occur. Following excavation, to ensure CULs in groundwater are met within a reasonable timeframe at the CPOC, follow-up treatment of groundwater with bioremediation amendments will be implemented. Soil within minor cleanup areas will also be excavated and either disposed of or relocated on site. To address the fourth RAO, institutional controls in the form of limited use/notification restrictions will be applied in areas where soil or groundwater exceeds applicable MTCA Method A or B CULs (*e.g.,* for petroleum-related contaminants) and in areas where MTCA Method C is the applicable CUL (*e.g.,* dioxins and PCP). Institutional controls are discussed in greater detail in Section 5.5. The selected cleanup action also includes long term compliance monitoring of groundwater at the shoreline monitoring wells, which serve to monitor the CPOC as well as in upgradient areas to ensure that the selected remedy is performing as expected. Compliance monitoring is discussed in more detail in Section 5.4.

5.3.1 Soil Excavation and Disposal

Excavation will occur over a large portion of the Site, including soil within the Gasoline Area, Hydraulic Oil Area, Stack Area, Hog Fuel Storage Area, and PCP Area. Soil within the Gasoline and Hydraulic Oil Areas that is above CULs and not excavated will be subject to institutional controls. Excavation will occur in both the vadose zone and smear zone. The total excavation volume is expected to be approximately 34,900 cubic yards (CY), of which 15,700 CY is estimated to be contaminated at levels greater than applicable CULs. The remainder of soil that will be excavated is 19,200 CY of overburden lying on top of contaminated soil. Details of the soil excavation activities would be described in an Engineering Design Report (EDR) presented to Ecology for approval prior to the initiation of construction activities.

Bulkhead and Concrete Pad Excavation Areas

Excavation of contaminated soil will primarily be conducted in the two areas shown in Figure 5.1. The northern area is termed the Bulkhead Excavation Area[4] and includes the soils contaminated by hydraulic oil (vadose and smear zone) as well as gasoline (primarily smear zone). The southern area is termed the Concrete Pad Excavation Area[5], which is primarily located under the former loading dock concrete pad and includes gasoline and to a lesser degree diesel contaminated soil occurring in both the vadose and smear zones. The total excavation volume of contaminated soil in these areas is approximately 15,000 CY. This soil volume is based on an approximate delineation of the extent of soil contamination as determined in the RI/FS. The extent of excavation is not expected to change significantly from what is shown on Figure 5.1 based on the relatively high degree of characterization performed during the RI/FS and prior investigations. Remediation in these areas includes the following:

- Removal of Pipeline 8 in its entirety.
- Excavation of soil for the protection of groundwater in the Bulkhead Excavation Area. Soil with COC concentrations greater than CULs would be removed from both the vadose and smear zone in this area. Removal of this soil from the smear zone would create a zone of clean soil for upgradient contaminated groundwater to flow through prior to discharge to the Harbor. It is expected that this clean zone, with subsequent bioamendments, will create optimum conditions for bioremediation to treat any residually-contaminated groundwater that enters from upgradient sources.
- The Bulkhead Excavation Area will also remove hydraulic oil-contaminated soil that contains LNAPL, some of which is co-mingled with gasoline-contaminated soil. The LNAPL and gasoline-contaminated soil to be removed from the Bulkhead Excavation Area is primarily located in the smear zone, but also includes vadose zone soil with gasoline and/or hydraulic oil contamination at concentrations greater than CULs. It is estimated that approximately 7,000 CY of contaminated soil from the smear zone and LNAPL area and 300 CY of contaminated soil from the vadose zone will be excavated from the Bulkhead Excavation Area.
- When excavating close to the bulkhead, it is possible that shoring may need to be used to provide excavation stability; nevertheless, setbacks from structures, including the bulkhead, are expected to be necessary. The need for shoring and setbacks will be determined during remedial design.
- The second large area subject to cleanup is the soil in the Concrete Pad Excavation Area. Removal of soil under the concrete pad is important as this area is the major source of the benzene/GRO plume currently found in site groundwater. It would also lessen the risk of vapor intrusion if buildings are constructed in this area. Soil in the vadose zone would be excavated until site CULs for soil are achieved. Smear zone

[4] The Bulkhead Excavation Area replaces the description in the RI/FS as the area including “the Hydraulic Oil Cleanup Area and the comingled downgradient portion of the Gasoline Area”

[5] The Concrete Pad Excavation Area replaces the description in the RI/FS as “Gasoline Area contaminated soils lying upgradient of the Hydraulic Oil Area”.

soil would also be excavated, but to a remediation level of 10 mg/kg benzene and/or 3,000 mg/kg GRO. The objective of using a remediation level in the Concrete Pad Excavation Area is to remove the highest concentration soils that are a primary source of ground water contamination. These soils are shown in Figure 2.1 as the core contamination area defined by benzene concentrations greater than 10 mg/kg and GRO greater than 3,000 mg/kg. This action would remove approximately 90% of gasoline mass in the smear zone soils. Remaining smear zone contamination concentrations would be at concentrations greater than CULs but less than remediation levels. These soils will be addressed through monitored natural attenuation with optional bioremediation with a focus on treatment of groundwater where necessary to prevent future plume migration to the bulkhead.

- The volume of contaminated soil that will be excavated from the Concrete Pad Excavation Area is estimated to be approximately 10,250 CY in the smear zone and 5,250 CY in the vadose zone. An estimated 19,100 cubic yards of clean overburden will need to be excavated from this area. Excavated overburden, including the structural fill under the current pad, will be used as backfill if it can be demonstrated that such soil meets CULs prior to backfilling.
- Excavation in both areas would continue until CULs are achieved for all site COCs located in the vadose soil (soil generally above 8 feet bgs). Smear zone soil (soil generally between 8 and 12 feet bgs) would be excavated to CULs in the Bulkhead Excavation Area and to remediation levels in the Concrete Pad Excavation Area.
- Excavation will be conducted using standard construction equipment. Contaminated soil will be stockpiled on-site, loaded directly into trucks for transport to a recycling or disposal facility, or treated thermally on-site to CULs and then used as backfill (refer to Section 5.3). Contaminated soil that is stockpiled on-site prior to loading for off-site transport or treatment would be placed on pavement or plastic sheeting, bermed, and stabilized. Up to 13 existing monitoring wells may lie in areas to be excavated and will need to be abandoned beforehand or fully removed during excavation and some replaced following excavation. A conceptual layout of wells to be abandoned and replaced is shown on Figure 5.2.
- Site preparation work will include demolition of the concrete pad and existing concrete structures and concrete rubble piles to allow access to the underlying contaminated soil. Several composite samples of the concrete will be analyzed and evaluated to confirm it is suitable for reuse and will not cause further contamination, such as from heavy metals, of soil or groundwater. Visibly contaminated concrete will be removed for disposal and not reused. Crushing of the concrete will occur following demolition. The crushed concrete will be reused as backfill where geotechnically suitable. The structural fill soil located underneath the former loading dock concrete pad will be considered overburden and is expected to be suitable for re-use as clean backfill where geotechnically suitable.
- When conducting excavation to remove only smear zone soils, there will be a substantial amount of clean overburden soil that must be removed to allow access to the underlying contaminated smear zone soils. During excavation, overburden will be field screened with olfactory, visual, and photoionization detector (PID) methods so as to prevent comingling with underlying contaminated soils. Rapid analytical turnaround times will also help with delineation of boundaries between clean and contaminated soils. The overburden soil will be segregated from contaminated soil

and stockpiled on-site. Stockpiled overburden soil will be sampled and tested to confirm the soil is less than applicable CULs prior to backfilling.

- When excavating out the smear zone, it is likely that water-saturated soils will be encountered. Such soils will be stockpiled within the excavation area and allowed to free-drain to the degree practical. Following excavation of the smear zone crushed concrete or quarry spalls may need to be placed on the excavation bottom to allow a stable and dry working surface for machinery to complete excavation activities.
- A portion of the contamination in the smear zone lies below the groundwater surface and it may be not be possible in some areas to dig more than a few feet into the water table without soil caving. Limited dewatering may be necessary to allow for deeper excavation. As an alternative to dewatering, which poses significant implementibility challenges, chemical oxidants may be used to address remaining soil contamination. The oxidants would be applied in liquid or powder form and then mixed with the soil using standard excavation equipment with specialized mixing attachments.
- After the soil has been excavated, and prior to backfilling, a bioremediation amendment (such as oxygen release compound [ORC]) in powder or applied in a slurry will be directly applied to the open pit prior to any backfilling to begin to treat residual groundwater and smear zone soil contamination. The bioremediation amendment would be mixed as necessary with the excavator bucket and then covered with clean backfill as described above.
- Biotreatment of the benzene and TPH-G plume under Cedar Street will occur during construction activities as well, but will involve injection of a bioremediation amendment using a Geoprobe as no excavation activities are planned in this area.
- Infiltration galleries will be installed in both excavation areas prior to backfilling. These infiltration galleries will allow for future application of a bioremediation amendment (such as ORC) if groundwater monitoring indicates that the groundwater CULs are not likely to be attained at the CPOC within the estimated restoration time frame. The infiltration galleries would also likely be designed to allow for a limited amount of infiltration of clean site stormwater, such as from roof runoff, as this will introduce highly oxygenated water to stimulate bioremediation. The type of infiltration gallery to be used (trenched with slotted pipe, wells, vault, etc.) will be determined during remedial design. A conceptual layout for the infiltration galleries is shown in Figure 5.2.
- The excavation areas will be backfilled with a variety of fill types including soil that is relocated from another part of the Site, thermally treated soil, clean imported backfill, or crushed concrete could be used. The actual type of backfill requirements will be determined during design depending on future loading expectations. It is not expected, however, that a hard pavement surface will be placed over the excavation areas due to the high cost. Instead, a packed gravel surfacing is foreseen as the eventual pavement type. Therefore, the backfilled soils underlying this eventual surface will be geotechnically capable of addressing the expected loads from future boat building and transport activities.

Stack Area

The top 6 inches of dioxin-containing surface soil in the currently unpaved Stack Area will be scraped off and consolidated using standard construction techniques. It will be relocated on-site in excavation areas where backfill is needed. The soil will only be used for backfill at depths greater than 5 feet bgs. Approximately 1,200 CY of soil will be scraped, stockpiled, and reused.

Hog Fuel Storage Area

The soil from the Hog Fuel Storage Area will be excavated and the soil will be sent off-site for disposal. Approximately 200 CY of soil will be excavated from this area using standard construction equipment.

PCP Area

The soil from the PCP Area is currently in compliance with industrial CULs but will be incidentally excavated as it overlies gasoline-contaminated soil below. Due to the very limited volume of soil in this area, this soil will be sent for disposal rather than being re-used as backfill. Approximately 50 CY of soil will be excavated in this area.

5.3.2 Vapor Intrusion

The proposed cleanup action will remove all vadose zone gasoline-contaminated soil above CULs and a substantial portion of gasoline-contaminated smear zone soil to either CULs or remediation levels. Removal of these soils will substantially lessen, but not eliminate, the risk of a future vapor intrusion pathway from site soil or groundwater. Therefore, the risk of vapor intrusion for any future building constructed on site will still need to be addressed.

Institutional controls will be necessary to require that this evaluation be done. This evaluation will occur for any building constructed on the property and, depending on subsurface conditions under the building, may involve additional testing and analysis in accordance with current Ecology regulation or guidance to evaluate the actual risk of vapor intrusion into future buildings. If an unacceptable risk is anticipated as a result of this assessment, remedial measures may be necessary during construction, such as a vapor barrier). Institutional controls are expected to include an environmental covenant that describes the location of the known remaining contamination, requires evaluation and mitigation of the vapor intrusion risk when new construction is proposed, and meets other requirements under state law.

5.3.3 Groundwater Treatment

As discussed above, a bioremediation amendment will be used to stimulate the aerobic biodegradation of residual petroleum contamination during excavation activities. The bioremediation amendment will supply supplemental oxygen and nutrients to naturally occurring hydrocarbon-degrading bacteria. A chemical oxidant may also be used to speed treatment or address areas of deeper smear zone contamination as previously discussed. The amendment will be sprayed and mechanically mixed into the saturated soil at the base of the excavation prior to backfilling.

Following the completion of the source area excavation and backfilling as well as the initial injection of bioamendments under Cedar Street, an assessment of groundwater conditions would be performed to determine the need for additional in-situ bio treatment of groundwater, including in the backfilled excavation areas and along Cedar Street. Select monitoring wells that were abandoned prior to construction would be replaced and a compliance monitoring well network would be established (refer to Figure 5.2). Groundwater monitoring of these new wells would be conducted to determine current groundwater quality conditions both underneath the former mill building as well as along Cedar Street. The results of that monitoring will determine the need for additional groundwater treatment if monitoring indicates that the CULs will not be soon attained at the CPOC along the bulkhead within the restoration time frame.

The post excavation groundwater treatment would be adaptive and based on lessons learned from the excavation and initial response of the system to the ORC applications in both Cedar Street and in the backfilled excavation areas. The treatment could include application of biological amendments via the infiltration gallery delivery system that is installed following the excavation or via additional in-situ injections using a Geoprobe. Additional data may also be needed to fill data gaps (e.g. current dissolved oxygen levels, soil pH, soil oxygen demand, water chemistry, and bacteriological census count) prior the formulation of a specific treatment plan. Alternatively, a pilot test may be prudent to inform the treatment selection. Figure 5.2 indicates the general Site areas where bio treatment would occur, in particular, the core of the off property benzene plume under Cedar Street will be targeted as well as groundwater near the conditional point of compliance near the bulkhead. The approach to both syn- and post-construction bioremediation would be presented to Ecology in the Engineering Design Report. Following construction activities, as mentioned above, the extent of remaining groundwater contamination Site wide would be assessed and that information used to make modifications to the plan presented in the EDR.

5.3.4 Log Pond Fill Area

Additional sampling will be conducted in the Log Pond Fill Area to better delineate the boundary of the contamination and the necessary extent of institutional controls. A Soil Management Plan that will be developed as part of remedial design will specify how future work could be conducted in the Log Pond Fill Area without disturbing the deeper contaminated soils.

5.4 ON-SITE TREATMENT OPTION

An option instead of disposing all the contaminated soil off-site at a landfill is to thermally treat soil on-site using up to three portable soil treatment units. Contaminated soil is loaded into steel boxes that are placed inside a self-contained treatment unit. The soil is heated using electricity. Hydrocarbon vapors that are boiled off during heating are captured in a vacuum system and destroyed in a catalytic oxidizer. Treated soil would then be allowed to cool and be reused as backfill. This is a more sustainable option than trucking soil to Tacoma, the nearest transfer station, and then using rail transport to a distant landfill. In addition, clean backfill would need to be trucked in from a distant quarry to make up for the volume of soil that is sent off-site for landfilling. However, the ex-situ treatment option is an emerging technology and, while has been demonstrated to be effective in both urban areas (such as the LA Basin) as well as remote areas (such as Alaska), it is limited in treatment capacity so it may not be able to meet project schedules. The cost for treatment may also be significantly higher than disposal of soil in a landfill. The final decision as to how excavated soil at the Site will be addressed (i.e., on-site treatment and re-use or off-site disposal) will be determined during remedial design and the actual cost via a bidding process. If ex situ thermal treatment is determined to be cost-effective and ultimately used, an air permit will be first obtained from the local air permitting authority (ORCAA).

5.5 COMPLIANCE MONITORING REQUIREMENTS

Compliance monitoring requirements associated with remedy implementation consist of protection monitoring during construction activities, performance monitoring to ensure remedy construction is in accordance with the project plans and design, and confirmation monitoring following remedy completion to confirm the long-term effectiveness of the remedy.

5.5.1 Protection Monitoring

Protection monitoring will be conducted during both remedy construction and operation and maintenance activities to confirm the protection of human health and the environment. Protection monitoring requirements will be described in a Health and Safety Plan addressing worker activities during remedy construction and in the Soil Management Plan regarding future operations associated with the constructed remedy or institutional controls. Any activities conducted at the Site following remedy implementation that have the possibility of disturbing potential contamination left in place will require adherence to the Soil Management Plan and a post-remediation Health and Safety Plan that will describe worker protection monitoring requirements.

5.5.2 Performance Monitoring

Performance monitoring activities will be conducted during remedy construction. Performance monitoring will consist of the following:

- Soil sampling will be conducted during construction to ensure that the remaining soil following excavation meets applicable CULs or remediation levels (RLs). This will consist of the collection of soil samples from excavation sidewalls for vadose zone cleanup confirmation and excavation bottom samples for smear zone cleanup confirmation. The results following initial excavation will determine the need for any follow up over-excavation activities. It will also include testing of thermally treated soil, as well as testing of any imported fill material. A gridded approach to sampling will be utilized, with one confirmation bottom sample collected for approximately every 1,600 square feet of excavation area (40 x 40 ft) and one sidewall sample for 40 lineal feet of excavation perimeter. Details will be provided in the Engineering Design Report.
- Sampling of stockpiled soil will also occur to determine suitability for backfilling. Ecology current Guidance for the Remediation of Petroleum Contaminated Sites will be used to determine the frequency of sampling. For stockpiles with over 2,000 cubic yards of soil, the guidance recommends ten samples plus one additional sample for each additional 500 cubic yards of stockpiled soil.
- Olfactory, visual, and PID screening of overburden soil will be performed to prevent comingling of clean overburden stockpiles with contaminated soil. Details on the field screening will be included in the Engineering Design Report (EDR).
- Quality control monitoring for construction activities will be conducted, such as surveys to confirm excavation extent and backfill acceptance testing (i.e., imported backfill shall not contain contaminant concentrations greater than MTCA Method A CULs) and compaction testing.

5.5.3 Confirmation Monitoring

A plan for confirmation monitoring will be included in the EDR. The Soil and Groundwater Confirmation Monitoring Plan will include sampling of monitoring wells along the bulkhead (as close as practically possible to the surface water) as conditional point of compliance wells and upland wells to track the effectiveness of the implemented remedy. These wells must be clearly identified in the confirmation monitoring plan. Groundwater monitoring will ensure that smear zone contaminated soils left in place in the Concrete Pad Excavation area do not pose a risk to the surface water via leaching of contaminants to groundwater, and migration of contaminated groundwater to surface water. The confirmation plan will also include options to increase or decrease the frequency of monitoring based on sampling results. Confirmation monitoring activities will be conducted following completion of the remedy and will consist of the following:

- After completion of the excavation activities, and re-installation of wells, quarterly confirmation monitoring will be conducted for a minimum of two years after remedy implementation to confirm long-term remedy effectiveness. A reduction in sampling frequency to semi-annual may occur after this initial two year period according to the confirmation monitoring plan if results are stable and decreasing. Confirmation monitoring will be conducted until groundwater meets CULs at the conditional point of compliance over four consecutive monitoring events, following which sampling frequency will decrease in according with the confirmation plan and discussion with Ecology. A minimum sampling frequency of every 18 months is expected. Groundwater confirmation monitoring will be required as long as soil contamination above CULs remains.

- Long Term Soil Monitoring – Sampling of soil once every five years will be performed to confirm that MNA in areas of residually-contaminated soils is effective. The objective of this sampling will be to define the current limits of soil greater than CULs and average concentrations of COCs within these areas, which is expected to diminish over time.

If after initial in-situ bioremediation efforts during construction and additional post-construction bioremediation treatments as described in the post-construction bioremediation plan, contaminant concentrations continue to exceed cleanup levels without abating in groundwater samples after four quarters of post-treatment monitoring at the conditional point of compliance wells along the bulkhead (as established in the Soil and Groundwater Conformation Monitoring Plan), additional contingency actions will be developed and implemented as appropriate.

5.6 PROJECT PLANS

The project plans will consist primarily of the EDR. The EDR will adequately describe details of both the construction elements of the project, compliance sampling, and the syn- and post-construction bioremediation elements of the project. The EDR will describe in general terms the approach to bioremediation, including bioremediation during construction and after construction. The post-construction bioremediation plan will be adaptive and flexible, allowing for lessons learned and modification to best address the actual post-construction field conditions. The need for adaptability is driven by the potential for significant changes in the extent and magnitude of the current groundwater plume (both off site and on-site) compared to that following construction activities.

The EDR will include also include appendices that contain detailed plans addressing specific aspects of the project: including:

- Soil and Groundwater Confirmation Monitoring Plan and associated SAP/QAPP
- Health and Safety Plan
- Spill Protection, Containment, and Countermeasures Plan

- Temporary Erosion and Sediment Control Plan
- Archeological Unexpected Discovery Plan
- Ex Situ Soil Treatment Plan
- Geotechnical Report
- Biological Amendment and/or Chemical Oxidation Sizing Calculations

5.7 RESTORATION TIMEFRAME

All cleanup action components can be designed, permitted, and installed within 1 year after this CAP for the Site is finalized. The excavation portion of the cleanup action will require approximately 3 to 4 months to implement (average of 500 tons per day excavated). Post-excavation bio-treatment will follow. It is expected that it will take up to 10 years to achieve groundwater CULs at the CPOC depending on the levels of contamination that remain following excavation and the effectiveness of the bioremediation.

The time frame for all site soil to achieve CULs via monitored natural attenuation (i.e., primarily the smear zone soil left unexcavated in the Concrete Pad Excavation area at concentrations less than the site remediation levels but greater than the site CULs is expected to require up to 30 years. However, infiltration galleries will be positioned to deliver bio-amendments to accelerate this process if it appears to require longer than 30 years

5.8 INSTITUTIONAL CONTROLS

Institutional controls in the form of limited use/notification restrictions may be necessary in areas where soil or groundwater concentrations exceed applicable MTCA Method A or B CULs (e.g., for petroleum-related contaminants) and in areas where MTCA Method C is the applicable CUL (e.g., dioxins and PCP). Institutional controls will also be needed as a requirement that a vapor intrusion assessment is conducted for new buildings built on the Site. Institutional controls at the Site will include the following:

- An Environmental Covenant indicating that industrial CULs were applied at the Site and that the future uses of the property need to be consistent with industrial uses and CULs.
- Prohibition on withdrawal of groundwater except for monitoring purposes.
- Implementation of an Ecology-approved Soil Management Plan specifying soil management procedures for future excavation and health and safety requirements for subsurface work in areas where contamination concentrations greater than CULs remain. These procedures will be applicable to any future site redevelopment or maintenance that involves removal or disturbance of subsurface material. The Soil Management Plan will be prepared for Ecology approval concurrent with remedial design and will include specifications for the following:
    - Methods to identify and assess areas where soil remains at concentrations greater than the CUL (such as in the Log Pond Area or smear zone soils that remain above site CULs)
    - Health and safety requirements for working in and handling site soils.
    - Best management practices for soil stockpiling, dust control, and erosion control. Requirements for off-site disposal and associated recordkeeping.
    - Requirements for Ecology notification and reporting.

Institutional controls will also be necessary to require additional testing and analysis to evaluate the actual risk of vapor intrusion into potential future buildings constructed at the Site where contamination remains and what, if any, remedial measures may be necessary (such as a vapor barrier). The Environmental Covenant must include the following requirements regarding vapor intrusion and indoor air:

- A vapor intrusion assessment must be performed on any part of the property consistent with current Ecology guidance or regulation prior to the construction of buildings on site. If the assessment indicates no soil or groundwater contamination in or near future building areas, then no further action is necessary. However, if building will occur over areas of residual groundwater or soil contamination, then a more detailed assessment of the potential vapor intrusion must be performed, which may lead to the need for mitigation.
- In areas of vapor intrusion risk, only slab-on-grade buildings without basements shall be allowed to be constructed. Prior to construction, Ecology shall review and approve any proposed engineering plans for engineered controls and/or mitigation systems (such as vapor barriers and sub-slab depressurization systems).
- Land use is to remain industrial.

5.9 FUTURE REDEVELOPMENT

After the cleanup is performed, the Port will work to redevelop the Site for productive economic use as soon as possible. The Port seeks to prepare the site for redevelopment to the extent practicable and also consistent with the master plan for that area, which is one of support activities for the maritime industry (e.g., boat building or repairs). Goals of the redevelopment include the following:

1. Prepare the Site for industrial use in the marine trades, consistent with the adjacent terminal facilities and boat repair/construction operations across Cedar Street.
2. Return the Site to economic use in late 2016.

These objectives are in the interest of the Port and the economy of the area, and support the protection of the local environment.

5.10 SITE OWNERSHIP AND ACCESS

The Site is owned by the Port. There are portions of land off-shore of the Site that are owned by DNR, but these areas are managed by the Port under the Port Management Agreement. All proposed remedial actions will take place on Port-owned areas. Implementation of institutional controls and the Soil Management Plan to manage contaminated soil remaining in place will be conducted by the Port and future Port tenants. The Port has access to the entire Site, including that portion now leased short-term to the current debarking and log storage operation.

5.11 CULTURAL RESOURCES

The project site (or area) is located near Tumwater Creek and is in close proximity to one of the three documented Klallam villages in the Harbor area. The project area is approximately 1 mile from the *Tse-whit-zen* village site and another documented Klallam village site at the mouth of Ennis Creek. Cultural resource protocols for monitoring during all ground-disturbing activities during remediation will be implemented in compliance with federal, state, and local laws and regulations in accordance with the new Agreed Order. In addition, the Port, the City of

Port Angeles, and the Lower Elwha Klallam Tribe (LEKT) have an agreement that all ground-disturbing activities in the area between the bluff to the south and the shoreline behind which the K Ply mill is located require monitoring of site work by an archaeologist.

A Settlement Agreement between the Port, the City of Port Angeles, and the LEKT and a LEKT Monitoring and Inadvertent Discovery Plan (MIDP) outline protocols in the event that human remains or other archaeological deposits are discovered; however, this MIDP is general to the Settlement Agreement. The DAHP has reviewed this MIDP and has requested that a project-specific MIDP be prepared for the project. Prior to cleanup, the Port, the City of Port Angeles archaeologist, and the LEKT will be provided the scope of work and project-specific MIDP for review and comment, and will be notified of the construction schedule. The project-specific MIDP will be an appendix to the Engineering Design Report.

A subconsultant archaeologist with City/Tribal oversight and/or the city archaeologist or LEKT archaeologist, will monitor ground-disturbing cleanup activities, primarily excavation. All field observations will be recorded in a field notebook, and photographs will be taken of each monitored location and the general work area. A Cultural Resources Monitoring Report will be completed and included as part of the Construction Completion Report.

Of note, a Native American midden was uncovered in 2011 during the installation of a culvert into the Harbor in the Valley Creek stream bank, adjacent to the Valley Creek Estuary Park. The Valley Creek stream bank borders the K Ply log sorting yard on the east. Derek Beery from the City of Port Angeles was present at the time of the discovery and asked Bill White with the LEKT to confirm that the material was a deposited midden, which he did. The original location of the dredged/redeposited sediments was unknown, and that redeposited midden can still contain artifacts and other items of importance to the Tribe.

5.12 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The cleanup action complies with all ARARs under WAC 173-340-710 described below. Legally applicable requirements to be considered are those that specifically address a hazardous substance, cleanup action, location, or other circumstances at the Site.

5.12.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements

Chemical-specific ARARs are met through compliance with applicable CUL criteria.

5.12.1.1 Water Quality Standards for Washington Surface Waters (WAC 173-201A)

The cleanup action will comply with Washington State Surface Water Standards that apply to stormwater discharges during remedial construction. Standards that control discharge of other pollutants to stormwater generated during construction would be applicable. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared that describes how stormwater will be managed during construction.

5.12.1.2 National Toxics Rule

The National Toxics Rule sets numeric criteria for several priority toxic pollutants in marine surface waters, including several VOCs. This rule was used to develop CULs. Subpart D, Federally Promulgated Water Quality Standards, is applicable. These standards are referenced in MTCA (WAC 173-340-730(3)(b)) as applicable federal laws and are based on human health. Of the Site COCs, criteria are listed for benzene only.

5.12.1.3 National Recommended Water Quality Standards

The NRWQC federally-promulgated water quality standards are applicable. These standards are referenced in MTCA (WAC 173-340-730 (3)(b)) as applicable federal laws and are based on human health. Of the Site COCs, criteria are listed for benzene only, which is the proposed CUL for groundwater at this site.

5.12.1.4 Controls for New Sources of Toxic Air Pollutants (WAC 173-460)

Pursuant to RCW Chapter 70.94, Washington Clean Air Act, the purpose of this regulation is to establish controls for new or modified sources emitting toxic air pollutants in order to prevent air pollution, reduce emissions to the extent reasonably possible, and maintain such levels of air quality as will protect human health and safety. Operation of an on-site thermal desorption unit to treat soils as part of the cleanup action would establish a new potential source of benzene, ethylbenzene, and toluene, which are regulated as toxic air pollutants listed in WAC 173-460-150. The air emissions from the vapor treatment system would require a permit, monitoring, and reporting administered by the Olympic Region Clean Air Agency.

5.12.2 Location-Specific Applicable or Relevant and Appropriate Requirements

Location-specific ARARs are met through compliance with all applicable state, federal, and local regulations in place for the physical location of the Site. The following location-specific ARARs apply to the cleanup action.

5.12.2.1 Native American Graves Protection and Repatriation Act (25 USC 3001 through 3113; 43 Code of Federal Regulations [CFR] Part 10) and Washington's Indian Graves and Records Law (RCW 27.44)

These statutes, or local variations, prohibit the destruction or removal of Native American cultural items and require written notification of inadvertent discovery to the appropriate agencies and Native American tribe. Because the general waterfront area has been occupied, or otherwise used, by Native American tribes, remediation activities could uncover artifacts. A Cultural Resources Plan must be developed and submitted to the City of Port Angeles when significant ground-disturbing activities are implemented. The plan typically requires oversight by an archeologist to examine disturbed soil for evidence of artifacts. Refer to Section 5.9

5.12.2.2 Archaeological Resources Protection Act (16 USC 470aa et seq.; 43 CFR part 7)

This program, or similar local variations, sets forth requirements that are triggered when archaeological resources are discovered. These requirements only apply if archaeological items are discovered during implementation of the selected remedy. Refer to Section 5.9.

5.12.2.3 Washington State Shoreline Management Act (WAC 173-16-040(4) and City of Port Angeles Shoreline Master Program

The Washington state Shoreline Management Act, authorized under the federal Coastal Zone Management Act, and implemented through the City of Port Angeles' Shoreline Master

Program, establishes requirements for substantial development occurring within the waters of the State of Washington or within 200 feet of a shoreline. The cleanup action will comply with the applicable substantive requirements under the City of Port Angeles' Shoreline Management Act Program.

5.12.3 Action-Specific Applicable or Relevant and Appropriate Requirements

Action-specific ARARs are requirements that define acceptable management practices and are usually specific to certain kinds of activities that occur with or are specific to the technologies that are used during the implementation of cleanup actions. Applicable action-specific ARARs will be met through implementation of construction activities in compliance with all applicable construction-related requirements such as health and safety restrictions, site use and other local permits, and disposal requirements for excavated soil.

5.12.3.1 Washington Dangerous Waste Regulations (WAC 173-303)

These requirements potentially apply to the identification, generation, accumulation, and transport of hazardous/dangerous wastes at the Site during remediation. These standards are applicable to any soil wastes that are taken off-site for disposal with concentrations the exceed Washington Dangerous Waste criteria. Of primary concern would be benzene, which is present in some soils at relatively elevated concentrations that may trigger this ARAR if present in soil at leachable concentrations that exceed 0.5 milligrams per liter (mg/L). If so, the soil would be classified as a Dangerous Waste and would need to first be either treated to levels less than this concentration or disposed of at a Subtitle C hazardous waste landfill.

5.12.3.2 Washington Solid Waste Handling Standards (WAC 173-350)

These requirements establish minimum standards for handling and disposal of solid waste. They are applicable for alternatives that generate solid waste, the definition of which includes wastes that are likely to be generated as a result of site remediation, including contaminated soils, construction and demolition wastes, and garbage. The standards require that solid waste be handled in a manner that does not pose a threat to human health or the environment, and comply with local solid waste management rules and applicable water and air pollution controls.

5.12.3.3 Water Quality Standards for Surface Waters of the State of Washington (RCW 90.48 and 90.54; WAC 173-201A)

The cleanup action will comply with surface water quality standards such as turbidity and pH that apply to certain construction elements (e.g., during excavation activities). The area of construction and equipment staging will likely be greater than 1 acre, and so will require a National Pollutant Discharge Elimination System Stormwater Construction Permit, administered by Ecology to control discharge of pollutants from the construction activities. A SWPPP will be prepared that describes how stormwater will be managed during construction.

5.12.3.4 State Environmental Policy Act

State Environmental Policy Act (SEPA) review should be conducted in conjunction with design and permitting to evaluate SEPA/National Environmental Policy Act (NEPA) compliance.

5.12.3.5 Federal and State of Washington Worker Safety Regulations

The safety of workers implementing remedies at hazardous waste sites are covered by the following regulations:

- Health and Safety for Hazardous Waste Operations and Emergency Response (HAZWOPER), WAC 296-62 and Health and Safety 29 CFR 1901.120
- Occupational Safety and Health Act (OSHA)
- Washington Industrial Safety and Health Act (WISHA), WAC 296-62, WAC 296-155, and RCW 49.1

The HAZWOPER regulates health and safety operations for hazardous waste sites. The health and safety regulations describe federal requirements for health and safety training for workers at hazardous waste sites.

OSHA provides employee health and safety regulations for construction activities and general construction standards, as well as regulations for fire protection, materials handling, hazardous materials, personal protective equipment, and general environmental controls. Hazardous waste site work requires that, prior to participation, employees to be trained in site activities, medical monitoring, monitoring to protect employees from excessive exposure to hazardous substances, and decontamination of personnel and equipment.

Washington State adopted the standards that govern the conditions of employment in all work places under its WISHA regulations. The regulations encourage efforts to reduce safety and health hazards in the work place and set standards for safe work practices for dangerous areas such as trenches, excavations, and hazardous waste sites.

5.12.3.6 Underground Injection Well Registration

The Underground Injection Control (UIC) Program protects groundwater quality by regulating discharges to UIC wells. UIC wells are manmade structures used to discharge fluids into the subsurface. Introducing ORC may require registration with the UIC Program, especially if done using infiltration galleries. Injection wells utilized for purposes of environmental cleanup under MTCA are rule-authorized, provided they meet the non-endangerment standard. It is expected that introduction of ORC will meet this standard.

5.12.3.7 Minimum Standards for Construction and Maintenance of Wells (WAC 173-160)

Groundwater monitoring wells will need to be installed as a part of post-construction confirmational groundwater monitoring outlined in section 5.4.3. Also the existing wells within the excavation area need to be abandoned before the excavation of contaminated soils. The new wells will be constructed and the existing wells will be abandoned in accordance with the requirements of WAC 173-160 to further ensure protection of groundwater resources at the Site.

5.13 RATIONALE FOR SELECTION OF THE CLEANUP ACTION AND COMPLIANCE WITH THE MODEL TOXICS CONTROL ACT

The cleanup action for soil and groundwater meets the minimum requirements for selection of a cleanup action under MTCA WAC 173-340-360(2)(a) because it is protective of human health and the environment, complies with cleanup standards, complies with applicable state and federal laws, and provides for compliance monitoring. The cleanup action was determined to be the permanent remedy to the maximum extent practicable in the disproportionate cost analysis presented in the RI/FS. The selected cleanup action also meets the other MTCA requirements for selection of a cleanup action, including using permanent solutions to the maximum extent practicable, providing for a reasonable restoration time frame, and consideration of public concerns. Exposure pathways will be addressed through either containment or contaminant removal and disposal in a landfill or treatment and bioremediation. Institutional controls will be developed to manage contamination that will remain on-site at concentrations greater than CULs.

The cleanup action, Alternative 3, was selected as the proposed cleanup action over the other alternatives in the FS based on the following:

- A high level of effectiveness and implementability of excavation and bioremediation compared to alternatives that included ISCO or an air sparge curtain.
- A similar level of permanence, protectiveness, and effectiveness as Alternative 4, which includes significant additional excavation at a much higher cost.

Alternative 1 provided a low level of protectiveness, permanence, and effectiveness over the long-term compared to the selected cleanup action. Treatment of contaminated groundwater at the Site with an air sparge curtain would require a very long restoration time frame and would not be as effective as excavation and bioremediation.

The effectiveness and implementability of chemical oxidation under Alternative 2 is problematic at this Site given the volume and extent of source mass. Although chemical oxidation as a technology is theoretically capable of destroying sufficient contaminant mass to attain CULs, feasibility is governed by site-specific factors that suggest critical implementability and effectiveness problems. In addition, Alternative 2 would have left in place several areas of vadose zone-contaminated soil that would not be treatable with ISCO. There is too much source mass at the Site for chemical oxidation to be an effective solution site-wide.

The benefits of the selected cleanup action in terms of overall risk reduction are similar to those of the most permanent option considered in the FS, Alternative 4. The incremental cost of implementing more soil removal and bioremediation under Alternative 4 over the selected cleanup action was determined to be disproportionate to the benefits. Alternative 4 would have added to the selected cleanup action by removing contaminated smear zone soil (about 6,700 additional CY, plus substantially more overburden soil) from the center and southern edges of the former mill footprint, augmented with bioremediation of groundwater in this area. Additionally, Alternative 4 still requires an assessment of the vapor intrusion risk due to residually-contaminated groundwater. Alternative 4 would not achieve RAOs any faster, including groundwater compliance at the CPOC at the bulkhead, than the selected cleanup action or have a shorter overall restoration timeframe. Further, Alternative 4 is estimated to cost about $2.3 million more than the selected cleanup action.

6.0 Five-Year Review

Because the cleanup action described in Section 5.0 will result in hazardous substances remaining at the Site at concentrations exceeding cleanup levels, and because environmental covenants are included as part of the remedy, Ecology will review the selected cleanup action described in this CAP every 5 years to ensure protection of human health and the environment. Consistent with the requirements of WAC 173-340-420, the 5-year review shall include the following:

- A review of the title of the real property subject to the environmental covenant to verify that the covenant is properly recorded.
- A review of available monitoring data to verify the effectiveness of completed cleanup actions, including engineered caps and institutional controls, in limiting exposure to hazardous substances remaining at the Site.
- A review of new scientific information for individual hazardous substances or mixtures present at the Site.
- A review of new applicable state and federal lows for hazardous substances present at the Site.
- A review of current and projected future land and resouce uses at the Site.
- A review of the availability and practicability of more permanent remedies.
- A review of the availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology will publish a notice of all periodic reviews in the Site Register and will provide an opportunity for review and comment by the potentially liable persons and the public. If Ecology determines that substantial changes in the cleanup action are necessary to protect human health and the environment at the Site, a revised CAP will be prepared and provided for public review and comment in accordance with WAC 173-340-380 and 173-340-600.

7.0 Implementation Schedule

A schedule for implementation of the cleanup action is provided in this section. A schedule for major deliverables and work tasks for the cleanup action will be included with the AO of the implementation of this CAP. The EDR will include a schedule for final design and construction in accordance with WAC 173-340-400(a)(vi). Implementation of the remedy at the Site will likely be conducted as a single project; however select components (e.g., the eastern portion of the Site) may be phased.

Action	Due Date and Triggering Event	Notes
Public comment period on Public Review draft RI/FS, CAP, and AO		Estimated to occur in April of 2015. A public meeting will be held during the comment period.
AO signed by Ecology and CAP finalized	Following completion of the public comment period and addressing of public comments.	Ecology to endeavor to address public comments within 30 days
Draft Engineering Design Report	Due 60 days after signature of Agreed Order and finalization of CAP	Ecology will endeavor to provide comments within 45 days. Some field activities are expected to be necessary as part of design. EDR includes all environmental work items including soil and groundwater compliance monitoring plans and Health and Safety Plans.
Final EDR	Due 30 days after receipt of Ecology's comments	Ecology to endeavor to review and approve within 30 days.
Construction	Begin within 120 days of approval of EDR	Construction is assumed to take 8-12 weeks and will include all excavation activities and the addition of bioamendments in excavation areas and initial bio- treatment of the Cedar Street benzene plume.
Draft Construction Completion Report	90 days following construction completion	Construction Completion Report includes Soil Management Plan
Draft of Environmental Covenant	30 days following approval of Construction Completion Report	Draft to be provided by Port for Ecology Review and Approval
Environmental Covenant Recorded	10 days following approval by Ecology	
Installation of compliance	Within 90 days following	Installation of up to 10 wells

Action	Due Date and Triggering Event	Notes
monitoring wells and post construction assessment of groundwater	completion of construction activities	necessary for completion of monitoring network and redefinition of groundwater conditions. Redefinition in some areas via Geoprobe.
Quarterly Groundwater Monitoring and Reporting	Begins within 14 days of well installation following construction	Minimum 2 years of quarterly sampling is required.
Long Term Groundwater Monitoring	Following Initial 2 years of Quarterly Monitoring	Terminates following achievement of soil and groundwater cleanup levels in accordance with the Compliance Monitoring Plan
Long-Term Soil Monitoring	Every five years following completion of construction activities	Terminates following achievement of soil and groundwater cleanup levels in accordance with the Compliance Monitoring Plan
Draft Log Pond Fill Area Investigation Work Plan	Due 90 days prior to termination of lease with current log debarking tenant	Work Plan objective is to better define soil conditions and extent of contamination in Log Pond Area. Ecology will endeavor to review and provide comments within 30 days.
Final Log Pond Fill Area Investigation Work Plan	Due 30 days after receipt of Ecology's comments	Ecology will endeavor to review and approve within 14 days.
Supplemental Investigation of Log Pond Fill Area	Begin within 60 days following removal of log debarker site infrastructure	Assumes 2-day investigation by Geoprobe or test pits in late 2016
Quarterly Progress Reports	2015-2017	Quarterly progress report for first 2 years only.
Annual Reports	2017-2025	Yearly report to summarize all site activities and include all groundwater and soil sampling conducted during each year as well as a performance monitoring data for the remedial action. Includes recommendations for following year.
5 year Review	Every 5 years following date of Environmental Covenant recording	Ecology conducts 5 year review.

8.0 References

City of Port Angeles. 2011. *Draft Port Angeles Harbor Resources Management Plan 2011*.

Floyd|Snider. 2015. *K Ply Site Remedial Investigation/Feasibility Study.* Public Review Draft. 2 March.

Landau Associates, Inc. 1989. Proposed Remediation Program, Petroleum Hydrocarbons, Peninsula Plywood Facility, Port Angeles, Washington. Prepared for ITT Rayonier Corporation, Shelton, Washington. 20 March.

Plywood Pioneers Association. 2001. “Plywood in Retrospect.” *PenPly to K Ply, The History of Peninsula Plywood Corporation and its Successors*. No. 23. December.

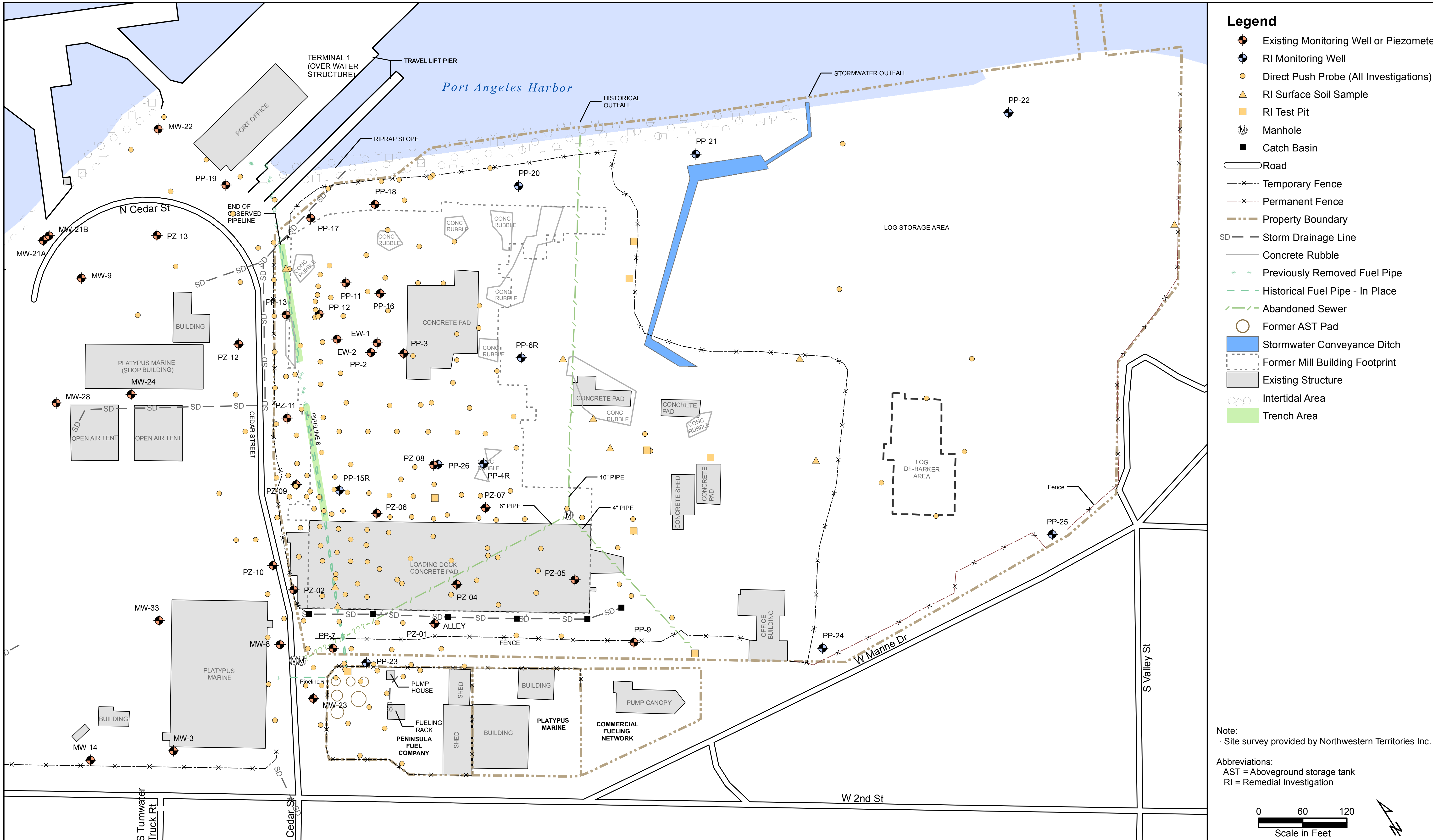
Ryan & Hayworth Co. 1967. *Area Plan Barge Receiving Lines*, Port Dock Area, Port Angeles, Wash. 8 August.

Washington State Department of Ecology (Ecology). 2012. *Agreed Order No. DE 9546.* 15 October.

Figures

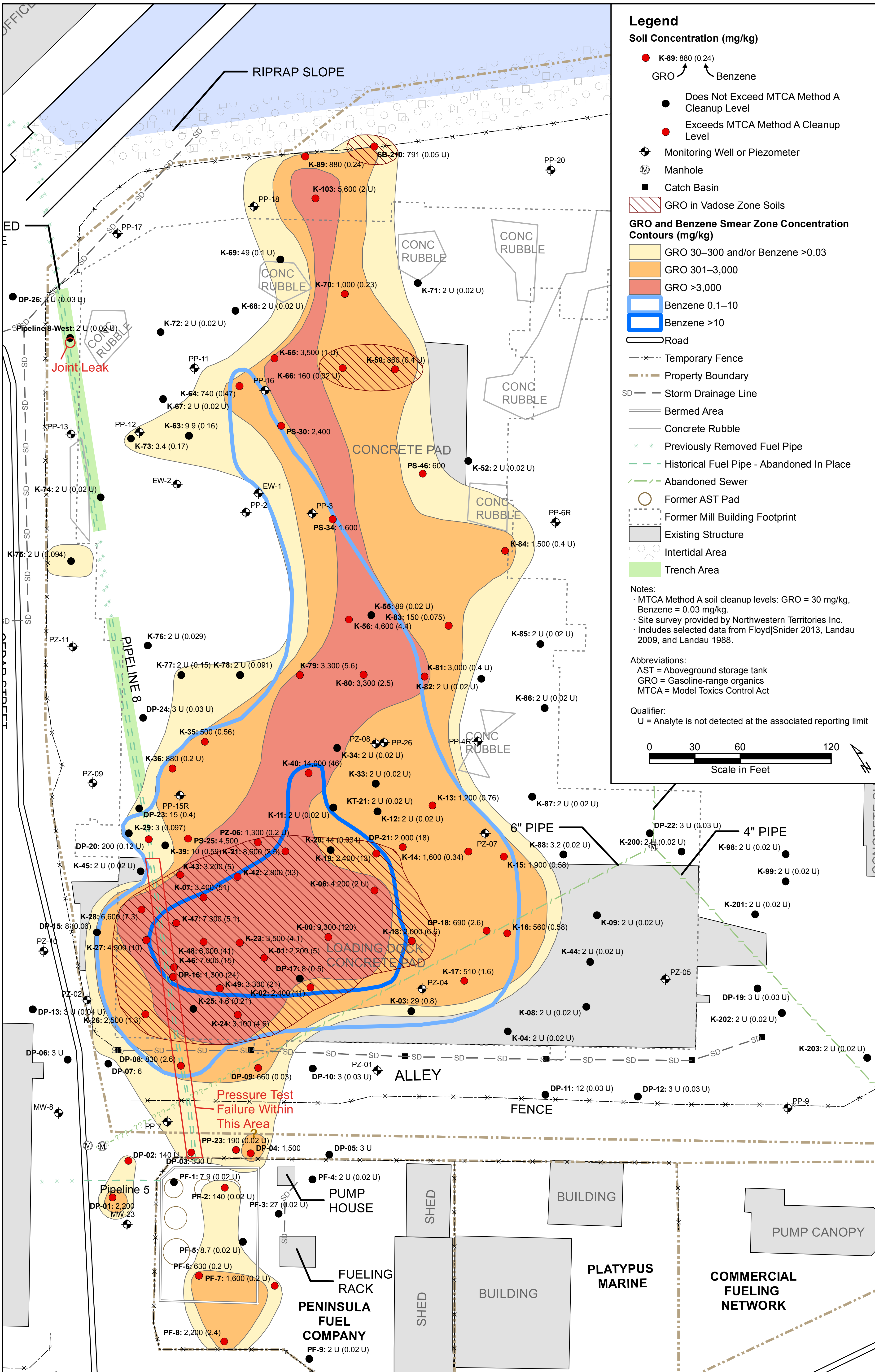
Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 1.1
Vicinity Map



Cleanup Action Plan
K Ply Site
Port Angeles, Washington

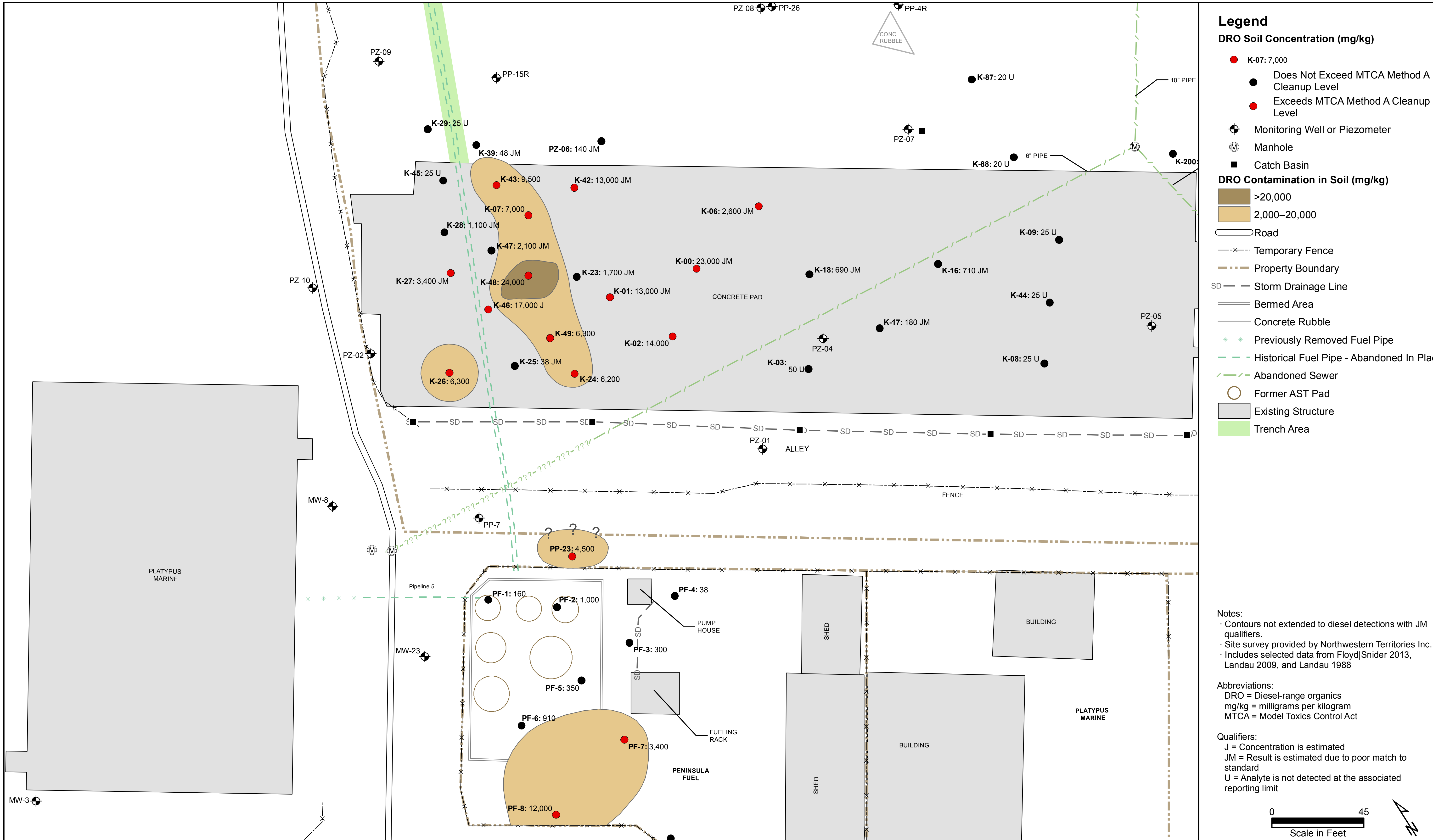
Figure 1.2
Site Map and Sample Locations



Cleanup Action Plan K Ply Site Port Angeles, Washington	Figure 2.1 GRO and Benzene Results in Soil

Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 2.1
GRO and Benzene Results in Soil

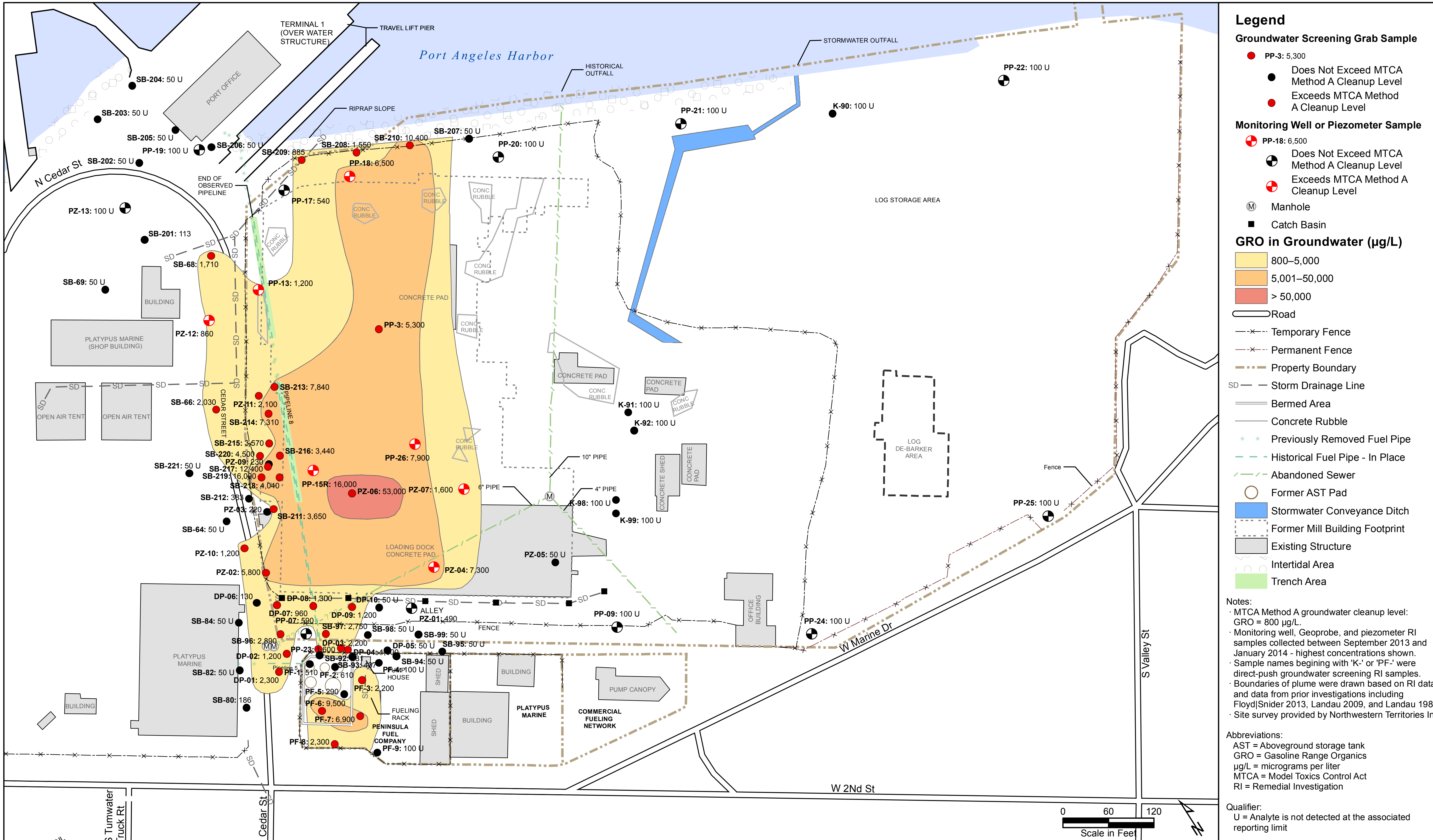


Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 2.2
DRO Results in Soil

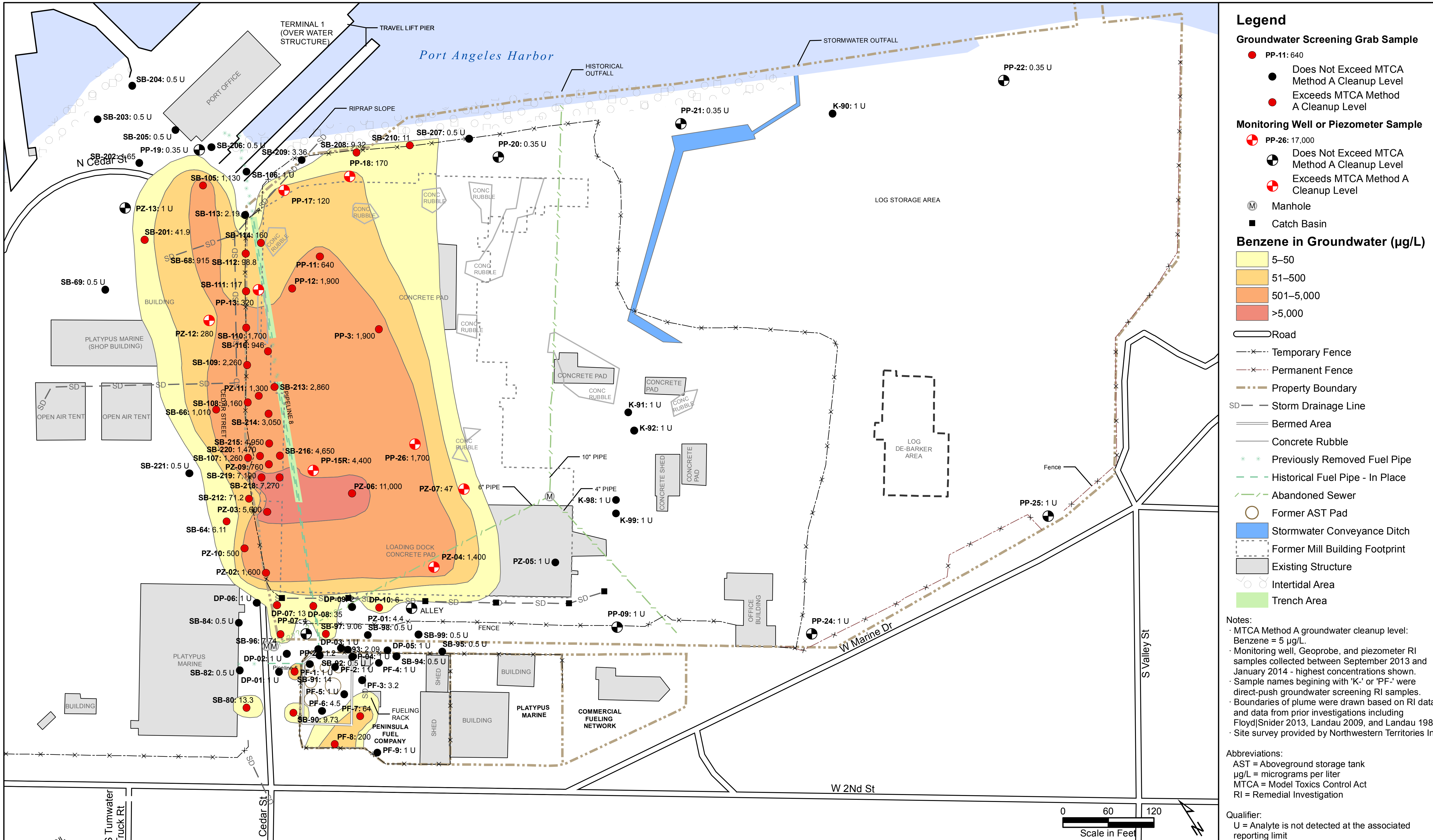
Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 2.3
ORO Results in Soil



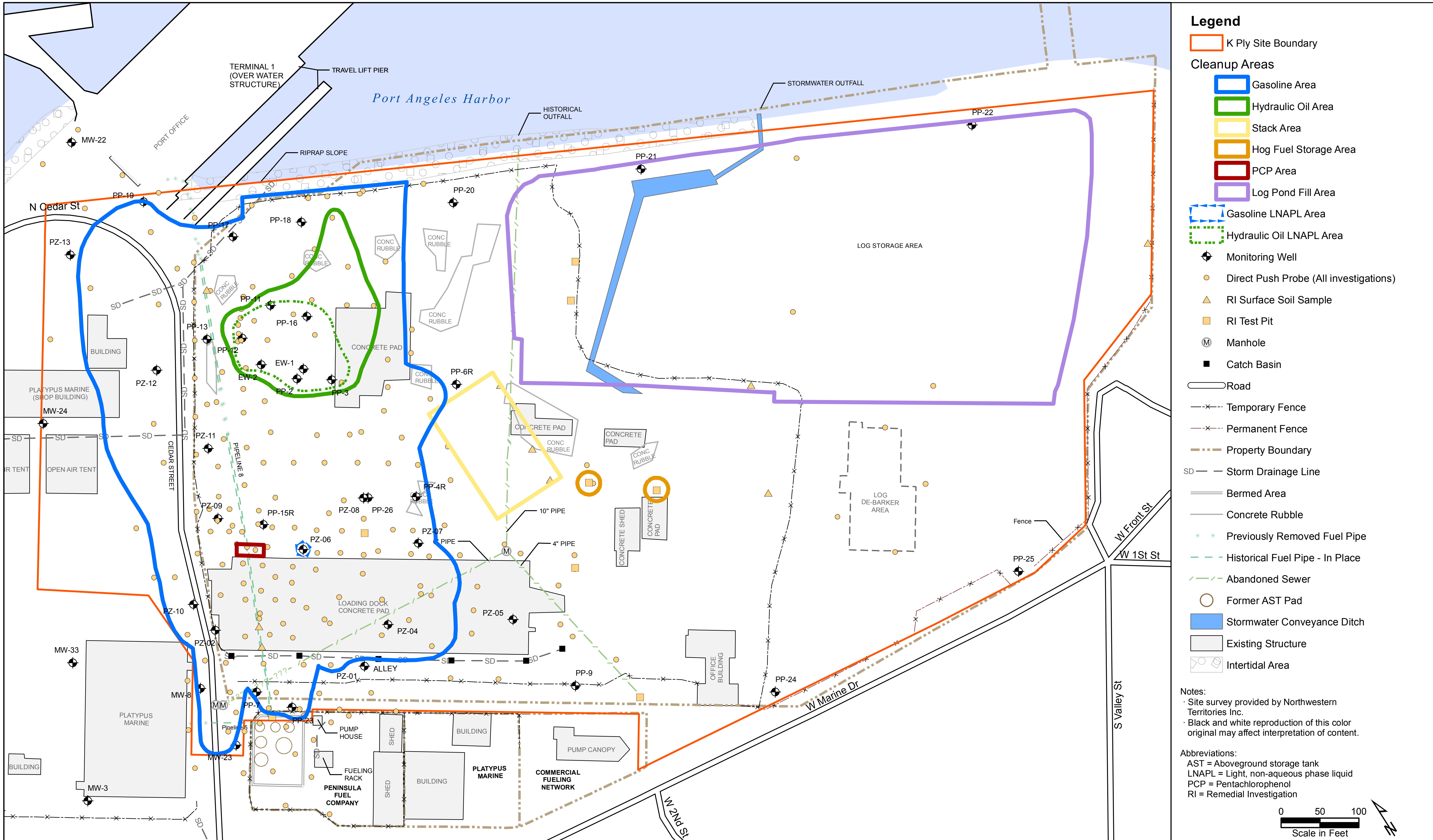
Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 2.4
GRO Results in Groundwater



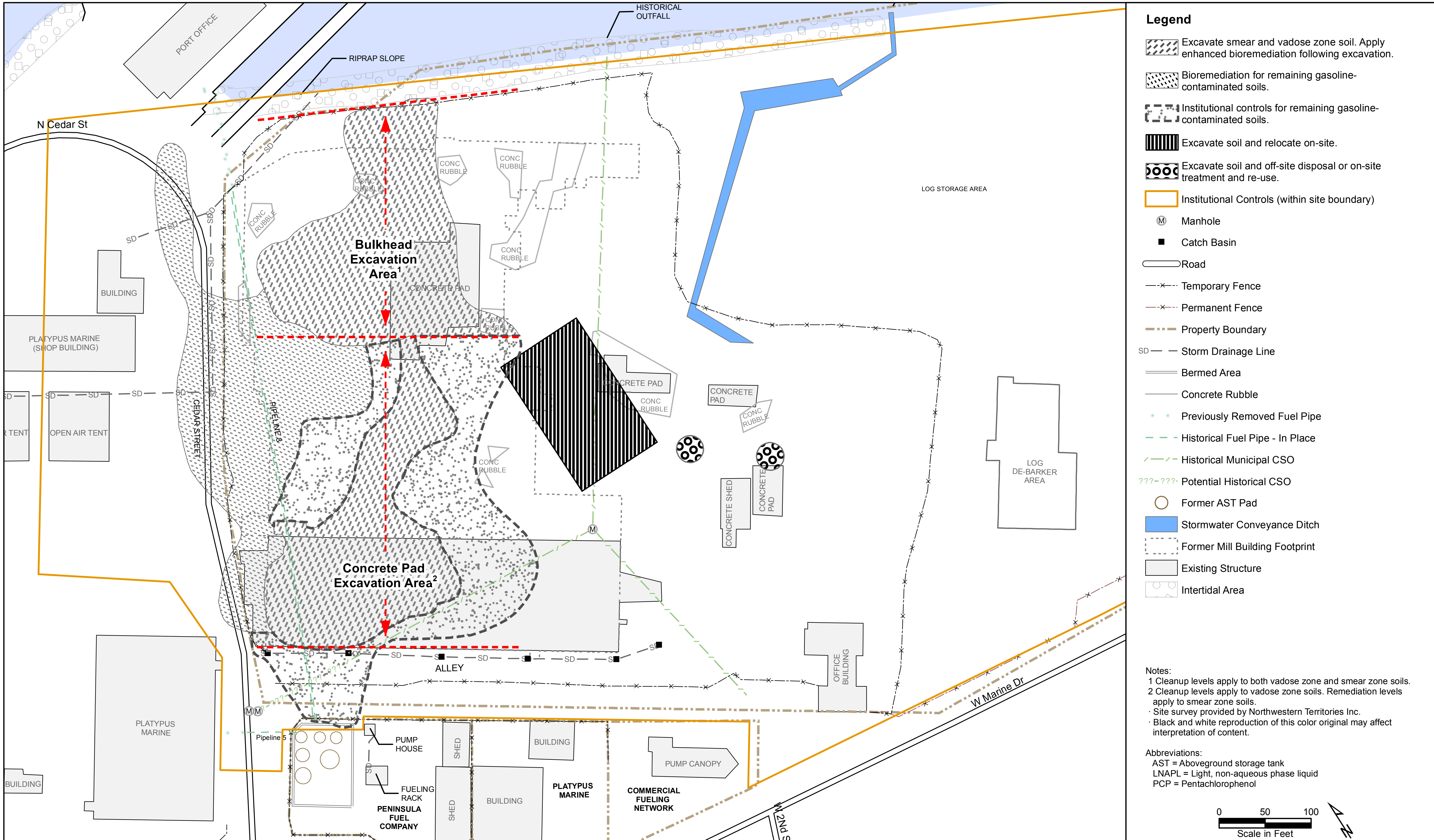
Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 2.5
Benzene Results in Groundwater



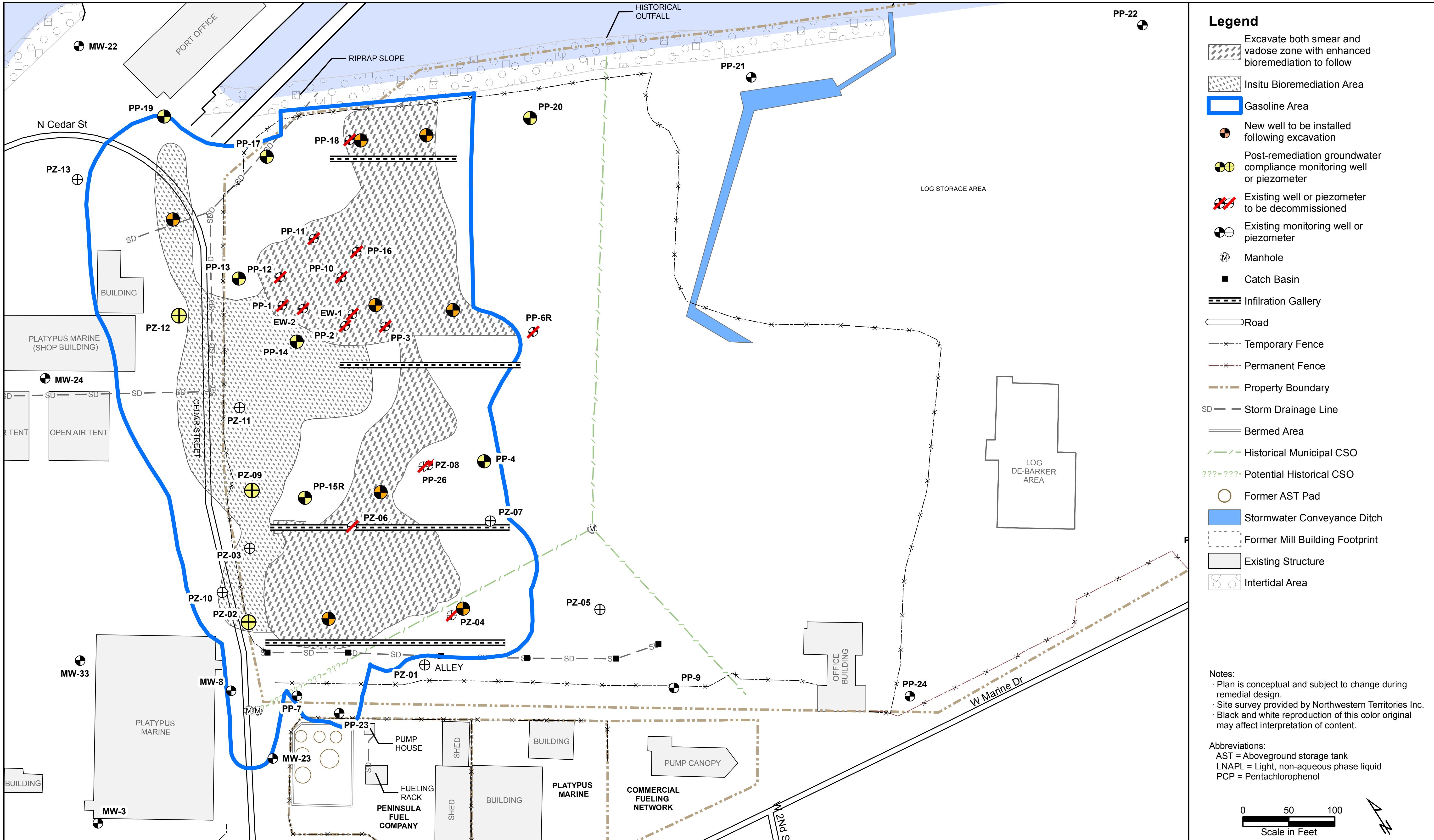
Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 4.1
Site Boundary And Cleanup Areas



Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 5.1
Selected Cleanup Action



Cleanup Action Plan
K Ply Site
Port Angeles, Washington

Figure 5.2
Groundwater Compliance Monitoring Well Network and Infiltration Gallery Layout