Oregon
John A. Kitzhaber, M.D., Governor

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September 21, 2001

Mr. Gary Honeyman
Union Pacific Railroad Company
P.O. Box B
221 Hodgeman
Laramie WY 82072

RECEIVED
SEP 24 2001

Re: DEQ Record of Decision Document
Ashland Rail Yard Project

Dear Mr. Honeyman:

Enclosed is a copy of the Record of Decision (ROD) document prepared by the Oregon Department of Environmental Quality (DEQ). With the ROD, DEQ formally selects the remedial action alternative for the former Ashland Rail Yard. The ROD document also provides a description of the project as well as the selected remedy.

The ROD was prepared based primarily on information contained in Remedial Investigation Report (RI) and the Feasibility Study Report (FS), both prepared by Environmental Resources Management (ERM) on behalf of Union Pacific Railroad Company. The ROD also includes discussion of comments received during the public comment period for the remedy. None of the comments received during the comment period required modification to the remedy proposed by DEQ.

The ROD document has been placed in the public document repository established for the project, which is located at the Ashland Public Library. If you have any questions, I can be reached at 541-686-7838, ext. 262.

Sincerely,

Gene Wong
Project Manager
Voluntary Cleanup Program

Cc: Mike Arnold, ERM-Bellevue (w/ encs.)
Donna Andrews, Donna Andrews Realty (w/ encs.)
Maria Harris, City of Ashland (w/ encs.)
Mike McCann, DEQ-Eugene (w/o encs.)

DEQ-DC1

MANAGEMENT APPROVAL FORM
(Preliminary Approval)

Department of Environmental Quality

Environmental Cleanup Division

Date: 9/16/01

REPORT/DOCUMENT TYPE:
(Attached)

Document Name Union Pacific Railroad Ashland Rail yard Site

Record of Decision __X__

Certification of Completion ______

Other (Describe)____________

Please review the attached document that describes a staff recommendation regarding an environmental cleanup activity. The approved preliminary recommendation has been advertised for public comments as required by ORS 465.320. The public comment period has expired. The attached document includes a discussion of public comments received and how those comments affected the final recommendation/decision.

FINAL APPROVAL:

____
Western Region Cleanup Manager

9/17/01
Date

____
Western Region Division Administrator

9/18/01
Date

Return completed form to Gene Wong WR – Eugene Section: WR-Cleanup

#F2, rev 10/93

ACTION SUMMARY & CROSS PROGRAM ISSUES

DATE: September 10, 2001

Summary/Notes to DA:
This Record of Decision (ROD) presents DEQ's selected remedy to address soil and surface water contamination at the Union Pacific Railroad (UPRR) Rail Yard site in Ashland. The rail yard operated as a locomotive maintenance, service, and railcar repair facility between 1887 and 1986. Facility operations resulted in environmental contamination. Soils have been contaminated with arsenic, lead, polynuclear aromatic hydrocarbon compounds (PAHs) and total petroleum hydrocarbons (TPH), and surface water bodies have been impacted with TPH. UPRR completed an RI/FS under a Voluntary Cleanup Agreement, which was signed in March 1993. The selected remedy includes excavation of soils containing contaminants above residential cleanup levels and transport of these soils off site for treatment and/or disposal. The remedy also includes removal and disposal of surface features including an oil/water separator, tank saddles, man-made Ponds A and B, the Bunker C area, ballast and residual petroleum associated with the former Drip Slab and contaminated soils near these surface features. Abandonment of the oil collection culverts and recovery wells, free-product observation probes, piezometer, and monitoring wells is also part of the remedy.

A 45-day public comment period, including a public meeting, was held on DEQ's proposed remedy. Several comments were received during the comment period; however, none of the comments required a modification to the proposed remedy.

The following programs will be affected by this action and coordination with the listed individuals has occurred:

- [x] No Cross Program Issues ____________________
- [ ] Air Quality ____________________
- [ ] Environmental Cleanup ____________________
- [ ] Hazardous Waste ____________________
- [ ] Onsite ____________________
- [ ] Solid Waste ____________________
- [ ] Tanks ____________________
- [ ] Water Quality ____________________
- [x] Public Affairs ____________________

Summary of Coordination Activities/Program Impact:
The Environmental Cleanup Project team has included at various times Eric Blischke, Bill Mason, Greg Aitken, Mike McCann, and Gene Wong. Jared Rubin, Susan Turnblom, and Angie Obery have provided review on toxicological matters at various points throughout the project. Gene Wong, the current Project Manager, has been with the project since 2000. Mike McCann, the current Project Engineer and former Project Manager has been with the project since 1995.

Public Affairs has been involved in the public information and participation portion of the work. This has involved the development and release of fact sheets and press releases.

No air quality, water quality, solid waste, tanks or hazardous waste issues were part of the project.

PROJECT TEAM APPROVAL

The Environmental Cleanup Division Project Team, listed below, for the Union Pacific Railroad Ashland Rail Yard Site Project, Voluntary Cleanup Agreement No. ECVC-SWR-93-02, has read the Record of Decision containing the selected remedial action and concurs with the proposed remedy.

Gene Wong
Project Manager

9/7/01
Date

Michael McCann, PE
Project Engineer and Senior Reviewer

9/7/01
Date

RECORD OF DECISION

FOR

UNION PACIFIC RAILROAD

RAIL YARD SITE

ASHLAND, OREGON

Prepared By

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
WESTERN REGION CLEANUP PROGRAM

September 10, 2001

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RECORD OF DECISION

**UNION PACIFIC RAILROAD
RAIL YARD SITE**

ASHLAND, OREGON

1.0 Introduction

This document presents the selected remedial action for the Union Pacific Railroad Company (UPRR) former rail yard (Yard) site located in Ashland, Oregon (see Figure 1). The remedial action was selected in accordance with Oregon Revised Statutes (ORS) 465.200 through 465.380, and Oregon Administrative Rules (OAR) Chapter 340, Division 122, Sections 010 through 110.

The selected remedial action is based on the administrative record for this site. A copy of the Administrative Record Index is attached as Appendix A. This Record of Decision summarizes the detailed information contained in the administrative record, particularly the *Final Remedial Investigation Report* (RI) (ERM; 1999) and the *Final Feasibility Study Report* (FS) (ERM; 2001) both prepared by Environmental Resources Management (ERM) on behalf of Union Pacific Railroad Company. The FS was submitted to the Oregon Department of Environmental Quality (DEQ) on February 15, 2001. The FS and other documents, as indicated in the Administrative Record, were completed under the Voluntary Cleanup Agreement No. ECVC-SWR-93-02, dated March 30, 1993, between UPRR and DEQ.

In addition to presenting the selected remedial action for the site, this report summarizes the more detailed information presented in the RI and FS reports.

2.0 Summary of the Selected Remedial Action

The Yard operated as a locomotive maintenance, service, and railcar repair facility between 1887 and 1986. Facility operations resulted in environmental contamination at the site. Soils have been contaminated with arsenic, lead, polynuclear aromatic hydrocarbon compounds (PAHs) and total petroleum hydrocarbons (TPH), and surface water bodies have been impacted with TPH. This selected remedial action addresses potential human health risks associated with exposure to the contaminated soil and surface water. No long-term ecological risks were identified.

The selected remedial action consists of the following elements:

- Excavate soils containing contaminants above residential cleanup levels, and transport these soils off site for treatment and/or disposal;
- Remove the oil/water separator, tank saddles, and contaminated soils near the separator and saddles;
- Abandon the oil collection culverts and recovery wells, free-product observation probes, piezometer, and monitoring wells;
- Backfill man-made Ponds A and B after water and sediments have been sampled and/or removed and disposed of, if necessary;
- Excavate contaminated impacted soil in the Bunker C area and dispose of the soils off site; and
- Remove ballast and residual petroleum associated with the former Drip Slab.

These actions are considered to be protective, effective, reliable, implementable and cost-effective. The selected remedy is consistent with the future anticipated use of the site as a mixed commercial/residential land use area.

3.0 Site Description and Background

This section provides a general description of the site, including location and surrounding land use, current and historical activities and operations, regional and site-specific geology and hydrogeology, and surface water hydrology.

3.1 Site Location and General Setting

The Yard is located on a 20-acre parcel at 536 A Street in the city of Ashland in Jackson County, Oregon. Ashland lies within the Bear Creek Valley in southwestern Oregon. The site and surrounding area are shown on Figure 1.

The Yard is currently inactive and is being considered for sale and redevelopment. The adjacent property to the west and north is currently under development for a mixture of residential, industrial, and commercial land use. Agricultural and residential properties border the site to the east and west, and residential and commercial properties border the site to the south. A current zoning map, including the Yard and surrounding areas, is shown on Figure 2.

A variety of historical operations have been conducted and a variety of structures were located within the Yard. These operations and structures are described in detail in the next section. The only structures currently remaining at the Yard are the former drip slab foundation, the oil/water separator and ponds, the former car repair shed foundation, and the former roundhouse foundation. The Yard is accessible to the public and not fenced except for an area surrounding the oil/water separator, Ponds A and B, and the Bunker C area.

3.2 Site History

The Yard operated as a locomotive maintenance, service, and railcar repair facility between 1887 and 1986. Various structures (including a hotel/passenger station, a freight station, a car repair shed, a turntable, a roundhouse, and miscellaneous work and storage buildings) were once present at the Yard. A steel, 55,000-barrel (3.025-million gallon) aboveground, Bunker C oil tank, used for fueling steam locomotives, was installed at the Yard around the turn of the century, and removed in the late 1940s. The locations of historic structures and features at the Yard are shown on Figure 3.

Development of the Yard reached its peak in the early 1900s, with some additional construction performed during the 1920s. Light locomotive maintenance and car repair functions were performed by the Southern Pacific Transportation Company (SPTCo), UPRR's predecessor, from the 1900s until the early 1970s. Most locomotive maintenance and fueling facilities were decommissioned before 1960. Diesel and steam locomotive fueling operations were performed in the same location and, similar to car repair activities, were limited to a relatively small area of the Yard. No railroad maintenance activities were performed west of the car repair shed, or east of the drip slab. UPRR acquired SPTCo and many of its assets, including the Ashland Yard, in fall 1997.

3.3 Historical Facility Operations

Two general facility operation areas are present at the Yard. The first area is the Locomotive Maintenance and Service Area (LMSA), which includes the former drip slab foundation, the former roundhouse, and the Pond C area. The second area is the Former Car Repair Shed Area. These areas are shown on Figure 3.

Locomotive refueling operations were performed at the location of the former drip slab foundation. Steam locomotives were refueled with Bunker C fuel oil from a 55,000-barrel, aboveground storage tank (AST) located in this area. This tank was removed when diesel locomotives were brought into service (1955). The drip slab was installed in the mid-1980s to prevent the migration of diesel fuel and lubricating oil into the soil beneath the fueling tracks. During installation of the drip slab, ballast and soil impacted with petroleum products by former fueling operations were removed from the drip slab and placed into the turntable pit.

The roundhouse was used for light maintenance of steam, and later, diesel locomotives. Operations most likely performed in this area would have included mechanical work on specific locomotive systems, welding, touch-up painting, and cleaning of locomotive parts. The turntable was used to direct locomotives to the appropriate stall for maintenance.

The Pond C area consisted of up to three, separate, holding ponds (Figure 3). Aerial photographs indicate that the ponds were constructed between 1938 and 1959. The ponds were used for retention of wastewater until they were decommissioned some time between 1965 and 1978. Soil excavated from the former Pond C area during closure was placed in the former turntable foundation.

The car repair shed was used for light maintenance of railcars. Operations performed in the car repair shed likely included minor welding, touch-up painting, bearing replacement, and greasing. These activities generally do not generate significant amounts of wastewater or waste that would impact soil or ground water beneath the site.

3.4 Geology

The soil and geology at the Yard has been characterized based on the results from the cone penetrometer testing (CPT) survey, soil borehole drilling, and soil physical testing results obtained during the RI field investigations. The geology beneath the Yard has been observed via soil borings and 25 CPT points down to depths of 34.3 feet below ground surface (bgs). Based on their investigations, the shallow geology beneath the Yard has been divided into four units, each with a unique lithologic character. These units include a surface soil unit, a silt/clay unit, a discontinuous sand unit, and an underlying dense sandy silt unit. Each of these units is described in detail below.

Surface Soil Unit
The surface soil at the Yard is composed of either native sandy clay or an imported fill material. The sandy clay is usually moist and typically dark brown. The native sandy clay is found across the Yard; however, fill material overlies the sandy clay in several developed areas, including the former drip slab, roundhouse, the holding ponds, and downslope of the holding pond area. The fill material is composed of variable mixtures of coarse, granular soil, including railroad ballast composed of red-brown volcanic rock (scoria). Bricks and other debris are occasionally found within this material. The sandy clay and fill material extend to depths of approximately 3 to 4 feet bgs, with the fill material increasing in thickness to the north (downslope).

Silt/Clay Unit
Underlying the surface soil is a silt/clay unit. This unit is encountered from approximately 3 to 4 feet bgs (beneath the surface soil), and extends to approximately 20 to 25 feet bgs. This unit ranges from silty clay/clayey silt to a sandy silt/clay.

The silt/clay unit is generally olive gray in color; however, discolored intervals are dark gray to black near the upper contact with the surface soil. The unit is generally medium stiff, moist to wet, and contains occasional thin, typically saturated, stringers of sand and fine gravel (typically less than 5 inches thick) that appear to be laterally discontinuous. At locations where the discontinuous sand unit (described below) is encountered, the silt/clay unit typically grades to a sandy clay/sandy silt material at the interface of the two units.

Discontinuous Sand Unit
The discontinuous sand unit has been encountered within the silt/clay unit described above. This sand unit varies from olive to yellowish brown, consists of sand to silty and clayey sand, is typically saturated, and is discontinuous beneath the site. This unit is encountered at approximately 10 to 15 feet bgs, and is generally 1 to 5 feet thick, although it appears to be thicker in the eastern section of the Yard. This unit was encountered at shallower depths (less than 10 feet bgs) in the southern portion of the Yard.

Dense Sandy Silt Unit
A very dense-to-hard sandy silt is encountered at approximately 18 to 30 feet bgs, and beneath the silt/clay and sand units described above. This material is a tan to dark brown, moderately to poorly indurated, partially or completely cemented silt to siltstone. The material is commonly fractured with iron oxide staining present along fracture planes. Where encountered, this material was dry. Only the top 1 to 2 feet of this unit was observed during the RI fieldwork. However, the log for a commercial well located approximately 200 feet south of the Yard, indicates a gray siltstone was encountered at 14 feet bgs and extended to a total depth at 499 feet bgs. Granite bedrock was encountered at total depth.

3.5 Hydrogeology

Four monitoring wells (MW-K08, MW-M03, MW-N08, and MW-P07) were installed at the Yard in March 1994 and two monitoring wells (MW-K05 and MW-V03) and one piezometer (PZ-K05) were installed at the Yard in May 1996. Occurrence, local flow and gradient, and hydraulic properties associated with the ground water beneath the Yard are summarized below.

Ground Water Occurrence
Ground water is typically first encountered beneath the Yard within the silt/clay unit, and/or the discontinuous sand unit, at depths between approximately 6 and 20 feet bgs. In the silt/clay unit, ground water generally occurs within the sandy silt sediments and the sand stringers. The silty or clayey sediments observed between the sandy silt sediments and wet sand stringers were observed to range from dry to wet. The discontinuous sand unit was observed to be fully saturated. The dense sandy silt unit (weathered bedrock) underlying both of these units was dry.

The shallow water-bearing formation beneath the Yard has been interpreted to extend from the first encountered saturated sediments, as discussed above, to the top of the dense sandy silt unit. Water levels measured in the six monitoring wells were observed to rise up to 4 feet above the level of first encountered ground water after installation, which may suggest semi-confined to confined hydrogeological conditions.

A localized perched ground water zone has also been defined in the area of the former drip slab foundation. This perched zone is within the top 3 to 4 feet of ballast/fill material in this area. Sediments between the perched ground water and the shallow water-bearing formation ranged from dry to moist. Piezometer PZ-K05 was installed within the perched zone to assess potentiometric head data in this area. The water level elevation measured in PZ-K05 was approximately 1.69 feet higher in elevation than in monitoring well (MW-K05), located approximately 10 feet from the piezometer when measured on 11 August 1996. This elevation difference confirmed the presence of a localized, perched ground water zone in the vicinity of PZ-K05.

Local Ground Water Flow and Gradient
Ground water contour maps prepared for each elevation-monitoring event indicate ground water flow at the site is consistently to the northeast under an average hydraulic gradient of 0.05 foot/foot.

Estimates of Hydraulic Properties and Ground Water Velocities
Hydraulic properties, such as horizontal and vertical hydraulic conductivity (K) and permeability, were estimated using field test results and published empirical methods. Depending on the test used and evaluation method applied, hydraulic properties were estimated as follows:

- Horizontal K: 0.05 to 0.45 foot/day based on slug test results evaluated using the Bouwer and Rice method (Bower and Rice, 1976);
- Horizontal K: 0.07 to 1.63 feet/day based on slug test results evaluated using the Cooper et al. method (Cooper, et al., 1967);
- Horizontal hydraulic coefficients of soil permeability (geometric mean): 5.4×10^{-4} to 1.4×10^{-3} feet/day based on pore dissipation test data collected during the CPT investigation; and
- Vertical K: 1.6×10^{-5} to 2.7×10^{-1} feet/day for saturated soil intervals as analyzed by the American Society for Testing and Materials.

Estimates of average linear ground water velocities (seepage velocities) were calculated as described in the RI Report and are presented below:

- Average seepage velocity using hydraulic conductivity calculated during slug testing is 0.03 foot/day; and

- Seepage velocity using the geometric mean of the horizontal coefficient of conductivity data derived from the pore pressure dissipation tests is 1.4×10^{-4} feet/day.

3.6 Surface Water Hydrology

The existing surface water drainage and ponds at the Yard are shown on all site figures. One natural pond is present in the north central region of the Yard. Two man-made ponds, Pond A and Pond B, are north of the former drip slab foundation and oil/water separator. There are two areas of active drainage at the Yard, the drainage along the eastern boundary of the Yard and that along the southwest boundary of the Yard. These drainage areas appear to run seasonally as storm water runoff.

Several creeks and areas of surface water drainage originate in the foothills to the south, and flow generally northward to Bear Creek, a tributary to the Rogue River. None of these creeks traverse the Yard property.

3.7 Previous Removal Actions

During installation of the former drip slab at the Yard (mid-1980s), ballast and soil impacted by former fueling operations were removed to the top of a perched ground water zone, which was encountered at 3.5 feet bgs. Nine passive product recovery wells (RW-001 to RW-009) were installed downgradient of the drip slab to remove floating product from the perched ground water zone. An oil/water separator and two holding ponds (Ponds A and B) were also installed at the same time as the drip slab. The oil/water separator was used to remove oil from the wastewater resulting from locomotive fueling and service operations in the drip slab area, and to treat the water recovered from the product recovery wells.

The oil/water separator consists of a settling tank equipped with a belt skimmer for removing oil. Recovered oil was pumped to an AST. The treated water was then discharged to the larger of the two ponds (Pond A) constructed of bermed earth and clay. A second pond (Pond B), which is usually dry, was used for containment of overflow from Pond A. Because floating product is no longer present in the product recovery wells, neither the product recovery wells nor the oil/water separator are currently operating.

4.0 Summary of Environmental Investigations Results

Several environmental investigations were conducted at the Yard between 1990 and 1998. These investigations included:

- Phase I and Phase II Environmental Site Assessments involving limited soil and ground water investigations conducted on a 2-acre portion of the Yard east of the drip slab, and on the oil/water separator and associated ponds.

- An extensive soil, ground water, surface water, and sediment investigation conducted in the LMSA during the Phase I RI.

- A Phase II RI involving extensive soil, ground water, sediment, surface water, and free product sampling, and slug testing.

- Quarterly groundwater sampling conducted through March 1998.

The general objectives of these investigations were to:

- Identify the petroleum hydrocarbons and other chemical compounds that have been released to the environment;

- Determine the nature and extent of petroleum hydrocarbons and other chemical compounds in affected media on and off property resulting from activities at the Yard;

- Determine the distribution of petroleum hydrocarbons and other chemical compound concentrations;

- Determine the direction and rate of migration of hazardous substances;

- Identify migration pathways;

- Identify the environmental impact and risk to human health and/or the environment; and

- Generate the information needed to develop and select a remedial action.

The scope of work completed during the investigations, as described in Sections 4.1 through 4.4, was conducted with the intent of achieving the RI objectives listed above. The results of these investigations are summarized in Section 4.5.

4.1 Phase I and Phase II Environmental Site Assessments

Two environmental investigations were performed both on an eastern 2-acre portion of the Yard, east of the drip slab, and the oil/water separator and ponds. These investigations were performed in anticipation of condemnation of the property for construction of an electrical substation. Fieldwork activities included:

- Collection of shallow soil samples (up to 3.0 feet bgs), deep soil samples (up to 20.0 feet bgs), and groundwater samples from soil borings;

- Installation and sampling of six groundwater monitoring wells; and

- Collection of surface water and sediment samples from a swale along the eastern boundary of the subparcel.

4.2 Phase I Remedial Investigation

The Phase I RI focused on the locomotive maintenance and service area (LMSA) of the Yard, as this area was identified to be the most likely to have potential impacts to the environment. An extensive soil, ground water, surface water, and sediment investigation conducted in the LMSA during the Phase I RI included:

- Collection of 29 shallow soil samples (up to 5.5 feet bgs) and four deep soil samples (up to 15.0 feet bgs);

- Advancement of 17 CPT direct-push points for assessment of soil lithology, ground water occurrence, and hydrogeologic properties;

- Installation and sampling of four ground water monitoring wells (MW-K08, MW-M03, MW-P07, and MW-N08);

- Collection of direct-push probe ground water samples at 19 locations; and

- Collection of surface water and sediment samples from Ponds A and B.

4.3 Phase II Remedial Investigation

The Phase II RI involved extensive soil, ground water, sediment, surface water, and free product sampling, and slug testing. The Phase II investigation included:

- Advancement of eight CPT direct-push points for assessment of soil lithology and ground water occurrence in the area of the former car repair shed;

- Advancement and sampling of two soil borings that were subsequently completed as monitoring wells - one upgradient of the former car repair shed (MW-V03) and one in the LMSA (MW-K05);

- Installation of one piezometer (PZ-K05) in the LMSA;

- Advancement and sampling of 22 soil borings, including four in the LMSA, eight in the former car repair shed area, and 10 in the off-property area;

- Collection and analysis of 26 surface soil samples (less than 2 inches bgs) within the former car repair shed area, the off-property area, and the LMSA;
- Collection and analysis of seven shallow soil samples (1 to 2 feet bgs) in the LMSA;
- Collection and analysis of 23 direct-push probe ground water samples within the former car repair shed area, the off-property area, and the LMSA;
- Collection and analysis of two sediment samples from Pond B, two sediment samples from the natural pond, and two surface water samples from the natural pond;
- Excavation of 14 shallow free product test pits and installation of five free product observation probes in the LMSA;
- Collection and analysis of a free product sample at recovery well 6 (RW-006); and
- Conducting falling and rising head slug tests at all monitoring wells.

4.4 1997-1998 Groundwater Monitoring

Four quarters of groundwater monitoring were conducted from June 23, 1997 to March 12, 1998. Groundwater elevations were collected from the six groundwater monitoring wells, one piezometer, and five free product observation probes at the Yard. The six groundwater monitoring wells were also purged and sampled. Measurements were also collected at the free product observation probes to evaluate the presence or absence of petroleum hydrocarbon (free product).

4.5 Sources and Nature of Environmental Impacts

Based on the results of the environmental investigations conducted at the site, sources of environmental impacts at the Yard may be attributed to:

- Locomotive fueling and fuel storage (both Bunker C and diesel);
- Light locomotive maintenance and light car repair, which may have included limited use of paints and solvents;
- Waste disposal;
- Wastewater retention; and
- Potential historical application of lead arsenate pesticides at the Yard prior to rail yard activities.

Based on the probable sources of contamination and the findings of the site investigations, the constituents of concern (COCs) at the Yard consist of:

- Inorganic lead and arsenic in soil;
- Longer carbon chain petroleum hydrocarbons, such as those associated with heavier fuels, in soil and in limited areas of ground water; and
- PAHs in soil (associated with heavy fuels and treated wood used for railroad ties).

4.6 Risk Assessments

Human health and ecological risk assessments were performed as part of the RI. Following is a summary of the risk assessment findings.

Human Health Risk Assessment
Based on the results of the human health risk assessment performed as part of the RI, the concentrations of COCs in soil, sediment, surface water, and ground water at the Yard, DEQ risk-based standards are exceeded for benzo(a)pyrene, lead and arsenic in soil. Results of the risk assessment are summarized below.

Potential pathways for human exposure to the identified COCs detected in soil, sediment, ground water, and surface water were evaluated. The exposure assessment identified inhalation and ingestion of affected soils, as well as skin contact, as exposure pathways of potential concern. Due to the fact that chemical impacts to soil can vary widely in concentration across the Yard, which can contribute significantly to overall site risk, the Yard was divided into four exposure areas (Western, Central, Eastern, and Buffer Zone Exposure Areas). Exposure pathways for soil were developed based on the use of the Yard as commercial/industrial property, with the exception of the Buffer Zone Exposure Area, where residential exposure pathways were developed in accordance with DEQ requirements. [Note: The risk assessment was performed when it was assumed that industrial cleanup levels, based on possible future land use, might be applicable. This assumption is no longer valid due to the Yard area being rezoned. Current zoning of the Yard property and nearby vicinity (see Section 4.8) assumes either residential land use or employment district with residential overlay; therefore, residential cleanup values will be applicable.]

Current potential receptors were considered to be a child trespasser and an industrial worker. Future potential receptors were considered to be a future construction worker and a future industrial worker for the Western, Central, and Eastern Exposure Areas, and a future resident adult and future resident child for the Buffer Zone Exposure Area.

The non-cancer risks and theoretical lifetime cancer risks associated with exposure to chemicals in soil were conservatively assessed using United States Environmental Protection Agency (USEPA) reference doses and slope factors. Under current site conditions, the sum of hazard quotients (hazard index) calculated for the child trespasser and industrial worker exposed to surface soil in the Western, Central, and Eastern Exposure Areas did not exceed one, indicating that ingestion and inhalation of surface soil, as well as skin contact, would not result in non-cancer adverse health effects. Also, the added lifetime cancer risks calculated for the child trespasser are well below the 1×10^{-5} (1 in 100,000) combined, maximum, lifetime cancer risk specified by the DEQ for persons exposed to multiple potential carcinogens. Calculated added lifetime cancer risks for the industrial worker exposed to surface soil within the Western, Central, and Eastern Exposure Areas were also below the DEQ acceptable limit of 1×10^{-5}. Only industrial worker exposure to benzo(a)pyrene in Western Exposure Area surface soil exceeded a lifetime cancer risk of 1×10^{-6}. The risk associated with benzo(a)pyrene was 2×10^{-6}.

Hypothetical future site conditions were assessed assuming exposure to surface and subsurface soil at the Yard (0 to 10 feet bgs). Hazard indices were calculated for future construction and industrial workers within the Western, Central, and Eastern Exposure Areas, and for a future residential child within the Buffer Zone Exposure Area. All calculated hazard indices were less than one, indicating that the future construction worker, future industrial worker, and residential child would be unlikely to experience non-cancer adverse health affects as a result of exposure to COCs in soil at the Yard.

Combined theoretical lifetime cancer risks calculated for the future construction worker within the Western, Central, and Eastern Exposure Areas were less than a lifetime cancer risk of 1×10^{-6}. For a future industrial worker within the Western and Eastern Exposure Areas, the combined cancer risks associated with ingestion, dermal, and inhalation exposure to benzo(a)pyrene in soil were 2×10^{-6} for both areas. No other chemical exceeded a lifetime cancer risk of 1×10^{-6} in any of the three exposure areas. Calculated lifetime cancer risks associated with residential exposure to Buffer Zone Exposure Area soil exceeded 1×10^{-6} for arsenic.

The methods described above to calculate intakes and subsequently calculate hazard indices were applied to evaluate the potential risks associated with the COCs at the Yard with two exceptions: lead and TPH. Risks associated with lead exposure were evaluated by comparing lead levels at the site to Maximum Allowable Soil Cleanup Levels established in the *Soil Cleanup Manual*, DEQ Waste Management and Cleanup Division (see Section 4.7). Risks associated with exposure to petroleum hydrocarbon mixtures were assessed using methods developed by the Massachusetts Department of Environmental Protection as described in Appendix C of the ERM submittal to DEQ dated 29 May 1998 (ERM; 1998).

Risk-Based Concentrations for Constituents of Concern in Soil
As part of the risk assessments described above, risk-based concentrations were developed for soil considering current site uses as well as future potential use of the site

under a residential setting (Table 1). However, instead of using site-specific, risk-based concentrations for lead and arsenic, the following values were used:

- The levels for lead are the Residential Maximum Allowable Soil Cleanup Levels established in the Soil Cleanup Manual (DEQ, 1994); and
- The levels for arsenic are based on the established background concentration.

Residential use of ground water was not evaluated since there is no identified beneficial use of the shallow aquifer and there is no evidence of off-site migration of COCs in the shallow ground water.

Ecological Risk Assessment
The ecological screening assessment of the Yard consisted of a survey by the Oregon Natural Heritage Program (ONHP) for rare, threatened, and endangered species, and comparisons of concentrations of chemicals detected in surface water and sediment to ecological preliminary remediation goals (PRGs). Although three animal species and one plant species listed by the ONHP as rare, threatened, or endangered are present within a 2-mile radius of the Yard, the locations of these species are not on or adjacent to the Yard. The Yard is not known to serve as a habitat for any of these rare, threatened, or endangered species. The reported locations in which these species occur are unlikely to be affected by chemicals detected in soil, sediment, ground water, or surface water at the Yard.

Two of the three ponds at the Yard are fenced, limiting access to the standing water in the ponds. Chemical concentrations in surface water and sediment from Ponds A and B and the natural pond were compared to ecological screening criteria. No ecological screening criterion was exceeded for surface water in the natural pond. Petroleum hydrocarbon concentrations in Ponds A and B exceeded the 1 milligram per liter criterion established by the DEQ for surface water. Single detections of lead and selenium in surface water in Ponds A and B also slightly exceeded federal ambient water quality criteria.

Average concentrations of chemicals detected in natural pond sediment samples were at or below ecological screening criteria. The maximum concentration of lead detected in natural pond sediment samples (160 mg/kg) was greater than the ecological screening criterion (110 mg/kg). No other constituent concentrations in natural pond sediment samples exceeded ecological screening criteria.

With the exception of acenaphthene and fluorine, the average detected values of chemicals present in Pond A and B sediments were below the ecological screening criterion. The average concentrations of acenaphthene and fluorene detected in sediment samples were less than two times the ecological screening criterion. Maximum concentrations of acenaphthene, anthracene, fluorene, and arsenic exceeded ecological screening criteria in several Pond A and B sediment samples.

4.7 Extent of Impacts Relative to Risk-Based Concentrations

The extent of COCs in soil relative to risk-based concentrations for the residential exposure scenario can be summarized as follows:

- Total petroleum hydrocarbons (TPH) detections in soil exceed residential concentrations within the LMSA, Ponds A and B, and the Former Car Repair Shed Area to a maximum depth of 6 feet bgs (Table 2).
- PAHs exceed residential concentrations in surface soils (0 to 0.25 feet bgs) within the LMSA and the Former Car Repair Shed Area. PAHs were also detected above residential concentrations at a depth of 5.5 feet bgs at soil boring SSB-K07.5. The most prevalent and elevated PAHs are benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene (Table 3).
- Arsenic and lead exceed residential concentrations in shallow soils (0 to 2.5 feet bgs) within the LMSA, Pond B, and the Former Car Repair Shed Area. Lead exceeding residential levels was detected in many surface soil samples (0 to 0.5 feet bgs) collected throughout the Yard. (Table 4).
- Bunker C has been observed in observation test pits advanced near grid nodes L07, L08, M07, and M08. In general, the vertical extent of Bunker C in this area was 3 feet bgs. The approximate lateral extent of Bunker C in this area encompasses approximately 3,600 square feet.

Figure 4 shows areas at the Yard where one or more COCs exceed residential risk-based concentrations in soil. Depths where goals are exceeded are also included in the figure, and isolated, single point exceedances are identified.

The extent of COCs in ground water can be summarized as follows:

- Heavy TPH ($> C_{14}$) has been detected in ground water at the LMSA, and light TPH (C_6 to C_{14}) has been detected in the Former Car Repair Shed Area. Concentrations of TPH in ground water at the site have been decreasing over time, and concentrations of TPH in upgradient monitoring wells are similar to those in on-site monitoring wells (Table 5).
- Volatile organic compounds (VOCs) have not been detected in ground water monitoring wells at concentrations exceeding federal maximum contaminant levels (MCLs). Benzene was detected above the MCL in one screening sample (H-V04) collected at the Former Car Repair Shed Area using a direct-push probe. Benzene was not detected in the other screening samples collected in this area, nor has it ever been detected in MW-V03, located upgradient of the Former Car Repair Shed (Table 6).

- The fuel oxygenate methyl tert-butyl ether (MTBE) has been detected in MW-V03, a well installed in 1996 to monitor ground water originating from an off-site upgradient source. Concentrations have fluctuated between 1,100 and 2,400 micrograms per liter (µg/L) over time (Table 6). These concentrations exceed the USEPA Region 9 PRG for tap water of 20 µg/L.
- PAHs have been detected sporadically in ground water monitoring wells, with the highest concentrations detected in recovery well RW-006. Of the nine PAHs detected, only benzo(a)pyrene has an established MCL of 0.2 µg/L, which has not been exceeded at the Yard (Table 7).
- Total chromium and total lead have been detected at concentrations exceeding federal MCLs in two monitoring wells at the LMSA. In addition, total chromium, total lead, total arsenic, and total mercury were detected in five screening samples collected from direct-push probe borings at the LMSA and the Former Car Repair Shed Area (Table 8). In addition, samples submitted for total metals analysis were also filtered in the field and submitted for dissolved metals analysis, to obtain data for an effective comparison of metals concentrations to MCLs. None of the detected levels of dissolved metals exceeded federal MCLs.
- Bunker C was observed during installation of piezometer PZ-K05 at 3 to 4 feet bgs; however, the presence of Bunker C was not detected during subsequent monitoring of this piezometer.

Although constituents have been detected in ground water, they are not considered to be of concern because shallow groundwater at the site has no known beneficial use and there is no evidence that constituents are migrating off site (see Section 4.8).

4.8 Beneficial Use

This section summarizes the results of the Phase II beneficial use survey.

Ground Water
Ground water for beneficial use in the site vicinity is drawn from a significantly deeper aquifer. There is no current or anticipated future use of shallow ground water at or in the vicinity of the Yard.

A well survey conducted for the Yard identified two domestic wells, two irrigation wells, one commercial well, and one unknown well within a ½-mile radius of the LMSA. Water drawn from these wells originates from depths greater than 60 to 100 feet bgs. The likelihood that COCs (Bunker C and diesel) will migrate to off-site supply wells and affect current and/or future, reasonably likely beneficial use is minimal based on the following factors:

- The viscous properties of Bunker C limit its mobility;

- The vertical separation between the shallow ground water zone at the Yard and the aquifer utilized for beneficial use is at least 40 to 60 feet, of which, 20 to 40 feet is bedrock; and
- Cross-contamination of the deeper aquifer by the future installation of a well or borehole through contaminated shallow soil or shallow ground water is minimized through the use of the State of Oregon well construction standards (Oregon Administrative Rule [OAR] 690 - Division 210).

Based on information from the City of Ashland's Department of Community Development, future land use in this area will continue to be devoted to employment, commercial, medical, and mixed-use residential uses. In addition, future property owners in this area are not likely to install new wells because new developments would be required to hook up to City water lines.

On-Site Surface Water
The natural pond is an ecological habitat with beneficial uses that include the capacity to maintain aquatic life. Ponds A and B are man-made for wastewater treatment and have no current or future reasonably beneficial use. Areas of surface water drainage at the site exist on the eastern and southeastern edges of the Yard. This drainage appears to run only in response to storm water or other discharge from areas south of the site.

Off-Site Surface Water
One irrigation canal was identified within the survey area. The intake to the canal is approximately ½-mile north of the Yard near the intersection of Bear Creek and Oak Street. In addition to irrigation, likely future beneficial uses of Bear Creek include industrial water supply and livestock watering.

Land
The City of Ashland supplied current and future land use data for the Yard and surrounding area. Since completion of the RI, the Yard and some surrounding areas have been rezoned. Current zoning is provided and briefly described in Figure 2, and summarized as follows:

- The Yard and the adjacent property to the south and west are zoned as employment district (E-1) with residential overlay.
- The land further south and west of the Yard is zoned as residential district (R-2).
- The adjacent area to the north of the Yard is zoned as an employment district (E-1). The area north of the E-1 zoning and approximately 250 feet north of the Yard is zoned E-1 with residential overlay.

- The area approximately 200 feet north of the northeast end of the Yard is zoned as a multi-family residential district (R-2). The area approximately 100 to 150 feet north of this R-2 zone is zoned as a suburban residential district (R1-3.5).
- The land to the east is zoned as a single-family residential district (R-1-5).

Uses for land zoned E-1 with residential overlay include commercial use (i.e., retail, entertainment, offices) of at least 65 percent of first-floor space. Residential use is restricted to less than 15 units per acre, with residential use permitted on the second floor space, and on no more than 35 percent of the first floor space. No parks, other than the park presently at the corner of 6th and A Streets, are planned to be developed in the vicinity of the Yard. Finally, there are no known structures protected at the Yard, and there are no current conditional or non-confining uses existing within 350 feet of the Yard boundaries.

Following the rezoning of the Yard to E-1 with residential overlay, the Yard was partitioned into seven sale parcels effective 26 May 2000, as detailed on Figure 5. Parcel 7 includes the former active portion of the Yard, which is the subject of the RI/FS work, and the 100-foot-wide, railroad right-of-way easement along the southern property border. As a condition of the partitioning, the City of Ashland restricted further development or land division of Parcel 7 until the property has been cleaned to residential standards, with written compliance provided by DEQ.

4.9 Extent of Impacts Relative to a Commercial/Residential Mixed Land Use Scenario

Oregon's Cleanup Law requires cleanup levels for properties that are protective of current and future likely use. Sites proposed for unrestricted multiple use are generally remediated to residential standards, which are the most restrictive. Areas proposed for commercial or industrial use are generally remediated to less stringent standards. Deed restrictions can be placed on industrial or commercial property to prevent future residential use, thereby enabling use of the less restrictive cleanup standards.

In most cases, the cleanup standards are based on site-specific risk assessments for the various pertinent exposure scenarios. However, Oregon's Cleanup Rules also contain risk-based standards applicable to all sites within the State, and can be used in lieu of a site-specific risk assessment. These Soil Cleanup Standards (OAR 340-122-045) contain specific rules for applicability and use. The risk-based concentrations presented in Table 1 represent the soil cleanup goals that must be achieved to make the property suitable for future commercial/residential mixed land use.

Figure 4 illustrates areas throughout the Yard that exceed residential cleanup goals. The specific constituents (or constituent groups) that exceed the cleanup goals and the respective associated depths are also shown on Figure 4. Several of the areas where these goals are exceeded are based on one soil sample point, which is depicted on Figure

4 as a solid dot. These areas were denoted as a point because surrounding borings were not above cleanup goals, making it difficult to estimate the extent of cleanup goal exceedences. For the purpose of estimating costs, it was assumed that the lateral extent of each single point exceedence encompassed a 10-by-10-foot surface area. The actual extent of impact at these points will be determined in the field during remedial activities. At areas where the extent of remedial action is based on more than one point, the estimated extent of exceedences is outlined on Figure 4.

Based on the information presented on Figure 4, COCs exceeding the respective residential cleanup goals are present in approximately 5,600 cubic yards of soil.

4.10 Locality of Facility

Oregon regulations use "locality of the facility" to define the extent of facility-related hazardous substances, considering chemical and physical properties of COCs, migration pathways, natural and human activities affecting migration of COCs, biological processes affecting bioaccumulation of COCs, and the rate at which COCs migrate under these conditions. Based on the soil and ground water data collected during the various phases of RI, the locality of the facility is confined to within the property boundary. No off-site impacts have been identified.

4.11 Hot Spot Evaluation

DEQ requires that all remedies considered in an FS address treatment of "hot spots." According to the *Final Guidance for Identification of Hot Spots* (DEQ, 1998b), a hot spot in a media other than water exists if "the site presents an unacceptable risk and if the contamination is highly concentrated, highly mobile or cannot be reliably contained." Hot spots are not a concern at the Yard because a comparison between site analytical data and values in the *Final Pre-Calculated Hot Spot Look-Up Tables* (DEQ, 1998c) resulted in no exceedences of hot spot levels. In addition, the constituents present in the site soils are not reasonably likely to migrate and are reliably contained.

5.0 Remedial Action Objectives (RAOs)

Based on results of the environmental investigations, and the risk assessment (summarized in Section 4.6), and with consideration of the current zoning of the site as mixed commercial/residential, the following remedial action objectives have been identified:

- Prevent human exposure (via ingestion or inhalation) to soil that exceeds the residential cleanup goals (Table 1);
- Remove surface features associated with former Yard operations;

- Prevent human exposure to the Bunker C/TPH impacts in the former landfill area; and
- Quantify TPH impacts in the surface water in Ponds A and B, and remove and handle pond water appropriately.

As discussed in Section 4.11, there are no areas at the Yard that can be classified as hot spots as defined in OAR 340-122-115(31)(b). Therefore, the remedial action objectives do not consider the treatment of hot spots.

5.1 Areas Requiring Remedial Action

As depicted on Figure 4, areas of concern at the Yard that require remedial action are summarized as follows:

- Soils from 0 to 2 feet bgs in the LMSA and Former Car Repair Shed that contain lead and/or arsenic at concentrations above residential cleanup goals;
- Soils from 0 to 5 feet bgs in the area north of Pond A and surface soils in the Former Car Repair Shed that contain one or more PAH compounds exceeding residential cleanup goals.
- Surface soils near the former Drip Slab, and north of both Pond A and the former round house containing one or more PAH compounds exceeding the residential cleanup goals (based on single-point exceedences rather than widespread detections);
- Soils within the 5-foot range north of Pond A that contain TPH above the residential cleanup goal; and
- Soils within the 5-foot range adjacent to and beneath the former Drip Slab that contain TPH above the residential cleanup goal.

Features associated with former rail yard operations that require removal and/or remedial action include the following:

- The oil/water separator, underlying affected soils, and the tank saddles;
- Ponds A and B;
- The Bunker C area within the former land fill;
- Ballast and residual petroleum near the former Drip Slab Foundation; and
- Oil collection culverts and recovery wells, piezometers, free product observation probes, and monitoring wells.

6.0 Development of Remedial Action Alternatives

Remedial action alternatives were developed by initially reviewing four general response action categories:

- No Action;
- Engineering and/or institutional controls;
- Treatment; and
- Excavation and off-site disposal without treatment.

Remedial technologies associated with each general response action category were then evaluated and screened in the FS (ERM; 2001) to address the remedial action objectives at the site. The remedial technologies identified were as follows:

General Response Action: Engineering and/or institutional controls

- Asphalt or Concrete Cap
- Soil or Gravel Cap
- Land Use Restriction

General Response Action: Treatment

- In Situ Bioremediation
- In Situ Phytoremediation
- Phytoextraction
- Rhizosphere Biodegradation
- In Situ Soil Flushing
- Pneumatic Fracturing
- Excavation and Ex Situ Treatment
- Aboveground Treatment Cell Bioremediation
- Thermal Treatment
- Ex Situ Soil Washing
- Stabilization/Solidification
- Asphalt Incorporation

General Response Action: Excavation and Off-Site Disposal or On-Site Encapsulation

- Excavation and Off-Site Disposal
- Excavation and On-Site Encapsulation

Those technologies that screened favorably were used to develop the five remedial action alternatives described below.

6.1 Description of Remedial Alternatives

Remedial alternatives developed to address the removal action objectives for soil are described in this section and summarized in Table 9. In addition, a common strategy for removing surface features associated with former Yard operations is included under each action alternative (Section 6.1.2).

6.1.1 Alternative 1 – No Action

The No Action alternative constitutes a measure in which no action is taken to reduce or remove site impacts or restrict site access. However, natural subsurface processes to reduce contaminant concentrations, such as dilution, attenuation, biodegradation, adsorption, and chemical reactions, would continue. The No Action alternative is used to establish a baseline against which the degree of remediation and associated costs of the other alternatives can be compared.

6.1.2 Common Tasks of Alternatives 2, 3, 4, and 5

In addition to the various strategies for addressing affected soils, Alternatives 2, 3, 4, and 5 have common tasks that address the surface features associated with former Yard operations, which include:

- Removal of the oil/water separator, including affected soils, and removal of the tank saddles near the oil/water separator;
- Abandoning the oil collection culverts and recovery wells, free-product observation probes, piezometer, and monitoring wells;
- Backfilling Ponds A and B;
- Excavation and off-site disposal of the Bunker C area;
- Removal of ballast and residual petroleum associated with the former Drip Slab; and

Figure 6 shows the areas at the Yard where these tasks would occur. The tasks described above are considered to be "presumptive remedies," because there are limited options available for completing the common tasks, and because the proposed actions will most effectively satisfy the objective of removing surface features associated with former Yard operations. The common tasks are identical for all alternatives, except the No Action alternative and, therefore, discussion regarding these tasks will be limited to the following paragraphs.

Removal of Oil/Water Separator and Tank Saddles
This task will consist of the following activities:

- Sampling and analysis of the water in the oil/water separator, draining the oil/water separator tank, then either discharging the water on site or pumping it into a tanker car or truck for off-site disposal (disposition of water depends on the levels of COCs in the water);
- Disassembling and removing the oil/water separator;
- Excavating tank saddles down to the footings, breaking them up with a hoe ram, and stockpiling;
- Excavating visibly affected soils beneath and surrounding the oil/water separator and tank saddles, then stockpiling, sampling, and characterizing the soils for disposal at an approved off-site facility;
- Verification samples of the excavation sidewalls and bottom will be collected and analyzed;
- Transporting affected soils to an approved off-site facility for disposal;
- Disposing of concrete tank saddle footings and the oil/water separator at a Class III facility; and
- Backfilling and compacting the excavations with either imported fill material or soils originating on site (as proposed in Alternatives 3, 4, and 5).

Abandonment of Wells and Culverts
Oil collection culverts and oil recovery wells, free-product observation probes, piezometers, and monitoring wells will be properly abandoned. Abandonment will be performed in compliance with ODEQ requirements, which includes:

- Obtaining the necessary permits;
- Removing oil collection culverts by excavation, then backfilling with clean soil;
- Removing other wells by overdrilling;
- Filling the resulting holes with grout or a cement slurry; and
- Disposing well materials at an approved off-site facility.

Preparation and Backfilling of Ponds A and B
The preparation and backfilling of Ponds A and B will include:

- Sampling and analysis of water in Ponds A and B, draining the ponds, then either discharging the water on site or pumping it into a tanker car or truck for off-site disposal (disposition of water depends upon the levels of COCs in the water);
- Sampling and analysis of pond bottom sediments, and sediment removal, if necessary, based on COC concentrations observed in the samples;
- Clearing and grubbing debris and vegetation from in and around the ponds and disposal of the debris at a Class III facility;
- Laying filter fabric then rock at the base of the ponds to facilitate even compaction;
- Backfilling and compacting the ponds with either imported fill material or soils originating from on site (as proposed in Alternatives 3, 4, and 5); and
- Moisture-conditioning backfill material after placement, as necessary, and compacting material to a minimum of 90 percent maximum density in accordance with recognized standards.

Excavation and Off-Site Disposal of Bunker C
The removal of the Bunker C within the former landfill area will include the following:

- Excavating Bunker C-impacted soils, stockpiling the materials on plastic sheeting, then sampling the soils for characterization and disposal;
- Transporting oily ballast and oily soils to an approved off-site facility for disposal; and
- Backfilling and compacting the excavation with either imported fill material or soils originating from on site (as proposed in Alternatives 3, 4, and 5).

Remove Ballast and Residual Petroleum Associated with the Former Drip Slab
The removal of ballast and residual petroleum associated with the former drip slab will involve:

- Excavating ballast and oily soils adjacent to former drip slab, stockpiling the materials on plastic sheeting, then sampling the soils for characterization and disposal;
- Collecting and analyzing verification samples from the excavation sidewalls and bottom;
- Transporting oily ballast and oily soils to an approved off-site facility for disposal; and

- Backfilling and compacting the excavation with either imported fill material or soils originating from on site (as proposed in Alternatives 3, 4, and 5).

6.1.3 Alternative 2 – Engineered Soil Cap

Alternative 2 would include the common elements discussed above, plus the placement of a soil cap over the areas exceeding the residential cleanup goals (Figure 4). The engineered soil cap would consist of certified clean soil compacted to 90 percent of maximum density. The soil cap would eliminate direct exposure to impacted surface soils and reduce potential migration of surface and subsurface contaminants due to the infiltration of surface water. The installation of an engineered soil cap would include:

- Soliciting bids and hire contractor(s);
- Securing and testing cap soil to ensure that it does not contain organic or metal contaminants;
- Preparing the site (such as establishing fencing, equipment and soil staging areas, utility locations, and removing concrete in capping areas);
- Collecting and analyzing soil samples to define the surface areas to be capped, and surveying to outline impacted areas;
- Removing and disposing of trees, shrubs, debris, and other surface features from the areas to be capped;
- Applying water for dust suppression during earth work;
- Installing and compacting soil in 4- to 6-inch lifts and compacting each lift to 90 percent maximum density until soil cap is approximately 2 feet thick, with a minimum of 5 additional lateral feet beyond the defined area of impact;
- Placing and compacting 6-inch top soil layer, then planting with native grasses;
- Surveying final limits of soil cap and including this information and the surveyed limits of affected areas into the title and deed restriction documents; and
- Conducting annual inspections and performing routine maintenance to ensure cap integrity.

Should future development involve the need to uncover or remove affected soils (such as placement of a roadway, or installation of a building or structure), an environmental contractor must be hired to conduct the earthwork and handle the soils appropriately. Such activities would also require notification of the DEQ prior to excavating or managing soils from beneath the soil cap. Similarly, should future development of the site involve the installation of a utility corridor through a capped area, an environmental contractor must do the excavation work. Utility corridors should then be backfilled with clean material, such as soil or gravel to enable future access to buried utilities by workers.

6.1.4 Alternative 3 – Excavation and Off-Site Disposal

With Alternative 3, soils exceeding residential cleanup goals would be excavated and transported off site for treatment or disposal. The estimated extent of soils exceeding applicable cleanup goals is shown on Figure 4.

Soils would be excavated using an excavator or backhoe operated by qualified personnel. Excavated soils would be placed on plastic sheeting prior to transportation off site via truck or rail. Although existing site data will be used to guide excavation activities, confirmation soil sampling will be conducted to determine when to stop digging in each area.

Underground utilities would be located prior to digging through Underground Services Alert, a private utility locator, and UPRR Hot Line (1-800-336-9193). If active underground utilities are encountered during excavation, they will remain in place and be carefully uncovered and supported. If abandoned underground utilities are encountered, they will be cut, removed, and capped as necessary.

Implementation of this alternative would generally include:

- Soliciting bids and hiring contractor(s);
- Securing and testing backfill material;
- Preparing the site (such as establishing fencing, staging areas, stockpile areas, utility locations, and removing concrete in excavation areas);
- Surveying to define excavation areas;
- Performing excavation and stockpiling as described above;
- Collecting and analyzing soil samples from the base and sidewalls of each excavation to determine if cleanup goals have been achieved, or if additional excavation is required, and to document residual COC concentrations;
- Collecting and analyzing samples from the stockpiled soil slated for off-site treatment and/or disposal to satisfy disposal facility profile requirements;
- Transporting soils containing COCs above residential cleanup goals to an approved treatment and/or disposal facility;
- Surveying the final limits of the excavations;
- Backfilling the excavations that extend greater than 6 inches bgs with certified clean imported soil; and
- Compacting backfill to a minimum of 90 percent maximum density in accordance with recognized standards, and performing compaction testing to verify.

6.1.5 Alternative 4 – Excavation with Asphalt Incorporation and On-Site Reuse

With Alternative 4, soils exceeding residential cleanup goals would be excavated then incorporated into asphalt, which could be used on site in roadways and parking lots during redevelopment. Prior to implementation, bench-scale testing and leachate testing of representative soil samples would be necessary to ensure that the COCs will be stabilized in the asphalt incorporation process.

Implementation of Alternative 4 would generally include:

- Conducting bench-scale testing and leachate testing of representative soil and asphalt batch samples;
- Hiring contractors, securing backfill material, and preparing the site as described in Alternative 3;
- Excavating soils, as described in Alternative 3, and segregating soils into stockpiles;
- Surveying the final limits of the excavations;
- Mobilizing asphalt-incorporation equipment and needed materials to the site;
- Delineating and preparing areas where the treated material will be used (i.e., roadways or parking lots);
- Creating either asphalt, concrete, or bituminous road base using asphalt incorporation, then placing the treated material in predetermined locations; and
- Backfilling and compacting the excavations as described for Alternative 3.

6.1.6 Alternative 5 – Excavation with Off-Site Disposal and On-Site Encapsulation

Under Alternative 5, TPH-affected soils would be excavated and transported off site for disposal. Soils exceeding residential cleanup goals for PAHs and metals would be excavated, then either buried on site beneath asphalt or concrete, or transported off site for disposal. For cost estimation purposes, it was assumed that approximately two-thirds of the soils exceeding residential levels for metals and PAHs would be buried on site, while the remaining one-third would be transported off site with the TPH-impacted soils. The actual amounts, however, may vary.

Soils targeted for off-site disposal would be excavated first then transported off site for treatment or disposal as described in Alternative 3.

Excavated soils exceeding residential cleanup goals for metals and PAHs and targeted for on-site burial would be stockpiled on plastic sheeting, sampled, and analyzed by a certified analytical laboratory. Soil analyses would include leachate testing to ensure that the COCs remain stable once buried. Soils that have unacceptable leachate concentrations would be profiled and shipped off site for disposal.

On-site area(s) would be established for the purposes of burying the affected soils. These area(s) would include selected areas targeted for development as roadways and/or parking lots. Designated areas would be excavated to a depth less than the historical minimum depths to ground water (a depth of 3 feet bgs was used for cost estimation purposes). The resultant soils would be stockpiled, sampled, and analyzed, then used as fill.

Provisions for utility corridors must be made prior to placing the affected soils in the burial area(s) so that utilities could be accessed for expansion and/or repair without disturbing these soils.

Soils with residential goal exceedences deemed acceptable for on-site burial would be placed in the designated soil burial areas, whereas the remainder of the stockpiled soils would be used to backfill open excavations at the site. Clean fill material would be imported to satisfy the remainder of the fill needs. During backfilling, soil would be moisture-conditioned, as necessary, then compacted to a minimum of 90 percent maximum density. Following the placement and compaction of the affected soils, asphalt would be placed over the impacted soils with a 2-foot overlay on all sides. The final dimensions and locations of each soil burial area would be surveyed and documented.

Implementation of Alternative 5 would generally include:

- Hiring contractors, preparing the site, and securing fill material, if needed, as described in Alternative 3;
- Excavating soils from burial areas, stockpiling, and sampling;
- Excavating, stockpiling, and sampling TPH soils;
- Excavating and stockpiling soils exceeding residential cleanup goals for metals and PAHs, sampling and analysis including leachate analysis of soils to be buried;
- Profiling and transporting all soils targeted for off-site disposal to an approved treatment and/or disposal facility, as described in Alternative 3;
- Surveying the final limits of the excavations and the soil burial area(s);
- Placing soils in burial area, compacting as described above, and surfacing with asphalt;
- Backfilling and compacting the other excavations that extend greater than 6 inches bgs, as described for Alternative 3, using soils excavated from burial areas as fill if clean;

- Surveying final limits of asphalt cap(s) and recording this information on the deed restriction; and
- Conducting annual inspections and performing routine maintenance to verify the integrity of the asphalt cover.

The deed restriction incorporated into this alternative would require notification of the DEQ prior to excavating and managing soils from beneath the asphalt cap.

7.0 Evaluation of Remedial Action Alternatives

This section presents an evaluation of remedial action alternatives. First, the DEQ evaluation criteria are described. Then, the alternatives are rated against each other relative to the evaluation criteria. A more detailed analysis of each remedial action alternative with respect to the evaluation criteria is presented in the FS report (ERM; 2001).

7.1 Evaluation Criteria

Oregon's environmental cleanup laws require that each remedial action alternative be evaluated against the protectiveness requirement, the preference to treat hot spots, if present, and a balancing of the remedy selection factors. These assessment criteria are described below.

7.1.1 Protectiveness

Protectiveness represents the ability of the remedial action alternative to protect human health and the environment, as demonstrated through a residual risk assessment. The residual risk assessment includes:

- A quantitative assessment of the risk resulting from concentrations of untreated waste or treatment residuals remaining at the site at the conclusion of remedial action, which considers both current and likely future land and water use scenarios, and the exposure assumptions used in the baseline risk assessment;
- A qualitative or quantitative assessment of the adequacy and reliability of any institutional or engineering controls to be used for management of treatment residuals and untreated hazardous substances remaining at the site; and
- Demonstration that the combination of the above-mentioned assessments would attain acceptable levels of risk, as defined in OAR 340-122-115, in the locality of the facility.

Residual risks are typically evaluated qualitatively as part of the detailed alternatives evaluation. A quantitative residual risk assessment is required to support the recommendation for a specific remedial action alternative (see Section 9.2).

7.1.2 Treatment of Hot Spots

Treatment of hot spots at this site is not necessary because, as discussed in Section 4.11, no hot spots exist at the Yard.

7.1.3 Remedy Selection Balancing Factors

The remedial action alternatives will be assessed based on a balancing of five remedy selection factors. These balancing factors and the criteria to assess each factor are described below.

Effectiveness
The assessment of effectiveness determines if the remedial action alternative is able to achieve the desired level of protection to human health and the environment. The effectiveness in achieving protection is assessed by the following criteria, as appropriate:

- Magnitude of risk from untreated waste or treatment residuals remaining at the site without any risk reduction achieved through on-site management of exposure pathways;
- Ability of engineering and institutional controls to manage the risk from treatment residuals and untreated hazardous substances remaining at the site;
- Ability for treatment technologies to meet treatment objectives;
- Time required for achievement of remedial action objectives; and
- Any additional information relevant to effectiveness.

Long-Term Reliability
The assessment of long-term reliability determines the ability of a remedial action alternative to maintain the required level of protection after its implementation. Each remedial action alternative is assessed for long-term reliability, using the following criteria, as appropriate:

- Reliability of treatment technologies in meeting treatment objectives;
- Reliability of engineering and institutional controls necessary to manage the risk from treatment residuals and untreated hazardous substances, based on the characteristics of the hazardous substances to be managed;
- The effectiveness and enforceability over time of engineering and institutional controls in preventing migration of contaminants and in managing risks associated with potential exposure;
- The nature, degree, and certainties or uncertainties of any necessary long-term management; and

- Any other information relevant to long-term reliability.

Implementability
The assessment of implementability determines whether, or with how much difficulty, the remedial action alternative can be implemented and if the alternative's continued effectiveness can be assessed and verified. Each remedial action alternative is assessed for the ease or difficulty of remedial action implementation, using the following criteria, as appropriate:

- Practical, technical, and legal difficulties and unknowns associated with the construction and implementation of a technology, engineering control, or institutional control, including potential scheduling delays;
- Ability to monitor the effectiveness of the alternative;
- Consistency with federal, state, and local requirements; activities necessary for coordination with other agencies; and ability and time to obtain necessary authorization from other governmental bodies;
- Availability of necessary services, materials, equipment, and specialists; and
- Any other information relevant to implementability.

Implementation Risk
Implementation risk addresses the effects on human health and the environment during the construction and implementation phase. Each remedial action alternative is assessed for the potential risk associated with implementing the remedial action using the following criteria, as appropriate:

- Potential impacts on the community during implementation of the remedial action and the effectiveness and reliability of protective or mitigative measures;
- Potential impacts on workers during implementation of the remedial action and the effectiveness and reliability of protective or mitigative measures;
- Potential impacts on the environment during implementation of the remedial action and the effectiveness and reliability of protective or mitigative measures;
- Length of time until the remedial action is complete; and
- Any other information related to implementation risk.

Reasonableness of Cost
The assessment of reasonableness of cost ordinarily is a two-part assessment. First, the remedial action cost is estimated using standard engineering procedures. Second, the degree to which the costs are "proportionate to the benefits" is determined in a qualitative

manner. The remedial action alternative is assessed for the reasonableness of cost by considering the following criteria, as appropriate:

- Cost of the remedial action including:
  - Direct and indirect capital cost;
  - Annual operation and maintenance (O&M) costs;
  - Costs of any required periodic reviews; and
  - Net present value of all of the above.
- Proportionality of remedial action costs to the benefits to human health and the environment created through risk reduction or risk management.
- Degree of sensitivity and uncertainty of the costs.
- Any other information relevant to reasonableness of cost.

7.2 Comparative Analysis of Remedial Action Alternatives

During the FS process, the five remedial action alternatives were analyzed individually with respect to protectiveness, effectiveness, long-term reliability, implementability, implementation risk, and reasonableness of cost. These individual analyses are presented in detail in the FS report and are the basis for the comparative analysis discussed below. The alternatives are compared to each other and rated based on how well each satisfies the evaluation criteria. Because all of the action alternatives involve the completion of a set of common tasks, the following comparative analysis focuses only on those actions that are different for each action alternative.

7.2.1 Protectiveness

The protectiveness criterion provides a means of measuring risk resulting from COCs remaining on site after the selected remedial action has been completed. Qualitatively, Alternative 3 (off-site disposal) appears to best satisfy the protectiveness criterion because it provides the most effective and long-term solution. Alternative 4 (asphalt incorporation) would be equally protective, provided the COCs could be stabilized over the long term. Alternative 5 (off-site disposal and on-site burial) would not be as effective as Alternatives 3 and 4 at providing long-term protection, but would be easier to manage and control long-term risk when compared to Alternative 2 (soil cap). The residual risk resulting from Alternative 1 (No Action) make this the least protective alternative.

7.2.2 Effectiveness

The effectiveness criterion measures the effectiveness at protecting human health and the environment. Alternative 3 best satisfies this criterion because it uses a proven approach for reducing toxicity, mobility, and volume of COCs. Alternative 4 could be as effective at reducing toxicity and mobility of COCs, although this has yet to be demonstrated at the site. Alternatives 2 and 5 utilize engineering controls to reduce mobility of COCs; however, Alternative 5 would provide better protection over the long term. Alternative 1 is the least effective, as it provides no measures to protect human health and the environment.

7.2.3 Long-Term Reliability

The long-term reliability criterion measures how well an alternative will control or manage risk over the long term. Alternative 3 offers the most permanent solution and, therefore, best satisfies this criterion. The ability for asphalt incorporation, as proposed in Alternative 4, to effectively stabilize COCs over the long term would need to be proven through leachate testing. Alternatives 2 and 5 could both control risk over the long term but would require routine inspections and maintenance. Alternative 1 provides the least amount of long-term reliability because it involves no action to control or manage risk.

7.2.4 Implementability

This criterion measures the degree of difficulty associated with implementation. Alternative 1 is by far the easiest to implement because no action is involved. Alternative 3 would be the easiest action alternative to implement because it involves excavation, loading, off-site transport and disposal. Alternative 4 would be as easy to implement provided an end use for the resulting asphalt is identified. Placement of a soil cap, as proposed in Alternative 2, would be relatively easy to implement, but it may be difficult to assess and verify continued effectiveness. Burying soils beneath paved surfaces (Alternative 5) would be the most difficult to manage because stockpiling and segregating soils during implementation could prove to be quite cumbersome. Additionally, it may be difficult to monitor effectiveness or ensure asphalt integrity over the long term.

7.2.5 Implementation Risk

The implementation risk criteria measures the degree of risk posed to site workers and the surrounding community during implementation. Alternative 1 poses no short-term risk since it involves no action. With all of the action alternatives, the majority of implementation risk is associated with the generation of dust emissions and affected runoff, which can be controlled. Alternative 2 poses the least amount of implementation risk because it involves disturbing only a minimal amount of affected soils. Alternative 3 would likely present a relatively moderate risk to site workers and the community because soil handling volumes and duration of activities are increased in comparison to Alternative 2, but are less than Alternatives 4 and 5. Alternatives 4 and 5 pose the greatest level of implementation risk because both alternatives involve handling a similar volume of soil as Alternative 3 and would take significantly longer to complete than the other alternatives.

7.2.6 Reasonableness of Cost

This criterion measures the total capital and O&M cost of each alternative, relative to the benefit provided to human health and the environment. Table 10 presents a summary of the costs associated with each remedial action alternative. Alternative 3 best satisfies the reasonableness of cost criterion because it would be the least costly, and would provide the highest degree of long-term protection. Alternative 4 would cost slightly more than Alternative 3 and, if demonstrated effective, would provide the same degree of long-term protection. Alternative 5 has the potential to provide long-term protection, but would be more costly to implement and maintain. With Alternative 2, it would be difficult to ensure long-term protection and, as a result, would be significantly more costly than the other action alternatives. Because Alternative 1 provides no benefit to human health and the environment, it would not satisfy the reasonableness of cost criterion under a commercial/residential land use development scenario.

8.0 Peer Review Summary

An internal peer review project team consisting of technical staff from DEQ's Western Region Cleanup Program was assembled for this project. The project team has included a hydrogeologist, a toxicologist, and an engineer since the initiation of the Voluntary Cleanup Agreement. The project team reviewed and commented on project reports, focusing on areas pertinent to their areas of expertise. Throughout the remedial investigation and feasibility study process, the project team provided input to UPRR and their consultants on identified data gaps, hydrogeologic evaluations, toxicological evaluations and risk estimation procedures, and required remedy components. Written comments on the primary project deliverables are included in the Administrative Record Appendix A).

The current DEQ project team has reviewed and agrees with the selected remedial action for the UPRR Rail Yard site. The project engineer has verified that the selected remedy is technically feasible. The project toxicologist has verified that the residual risk associated with the selected remedial action will meet the acceptable risk level specified in OAR 340-122-115(1).

9.0 Public Notice and Comment

DEQ's notice of the proposed remedial action was published on June 1, 2001 in the Secretary of State's Bulletin. A news release was issued to area media on June 11, 2001. Display ads were printed in the Ashland Daily Tidings, Ashland's daily newspaper, and the Medford Mail-Tribune, Medford's daily newspaper. Copies of the Staff Report and other documents that make up the Administrative Record were made available for public review at the Public Documents Repository located at the Ashland Public Library, and at DEQ's Eugene office. The original comment period ran from June 1 to July 16. The comment period was extended to July 20 to facilitate citizens who had difficulties accessing the Administrative Record documents. Several comments were received. These are discussed below.

In addition to the public comment period, a public meeting was held June 25, 2001. Area television stations broadcast information that described the proposed remedy, comment period, and announced the public meeting. This meeting was intended to provide an overview of the project, the remedy selection process, as well as answer questions about the project. Staff from DEQ were present as were staff from the City of Ashland, UPRR, and a representative from ERM, UPRR's environmental consulting firm. Five citizens attended the meeting. None of the citizens provided formal comments on the proposed remedy during the meeting.

9.1 Comments and Responses to Comments on the Selected Remedial Action

A letter was received that agreed with the selection of the proposed remedy. The author of the letter suggested that a more thorough site analysis be conducted given the mixed residential/commercial development being proposed for the site area. The writer also expressed concerns regarding potential impacts that implementation of the proposed remedy could have on the existing nearby residential areas and Mountain Creek. Lastly, the writer stated that while the ponds are highly contaminated, they should be considered wetlands and should be preserved. The soil sampling performed during the remedial investigations at the site has generally delineated the extent of soil contamination at the site. During implementation of the remedial action, confirmatory sampling will be performed to verify that soil above the target cleanup level has been removed. In order to minimize any potential impacts on the community or the environment during the remedial action, protective measures to control erosion and dust will be implemented. Pond A and Pond B, which are contaminated with TPHs, are manmade structures that were created as part of the mid-1980's removal actions to recover oil from beneath the site. Ponds A and B are not considered ecological habitats and will be removed. The natural pond in the northwest portion of the site is considered an ecological habitat and does not need to be disturbed during the remedial action. No remedy modification is necessary regarding this comment.

An e-mail was received which reflected a concern that the risks posed by disturbing the contaminated soil was actually greater than leaving the materials in place. The specific risk concern was related to air-borne dust containing contaminants. During implementation of the RA, dust control measures will be taken to protect workers and the community to ensure that exposures do not occur above protective levels. Dust control measures include keeping the excavated soils wetted, air monitoring, monitoring of worker's exposures, and contingency plans to limit work if air monitoring indicates a potential for unacceptable exposure. No remedy modification is required.

An e-mail was received inquiring whether the site area was thoroughly tested. As reflected in the first comment above, impacted areas were generally delineated during the RI. Verification sampling will be performed during implementation of the RA to confirm that contaminated soils above target cleanup levels are removed. No remedy modification was necessary.

Two other phone calls were received from citizens inquiring about property they were about to purchase and whether this property was impacted by the site. The citizens were informed that the property they were considering purchasing was not part of the site, and was not impacted by site contaminants. No remedy modification is necessary.

10.0 Documentation of Significant Changes

There were no changes made to the proposed remedial action as described in the May 2001 Remedial Action Recommendation Staff Report.

11.0 Selected Remedial Action

This section summarizes the selected remedial action alternative and presents a Residual Risk Assessment (RRA), which evaluates the risk to human health and the environment following completion of the remedial action.

11.1 Selected Remedial Action Alternative

Alternative 3, as developed by ERM for the FS, is the selected alternative because it best satisfies the protectiveness criteria, remedy selection-balancing factors and is cost effective. Alternative 3 includes excavation and off-site disposal of soils exceeding residential cleanup goals, and implementation of the common tasks described in Section 6.1.2. By implementing the actions included in Alternative 3, the following would be achieved:

- Human health and the environment would be protected over the long term under a commercial/residential land use scenario;
- The residual risk associated with COCs remaining after remediation would be acceptable as described in Section 9.2, below;
- Workers and the public would be protected during implementation through the use of dust and erosion controls; and
- Excavation and off-site disposal would be the easiest, quickest, and most cost-effective means of handling soils that exceed residential cleanup goals.

11.2 Residual Risk Assessment

An RRA was performed to evaluate the potential risks associated with COCs remaining in soils following completion of the selected remedial activities under Alternative 3. This section describes the methodology used to develop the RRA and presents the results of this analysis. Consistent with risk assessment guidance developed by DEQ and USEPA, this section is organized as follows:

- Data evaluation;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

Data Evaluation
The Final RI Report for the Yard presented risk-based cleanup levels for COCs in soil. These are summarized in Table 1. The values presented on Table 1 for a residential scenario are the applicable cleanup goals for the Yard. This RRA considers all constituents for which risk-based cleanup levels were developed.

Exposure Assessment
Soil cleanup levels for all portions of Ashland Yard will be based on a commercial/residential land use scenario as discussed in Section 4.9. Selection of this land use scenario is conservative, in light of planned future uses of Ashland Yard. Exposure assumptions (i.e., exposure pathways and intake parameters) used in the residual risk analysis were consistent with the assumptions used to develop the industrial and residential land use scenarios in the Health and Ecological Risk Assessment included in Section 5 of the Final RI Report. (Section 5 of the Final RI Report provides a complete discussion of the exposure pathways and intake parameters associated with residential land use.)

Exposure point concentrations used in the RRA were based on the maximum residual constituent concentrations that may be present in soil following remediation to residential cleanup levels. Soil data used to define these exposure point concentrations were based on the complete tabulation of soil data presented in the Final RI Report and in Tables 2, 3, and 4 of this report. For the exposure assessment, these concentrations are assumed to be in surface soils or soil otherwise directly available to human contact.

Toxicity Assessment
Toxicity data used in the RRA were consistent with data used in the Health and Ecological Risk Assessment and in the calculation of risk-based cleanup levels for Ashland Yard.

Risk Characterization
The calculation of residual risks presented in this RRA followed the approach used in the Health and Ecological Risk Assessment to derive risk-based cleanup levels. The specific steps associated with these calculations are as follows:

- First, the risk-based residential cleanup goals were compiled (Table 11) based on the residential levels presented in Table 1. Maximum residual soil concentrations reported in Table 1 were derived from the highest concentrations of each contaminant detected in soils outside of the planned remediation areas. The maximum detected concentrations were used to provide a conservative estimate of residual risk.
- As noted above, the RRA considered all constituents for which risk-based levels were developed in the RI.
- Next, the toxicological basis (i.e., carcinogenic effects, non-carcinogenic effects, or blood lead level) for each risk-based cleanup level was determined (Table 11), based on information presented in the Final RI Report.
- Then, the maximum residual soil concentrations were identified and tabulated (Table 11). For each constituent, the maximum residual concentration is equal to the maximum detected concentration that is less than the applicable cleanup level. The identification of residual concentrations was based on a compilation of all soil samples that did not contain an exceedence of any applicable cleanup level. Soil samples that showed an exceedence of any cleanup level were excluded from this compilation and were not considered in the identification of maximum residual constituent concentrations.
- The residual carcinogenic risk was then estimated for each carcinogenic constituent according to the following formula:[1]

  Risk = 0.000001 x Residual Concentration/Risk-Based Cleanup Level
- The residual hazard index was estimated for each non-carcinogenic constituent, according to the following formula:

  Hazard Index = Residual Concentration/Risk-Based Cleanup Level
- The total excess lifetime carcinogenic risk was then calculated as the sum of the constituent risks; similarly, the total hazard index was calculated as the sum of the constituent hazard indices (Table 11).

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[1] This formula incorporates a target risk level of one in one million (0.000001), consistent with the target risk level used to derive the risk-based cleanup levels for carcinogenic constituents.

As shown in Table 11, the total excess lifetime carcinogenic risk is 3×10^{-6}.[2] This represents an upper bound estimate of the excess lifetime carcinogenic risk associated with exposure to residual soil constituents under a residential land use scenario. The total risk is well below the acceptable level of cumulative carcinogenic risk defined by DEQ (1×10^{-5}). The risk associated with each individual constituent is also acceptable under DEQ guidelines (i.e., the excess lifetime carcinogenic risk associated with each constituent is less than 1×10^{-6}).

Similarly, the total non-carcinogenic hazard index is less than one, indicating that no adverse non-carcinogenic health effects are anticipated to be associated with exposure to residual soil constituents under a commercial/residential land use scenario.
Maximum site-wide residual concentrations were used in the RRA to simplify the calculation and presentation of residual risk. It must be emphasized that the use of maximum concentrations in this analysis represents a very conservative approach and that any residual risk is likely to be much less than estimated in this evaluation.
As noted on Table 11, arsenic and lead were not considered in the calculation of cumulative risks. The reasons for their exclusion are discussed below:

- Arsenic occurs naturally in soils, and the cleanup level for arsenic was based on site-specific information regarding typical arsenic concentrations in soils in the vicinity of the Yard. Because the cleanup level for arsenic is not risk-based, arsenic was not considered in the calculation of cumulative risks.
- The risk-based cleanup level for lead is based on estimated blood lead concentrations, rather than on carcinogenic risk or non-carcinogenic hazard. For this reason, lead was not considered in the cumulative risk calculations. However, residual lead concentrations will be less than the defined cleanup levels, indicating that residual concentrations of lead are not expected to result in unacceptable blood lead levels.

11.3 Conclusions

The selected remedial action to address the potential human health risks associated with exposure to the contaminated soil and surface water at the UPRR Rail Yard site is Alternative 3. Section 6.1.4 describes in more detail the components of the selected remedial action.

The selected remedial action addresses the RAOs primarily through excavation and off-site disposal of soils exceeding residential cleanup goals. The selected remedial action is considered to be protective, effective, reliable, implementable and cost-effective. The selected remedy is consistent with the future anticipated use of the site as a mixed commercial/residential land use area. Residual risks associated with the selected remedy are below DEQ's acceptable level for cumulative carcinogenic risk of 1×10^{-5}, below

[2] An estimated risk of 1×10^{-6} represents a unitless probability of one in one million that a carcinogenic response will occur during an individual's lifetime as a result of the defined conditions of exposure.

DEQ's guidelines for risk associated with individual constituents (1×10^{-6}), and the total non-carcinogenic hazard index is less than one.

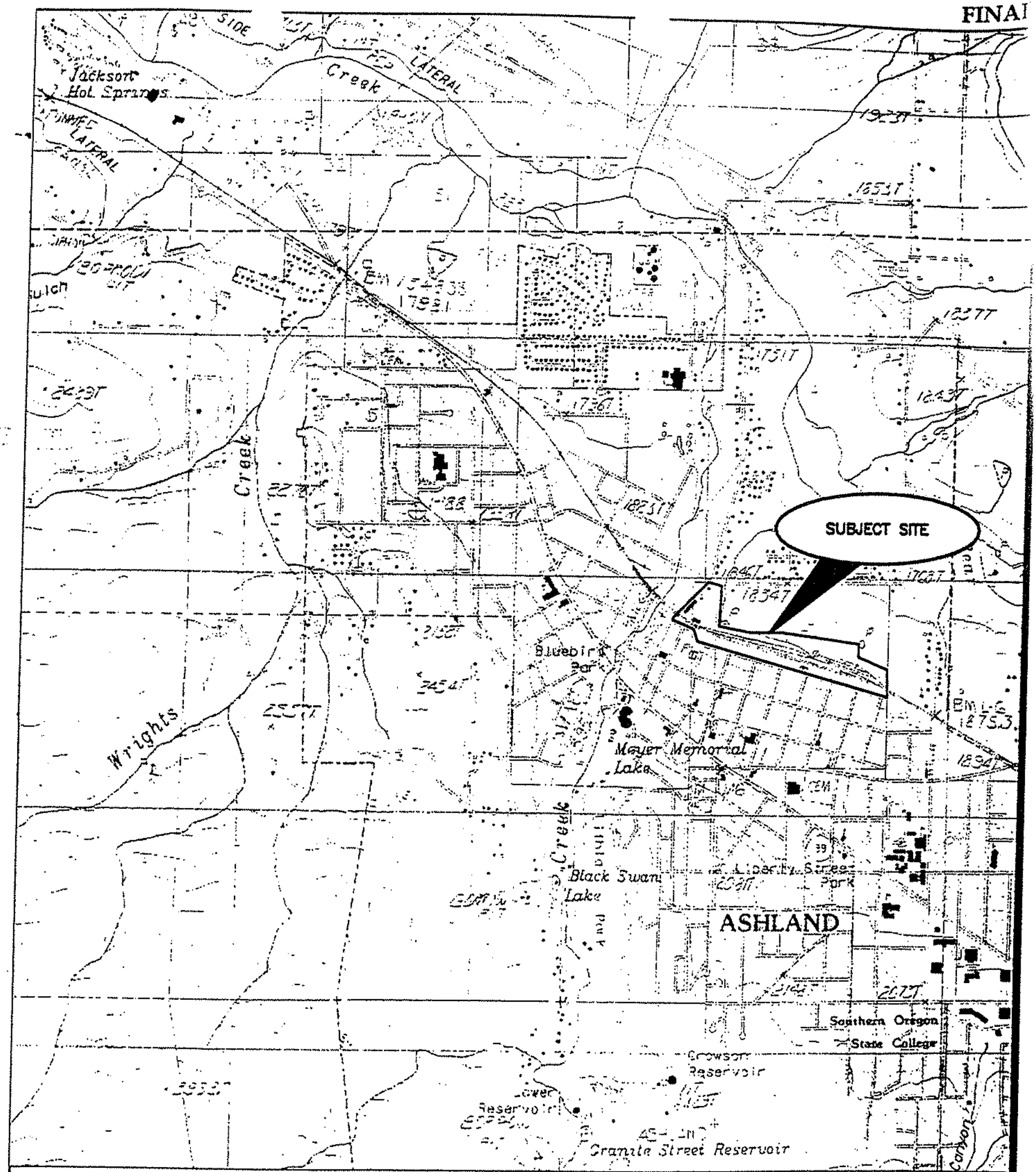
12.0 Statutory Determinations

The selected remedial action for the UPRR Rail Yard site is considered to be protective, effective, reliable, implementable and cost-effective. The selected remedy is consistent with the current and future anticipated use of the site as a mixed commercial/residential development area. No hot spots were identified at the site. Residual risks associated with the selected remedy are below DEQ's acceptable risk levels identified in OAR 340-122-115.

13.0 Signature of the Regional Administrator

Kerri L. Nelson, Western Region Administrator
Oregon Department of Environmental Quality

9/18/01
Date



SCALE 1:24,000

1 — 1/2 — 0 — 1 MILE

1000 — 0 — 1000 — 2000 — 3000 — 4000 — 5000 — 6000 — 7000 FEET

1 — .5 — 0 — 1 KILOMETER

N

References:
U.S.G.S. 7.5 Minute Series (Topographic Ashland Quadrangle, Oregon)
Dated: 1978; Photorevised 1983

Figure 1

Site Location Map
Union Pacific Railroad Company
Ashland Yard
Ashland, Oregon

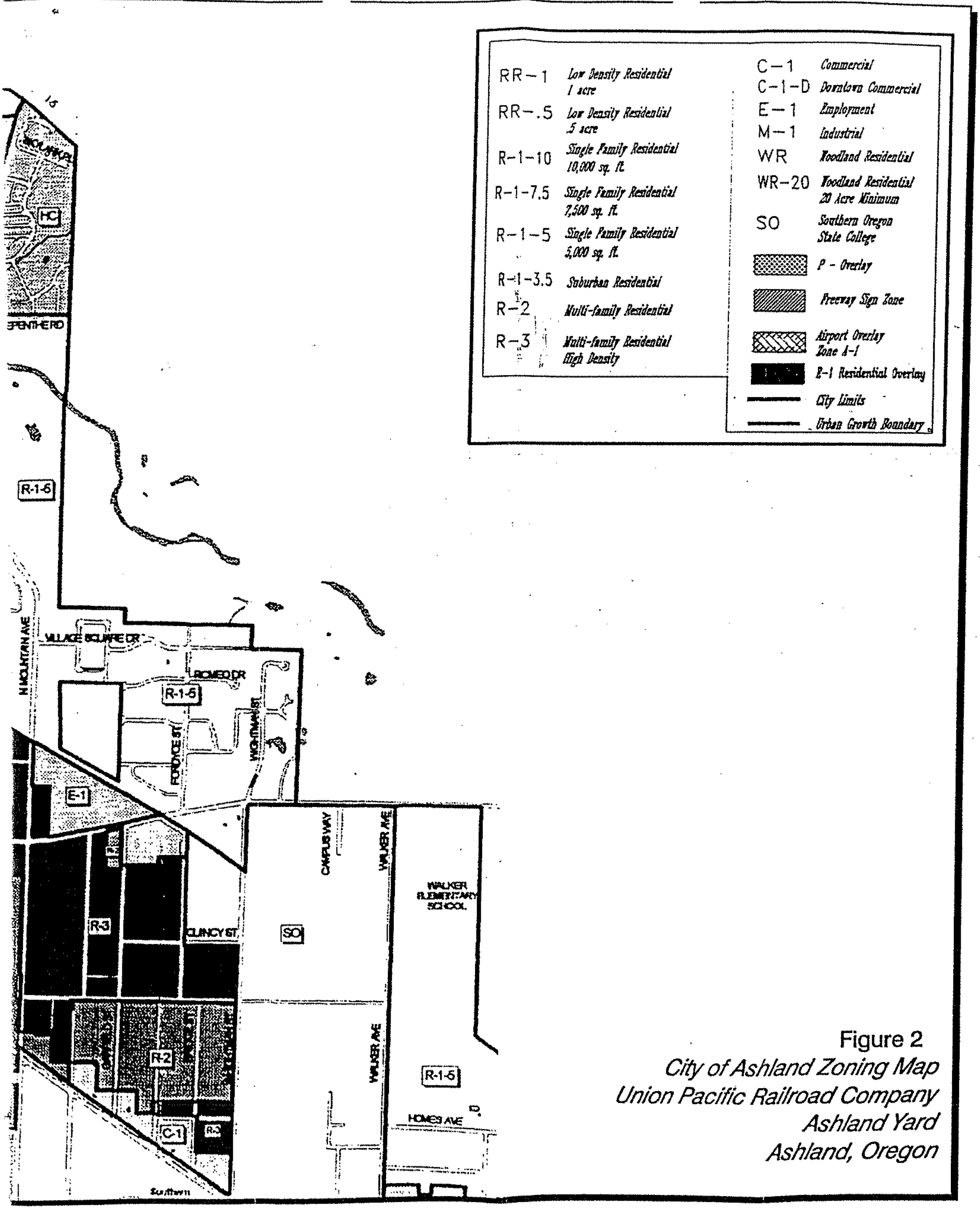


Figure 2
City of Ashland Zoning Map
Union Pacific Railroad Company
Ashland Yard
Ashland, Oregon

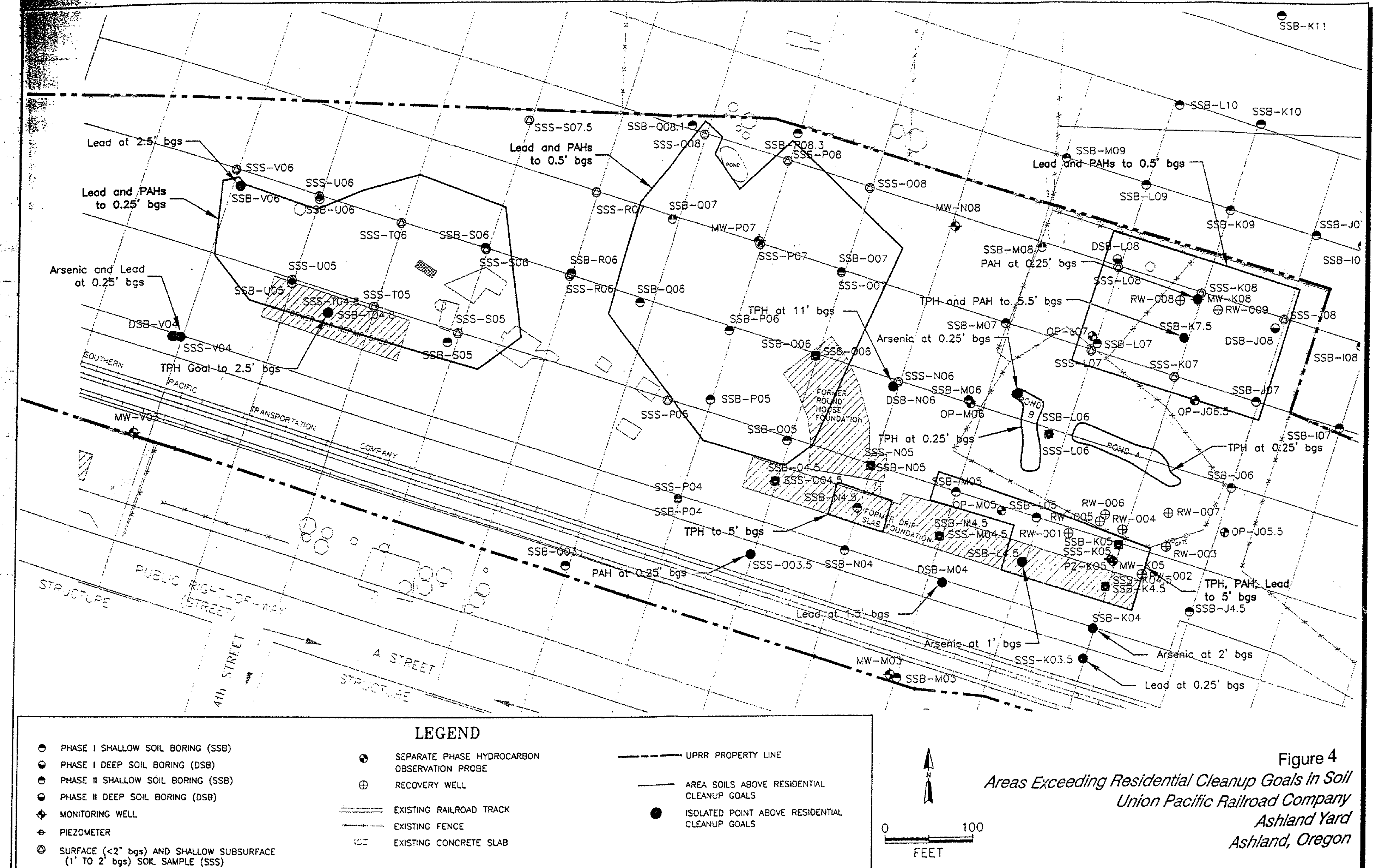


Figure 4
Areas Exceeding Residential Cleanup Goals in Soil
Union Pacific Railroad Company
Ashland Yard
Ashland, Oregon

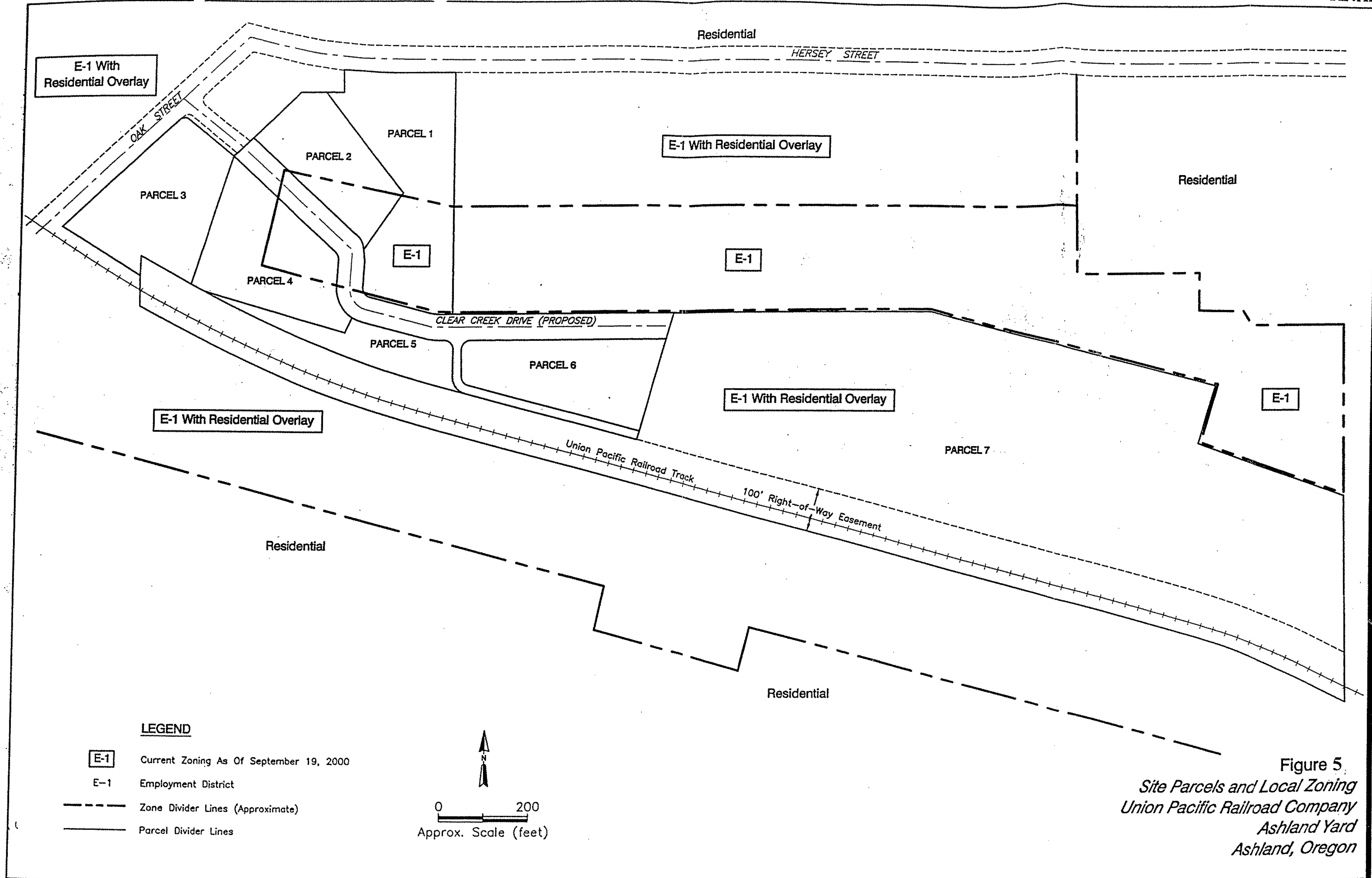


Figure 5
Site Parcels and Local Zoning
Union Pacific Railroad Company
Ashland Yard
Ashland, Oregon

FINAL

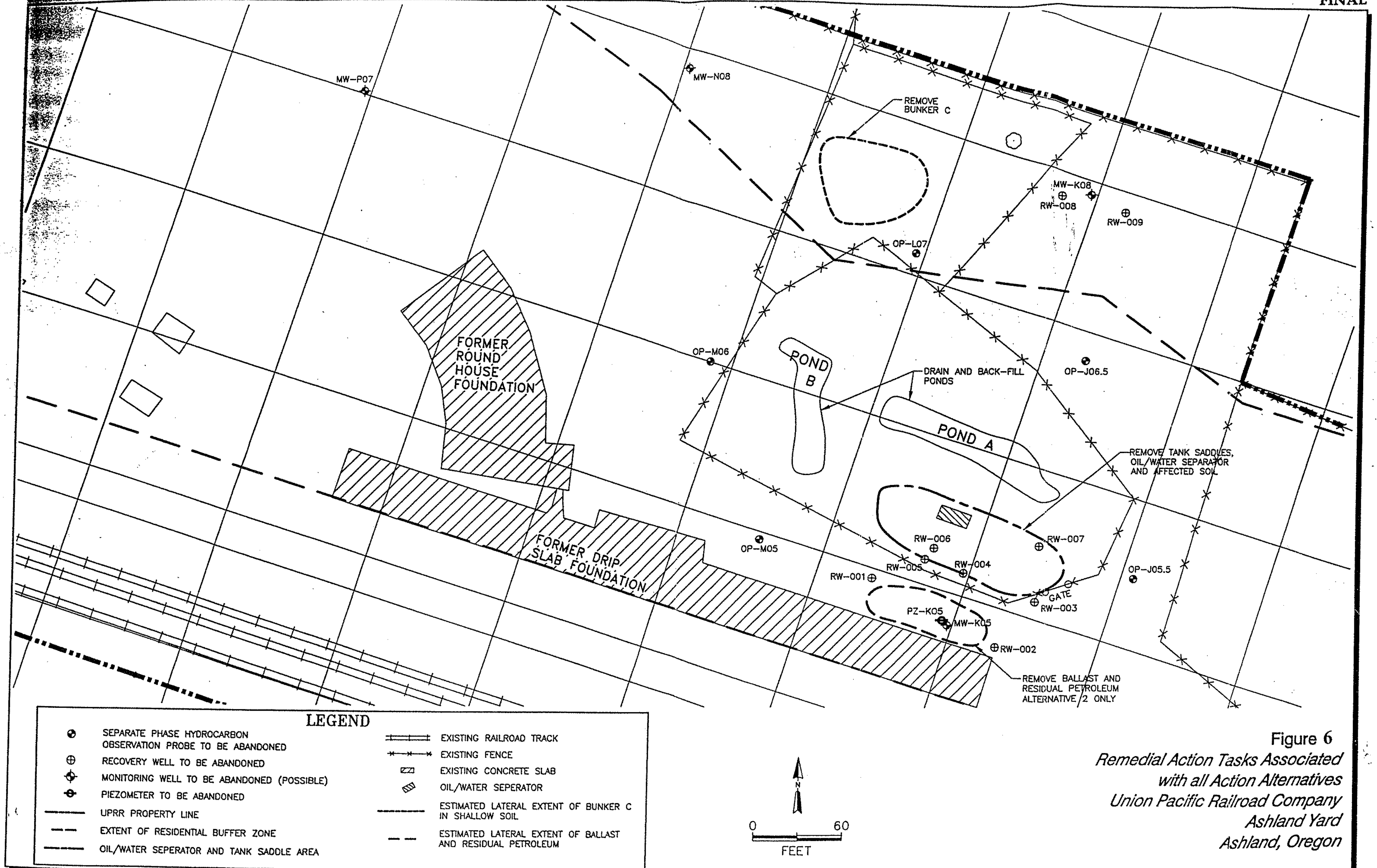


Figure 6
Remedial Action Tasks Associated with all Action Alternatives
Union Pacific Railroad Company
Ashland Yard
Ashland, Oregon

Table 1 *Risk-Based Cleanup Goals for Constituents of Concern in Soil*
Residential Land Use Scenarios
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Chemicals	Residential Land Use Scenario Risk-Based Cleanup Goals (mg/kg)	Carcinogen?
Volatile Organic Chemicals		
Benzene	0.27	Yes
Ethylbenzene	392	No
Toluene	NA	NA
Xylenes	146,500	No
Semivolatile Organic Chemicals		
Acenaphthene	3,116	No
Acenaphthylene	NA	NA
Anthracene	15,580	No
Benzo(a)anthracene	0.64	Yes
Benzo(a)pyrene	0.06	Yes
Benzo(b)fluoranthene	0.64	Yes
Benzo(g,h,i)perylene	NA	NA
Benzo(k)fluoranthene	6.37	Yes
Chrysene	63.7	Yes
Dibenz(a,h)anthracene	0.06	Yes
Fluoranthene	2,077	No
Fluorene	2,077	No
Indeno(1,2,3-cd)pyrene	0.64	Yes
Naphthalene	2,077	No
Phenanthrene	NA	NA
Pyrene	1,558	No
Petroleum Hydrocarbons		
Total Petroleum Hydrocarbons	1,558	No
Inorganics		
*Arsenic	30	Yes
Barium	2,161	No
Cadmium	34.5	Yes
Chromium	15,140	No
**Lead	200	No
Mercury	16.2	No
Selenium	366	No
Silver	284	No

Cleanup goals for residential land use scenario developed based on residential exposure assumptions.
Goals for carcinogenic chemicals of concern (COCs) based on 1×10^{-6} lifetime cancer risk.
Goals for non-carcinogenic COCs based on a hazard quotient of 1.0.
* Soil concentration based on background, not risk.
** Soil concentration based on Oregon Department of Environmental Quality soil action levels.
mg/kg Milligrams per kilogram
NA Not calculated due to lack of slope factor or reference dose.

Table 2 *Total Petroleum Hydrocarbon Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	TPH (Speciation Results)[a]	Diesel	Gasoline
DSB-J08	0.5	03/29/94	NA	542	NA
DSB-J08	5	03/29/94	NA	81	NA
DSB-J08	10	03/29/94	NA	<20	NA
DSB-M04	0.5	03/29/94	219	220	NA
DSB-M04	3	03/29/94	<20	NA	NA
DSB-M04	10.5	03/29/94	<20	NA	NA
DSB-N06	0.5	03/28/94	150	234	NA
DSB-N06	3	03/29/94	<20	NA	NA
DSB-N06	5	03/29/94	NA	<20	NA
DSB-N06	10	03/29/94	NA	1,060	NA
DSB-N06	11	03/29/94	1,700	1,700	NA
DSB-V04	4.5	05/09/96	NA	<20	NA
DSB-V04	8	05/09/96	297	47 NJT	NA
DSB-V04	14.5	05/09/96	NA	<20	NA
DSB-V04	18.5	05/09/96	NA	<20	NA
DSB-V04	21	05/09/96	NA	<20	NA
MW-K05	3.5	05/11/96	NA	6,880 J	NA
MW-K05	7.5	05/11/96	NA	1,800 NJO	NA
MW-K05	10	05/11/96	NA	<20	NA
MW-Q03	2.5	05/12/96	NA	<20	NA
MW-Q03	6	05/12/96	NA	<20	NA
MW-Q03	10	05/12/96	NA	<20	NA
MW-V03	3	05/20/96	NA	<20	<10
MW-V03	8	05/20/96	NA	<20	<10
P2-1	9	05/20/96	NA	<20	NA
P4-1	3	05/20/96	NA	3,270 NJO	NA
P5-1	3	05/20/96	NA	<20	NA
P6-1	3	05/20/96	NA	447 NJO	NA
P7-1	3	05/20/96	NA	20 N	NA
P9-1	3	05/20/96	NA	51 NJO	NA
P10-1	3	05/20/96	NA	<20	NA
P11-1	3	05/20/96	NA	<20	NA
P12-1	3	05/20/96	NA	488 NJO	NA
P13-1	3	05/20/96	NA	<20	NA
P14-1	3	05/20/96	NA	<20	NA
Pond-A-S-001		04/07/94	3,300	478	NA
Pond-A-S-002		04/07/94	640	945	NA
Pond-B-S-001		04/07/94	180	230	NA
Pond-B-S-002		04/07/94	2,200	300	NA
SSB-I07	2	05/29/96	NA	<20	NA
SSB-I07	6	05/29/96	NA	<20	NA
SSB-I08	2	05/29/96	NA	<20	NA
SSB-I08	7	05/29/96	NA	<20	NA
SSB-J04.5	2	03/24/94	NA	<20	NA
SSB-J04.5	5	03/24/94	NA	<20	NA
SSB-J04.5	10	03/24/94	NA	<20	NA

Table 2 ***Total Petroleum Hydrocarbon Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	TPH (Speciation Results)[a]	Diesel	Gasoline
SSB-J06	0.5	04/05/94	NA	<20	NA
SSB-J06	5	04/05/94	NA	<20	NA
SSB-J06	10	04/05/94	NA	<20	NA
SSB-J07	0.5	03/28/94	NA	406	NA
SSB-J07	5	03/28/94	NA	<20	NA
SSB-J07	10	03/28/94	NA	<20	NA
SSB-J09	2	05/29/96	NA	<20	NA
SSB-J09	7	05/29/96	NA	<20	NA
SSB-K04	2	03/22/94	NA	148	NA
SSB-K04	5	03/22/94	NA	1,220	NA
SSB-K04	10	03/22/94	NA	<20	NA
SSB-K04.5	1	03/24/94	NA	1,850	NA
SSB-K04.5	5	03/24/94	NA	15,000	NA
SSB-K04.5	10	03/24/94	NA	<20	NA
SSB-K05	1	03/22/94	NA	10,000	NA
SSB-K05	5.5	03/22/94	NA	5,400	NA
SSB-K05	15	03/22/94	NA	453	NA
SSB-K07.5	0.5	03/28/94	NA	<20	NA
SSB-K07.5	1	03/28/94	2,900	2,900	NA
SSB-K07.5	2	03/28/94	NA	2,350	NA
SSB-K07.5	5	03/28/94	NA	16,000	NA
SSB-K07.5	5.5	03/28/94	32,000	32,000	NA
SSB-K07.5	10	03/28/94	NA	<20	NA
SSB-K07.5	10.5	03/28/94	<20	NA	NA
SSB-K07.5	15	03/28/94	NA	<20	NA
SSB-K09	2	05/29/96	NA	<20	NA
SSB-K09	7	05/29/96	NA	<20	NA
SSB-L04.5	1	03/23/94	NA	7,700	NA
SSB-L04.5	5	03/23/94	NA	4,480	NA
SSB-L04.5	10	03/23/94	NA	<20	NA
SSB-L05	2	03/28/94	NA	1,620 J	NA
SSB-L05	4	03/24/94	NA	1,000	NA
SSB-L05	5.5	03/24/94	NA	146	NA
SSB-L05	6	03/24/94	NA	<20	NA
SSB-L05	10	03/24/94	NA	<20	NA
SSB-L06	0.5	03/28/94	NA	1,480	NA
SSB-L06	5	03/28/94	NA	279	NA
SSB-L06	10	03/28/94	NA	<20	NA
SSB-L07	0.5	03/28/94	NA	284	NA
SSB-L07	5	03/28/94	NA	275	NA
SSB-L07	10	03/28/94	NA	<20	NA
SSB-L07	15	03/28/94	NA	<20	NA
SSB-L09	2	05/28/96	NA	130 NJO	NA
SSB-L09	6.5	05/28/96	NA	<20	NA
SSB-L10	2	05/29/96	NA	<20	NA
SSB-L10	7	05/29/96	NA	<20	NA

Table 2 *Total Petroleum Hydrocarbon Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	TPH (Speciation Results)[a]	Diesel	Gasoline
SSB-M03	2.5	05/11/96	NA	<20	NA
SSB-M03	7.5	05/11/96	NA	<20	NA
SSB-M04	0.5	03/22/94	NA	79	NA
SSB-M04	2	03/22/94	NA	<20	NA
SSB-M04	5	03/22/94	NA	<20	NA
SSB-M04	10	03/22/94	NA	<20	NA
SSB-M04.5	1	03/23/94	NA	551	NA
SSB-M04.5	4.5	03/23/94	NA	<20	NA
SSB-M04.5	10	03/23/94	NA	<20	NA
SSB-M05	1	03/24/94	NA	136	NA
SSB-M05	2	03/24/94	NA	41	NA
SSB-M05	5	03/24/94	NA	1,670	NA
SSB-M05	8	03/17/94	NA	254	NA
SSB-M05	10	03/17/94	NA	<20	NA
SSB-M06	0.5	03/28/94	NA	<20	NA
SSB-M06	5	03/28/94	NA	<20	NA
SSB-M06	10	03/28/94	NA	<20	NA
SSB-M08	0.5	03/28/94	NA	786	NA
SSB-M08	5	03/28/94	NA	<20	NA
SSB-M08	10	03/28/94	NA	<20	NA
SSB-M08	11.8	03/28/94	NA	<20	NA
SSB-M09	2	05/29/96	NA	<20	NA
SSB-M09	7	05/29/96	NA	<20	NA
SSB-N04	2	03/30/94	NA	<20	NA
SSB-N04	6	03/30/94	NA	182	NA
SSB-N04.5	1	03/23/94	NA	<20	NA
SSB-N04.5	5	03/23/94	NA	3,760	NA
SSB-N04.5	10	03/23/94	NA	821	NA
SSB-N05	2	03/24/94	NA	361	NA
SSB-N05	5	03/24/94	NA	956	NA
SSB-N05	10	03/24/94	NA	<20	NA
SSB-O4.5	0.5	03/22/94	NA	<20	NA
SSB-O4.5	5	03/28/94	NA	<20	NA
SSB-O05	0.5	03/24/94	NA	554	NA
SSB-O05	4	03/24/94	NA	<20	NA
SSB-O05	6	03/24/94	NA	<20	NA
SSB-O05	10	03/24/94	NA	<20	NA
SSB-O06	0.5	03/30/94	NA	193	NA
SSB-O06	5	03/30/94	NA	208	NA
SSB-O06	12	03/30/94	NA	<20	NA

Table 2 ***Total Petroleum Hydrocarbon Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	TPH (Speciation Results)[a]	Diesel	Gasoline
SSB-O07	0.5	03/25/94	NA	691	NA
SSB-O07	5	03/25/94	NA	<20	NA
SSB-O07	10	03/25/94	NA	<20	NA
SSB-O07	12	03/25/94	NA	<20	NA
SSB-P04	2	03/22/94	NA	<20	NA
SSB-P04	5	03/22/94	NA	<20	NA
SSB-P04	10	03/22/94	NA	<20	NA
SSB-P04	15	03/22/94	NA	<20	NA
SSB-P05	0.5	03/25/94	NA	662	NA
SSB-P05	5	03/25/94	NA	<20	NA
SSB-P05	9	03/25/94	NA	<20	NA
SSB-P06	0.5	03/30/94	NA	40	NA
SSB-P06	5	03/30/94	NA	<20	NA
SSB-P06	6.5	03/29/94	<20	NA	NA
SSB-P06	6.5	03/29/94	NA	<20	NA
SSB-P06	9.5	03/30/94	<20	NA	NA
SSB-P06	9.5	03/30/94	NA	<20	NA
SSB-P06	10	03/30/94	NA	<20	NA
SSB-P06	14	03/30/94	<20	NA	NA
SSB-P06	14	03/30/94	NA	<20	NA
SSB-P08.3	2.5	05/11/96	NA	<20	NA
SSB-P08.3	5	05/11/96	NA	<20	NA
SSB-Q06	0.5	03/25/94	NA	1,060	NA
SSB-Q06	2	03/25/94	NA	<20	NA
SSB-Q06	5	03/25/94	NA	<20	NA
SSB-Q06	10	03/25/94	NA	<20	NA
SSB-Q07	0.5	03/25/94	NA	<20	NA
SSB-Q07	1	03/25/94	NA	<20	NA
SSB-Q07	5	03/25/94	NA	1,140	NA
SSB-Q07	10	03/25/94	NA	<20	NA
SSB-Q08.1	2.5	05/11/96	NA	<20	NA
SSB-Q08.1	4.5	05/11/96	NA	<20	NA
SSB-Q08.1	9	05/11/96	NA	<20	NA
SSB-R06	2.5	05/10/96	NA	<20	NA
SSB-R06	5	05/10/96	NA	<20	NA
SSB-R06	7.5	05/10/96	NA	<20	NA
SSB-S05	4.5	05/13/96	NA	<20	NA
SSB-S05	8	05/13/96	NA	<20	NA
SSB-S06	2.5	05/10/96	NA	<20	NA
SSB-S06	5	05/10/96	NA	<20	NA
SSB-S06	9.5	05/10/96	NA	<20	NA
SSB-S06	12.5	05/10/96	NA	<20	NA
SSB-T04.8	2.5	05/10/96	1,686	1,350 J	NA
SSB-T04.8	7.5	05/10/96	NA	<20	NA
SSB-T04.8	12	05/10/96	NA	<20	NA

Table 2 *Total Petroleum Hydrocarbon Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	TPH (Speciation Results)[a]	Diesel	Gasoline
SSB-U05	3.5	05/13/96	NA	<20	NA
SSB-U05	5	05/13/96	NA	<20	NA
SSB-U05	8	05/13/96	NA	<20	NA
SSB-U05	11	05/13/96	NA	<20	NA
SSB-U06	5	05/10/96	NA	<20	NA
SSB-U06	7	05/10/96	NA	<20	NA
SSB-V06	2.5	05/10/96	NA	<20	NA
SSB-V06	5	05/10/96	NA	<20	NA
SSS-R06	0.25	05/12/96	NA	<20	NA
SSS-R07	0.25	05/12/96	NA	<20	NA
SSS-S05	0.25	05/12/96	NA	<20	NA
SSS-S06	0.25	05/12/96	NA	<20	NA
SSS-S07.5	0.25	05/12/96	NA	<20	NA
SSS-T04.8	0.25	05/12/96	NA	NA	2,210 J
SSS-T05	0.25	05/12/96	NA	<20	NA
SSS-T06	0.25	05/12/96	NA	<20	NA
SSS-U05	0.25	05/12/96	NA	<20	NA
SSS-U06	0.25	05/12/96	NA	<20	NA
SSS-V04	0.25	05/12/96	NA	<20	NA
SSS-V06	0.25	05/12/96	NA	<20	NA
Industrial Worker Screening Level			17,090	17,090	17,090
Resident Screening Level			1,558	1,558	1,558

Notes and Key:

a = Speciation results indicate all TPH from carbon chain ranges C_6 to $>C_{28}$.

Units reported in milligrams per kilogram (mg/kg)

Detection reported at or above the Resident Screening Level.

Detection reported at or above the Industrial Worker Screening Level.

TPH = Total petroleum hydrocarbons

J = Analyte was positively identified, value is an approximate concentration.

N = Tentatively identified.

NJO = The product has been tentatively identified as oil with peaks extending into the diesel range.

NJT = The product has been tentatively identified as weathered gasoline with peaks extending into the diesel range.

Table 3 *Polynuclear Aromatic Hydrocarbon Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	ACNE	ACNL	ANT	B(a)A	B(a)P	B(b)F	B(ghi)P	B(k)F	CHRY	D(ah)A	FA	FLOR	I(1,2,3-cd)P	NAP	PA	PYR
DSB-M04	0.5	03/29/94	<0.005	<0.005	<0.005	<0.005	0.006	0.008	0.006	<0.005	0.011	<0.005	0.009	<0.005	0.009	0.01	0.01	0.022
DSB-M04	3	03/29/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
DSB-M04	10.5	03/29/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
DSB-N06	0.5	03/28/94	<0.005	<0.005	<0.005	0.006	0.006	0.009	0.016	<0.005	0.007	<0.005	0.005	<0.005	0.01	0.005	0.007	0.015
DSB-N06	3	03/29/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
DSB-N06	11	03/29/94	<0.005	<0.005	0.03	0.012	0.012	0.008	0.006	0.013	0.05	<0.005	0.013	0.029	<0.005	<0.005	<0.005	0.055
DSB-V04	4.5	05/09/96	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	0.0056	<0.0024	<0.0024
DSB-V04	8	05/09/96	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	0.057	0.0012	<0.0022
DSB-V04	14.5	05/09/96	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	0.00093	<0.0022	<0.0022
DSB-V04	18.5	05/09/96	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	0.0011	<0.0026	<0.0026	<0.0026	<0.0026	0.00092
DSB-V04	21	05/09/96	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Pond-A-S-001		04/07/94	0.2	0.028	0.059	<0.005	0.008	0.012	0.008	<0.005	0.019	<0.005	0.049	0.33	<0.005	0.019	0.51	0.092
Pond-A-S-002		04/07/94	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	0.016	<0.005	0.008	<0.005	0.005	<0.005	0.0009	<0.005	0.007	0.014
Pond-B-S-001		04/07/94	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.006	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008
Pond-B-S-002		04/07/94	0.36	0.021	0.34	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	0.029	0.12	<0.005	<0.005	0.49	0.083
SSB-K07.5	1	03/28/94	<0.020	<0.020	<0.020	0.06	0.08	0.11	0.26	0.03	0.11	0.05	0.03	<0.020	0.14	0.02	0.07	0.19
SSB-K07.5	5.5	03/28/94	1.8	0.7	1.5	3.1	1.1	0.5	1.1	0.6	3.6	0.3	1.4	4.5	0.4	0.2	18	8.7
SSB-K07.5	10.5	03/28/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
SSB-P06	6.5	03/29/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
SSB-P06	9.5	03/30/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
SSB-P06	14	03/30/94	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
SSB-R06	2.5	05/10/96	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	NA	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023
SSB-R06	5	05/10/96	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	NA	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022
SSB-R06	7.5	05/10/96	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	NA	<0.0022	<0.0022	<0.0022	0.0012	<0.0022	<0.0022	<0.0022	<0.0022	0.0012
SSB-R06	12	05/10/96	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	NA	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023
SSB-T04.8	2.5	05/10/96	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.0025	<0.0025	0.0012	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
SSB-T04.8	7.5	05/10/96	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	NA	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
SSB-T04.8	12	05/10/96	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	NA	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023
SSS-J08	0.25	05/14/96	<0.210	<0.210	<0.210	0.092	0.085	0.14	0.12	<0.210	0.1	<0.210	0.13	<0.210	0.094	0.067	0.12	0.17
SSS-K04.5	0.25	05/13/96	<0.220	<0.220	<0.220	0.24	0.087	0.16	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	0.1	<0.220	0.65
SSS-K05	0.25	05/14/96	<0.220	<0.220	<0.220	<0.220	0.11	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	0.11	<0.220	<0.220
SSS-K07	0.25	05/14/96	<0.230	<0.230	<0.230	<0.230	0.14	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	0.08
SSS-K08	0.25	05/14/96	<0.220	<0.220	<0.220	0.13	0.24	<0.220	<0.220	<0.220	0.15	<0.220	<0.220	<0.220	<0.220	0.17	<0.220	0.086
SSS-L06	0.25	05/14/96	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240
SSS-L07	0.25	05/14/96	<0.230	<0.230	<0.230	0.21	0.14	0.21	0.27	0.071	0.23	0.12	0.12	<0.230	0.24	0.15	0.12	0.15
SSS-L08	0.25	05/14/96	<0.240	<0.240	<0.240	0.17	0.095	0.09	0.2	<0.240	0.16	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	0.13
SSS-M04.5	0.25	05/13/96	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	0.12	<0.200	0.077
SSS-N05	0.25	05/14/96	<0.022	<0.022	<0.200	<0.200	0.011	0.011	<0.022	<0.022	0.013	<0.022	<0.022	<0.022	<0.022	0.0073	<0.022	0.0067
SSS-O03.5	0.25	05/13/96	0.0066	0.0049	0.017	0.054	0.063	0.083	<0.002	0.02	0.07	<0.002	0.11	0.0028	0.035	0.17	0.065	0.089
SSS-O04.5	0.25	05/13/96	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	0.0091	<0.022	<0.022	<0.022	<0.022	0.0086	<0.022	0.0086
SSS-O06	0.25	05/14/96	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220	<0.220
SSS-O08	0.25	05/13/96	<0.021	<0.021	<0.021	0.03	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	0.019	<0.021	<0.021	<0.021	0.012	0.019

Table 3 *Polynuclear Aromatic Hydrocarbon Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	ACNE	ACNL	ANT	B(a)A	B(a)P	B(b)F	B(ghi)P	B(k)F	CHRY	D(ah)A	FA	FLOR	I(1,2,3-cd)P	NAP	PA	PYR
SSS-P07	0.25	05/13/96	<2.2	<2.2	<2.2	2.1	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2
SSS-P08	0.25	05/13/96	<0.230	<0.230	<0.230	**0.093**	**0.11**	**0.079**	**0.12**	<0.230	**0.095**	<0.230	<0.230	<0.230	**0.079**	**0.079**	<0.230	<0.230
SSS-Q08	0.25	05/14/96	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230	<0.230
SSS-R06	0.25	05/12/96	<0.021	<0.021	<0.021	<0.021	**0.019**	<0.021	<0.021	<0.021	<0.021	<0.021	<21	<0.021	<0.021	**0.015**	<0.021	<0.021
SSS-R07	0.25	05/12/96	<0.021	<0.021	**0.014**	**0.021**	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	**0.032**	<0.021	<0.021	**0.022**	**0.054**	**0.038**
SSS-S05	0.25	05/12/96	**0.16**	<0.020	**0.015**	**0.024**	**0.036**	**0.044**	<0.020	**0.026**	**0.044**	<0.020	**0.097**	<0.020	<0.020	**0.036**	**0.052**	**0.17**
SSS-S06	0.25	05/12/96	<0.021	**0.014**	<0.021	**0.034**	**0.056**	**0.044**	**0.035**	**0.037**	**0.024**	<0.021	**0.041**	<0.021	**0.028**	**0.049**	**0.033**	**0.038**
SSS-S07.5	0.25	05/12/96	<0.0021	<0.0021	<0.0021	**0.0035**	**0.0038**	<0.0021	<0.0021	<0.0021	**0.0051**	<0.0021	**0.0074**	<0.0021	<0.0021	**0.003**	**0.0031**	**0.0053**
SSS-T04.8	0.25	05/12/96	<0.021	<0.021	<0.021	**0.018**	**0.037**	**0.056**	**0.041**	**0.013**	<0.021	<0.021	**0.036**	<0.021	<0.021	**0.029**	**0.032**	**0.028**
SSS-T05	0.25	05/12/96	<0.021	**0.014**	**0.023**	**0.043**	**0.078**	**0.082**	**0.044**	**0.023**	**0.059**	<0.021	**0.082**	<0.021	**0.046**	**0.11**	**0.1**	**0.081**
SSS-T06	0.25	05/12/96	<0.021	<0.021	<0.021	**0.021**	**0.027**	<0.021	**0.031**	<0.021	**0.034**	<0.021	**0.047**	<0.021	**0.021**	**0.023**	**0.04**	**0.041**
SSS-U05	0.25	05/12/96	**0.084**	**0.023**	**0.29**	**0.6**	**0.42**	**0.53**	<0.020	**0.12**	**0.47**	<0.020	**1.6**	**0.11**	**0.14**	**0.16**	**1.1**	**1**
SSS-U06	0.25	05/12/96	**0.0043**	**0.0081**	**0.01**	**0.031**	**0.034**	**0.048**	<0.0021	**0.017**	**0.032**	<0.0021	**0.05**	**0.0039**	**0.023**	**0.022**	**0.037**	**0.049**
SSS-V04	0.25	05/12/96	<0.022	<0.022	**0.048**	**0.053**	**0.017**	**0.17**	**0.15**	**0.049**	**0.1**	**0.017**	**0.16**	<0.022	**0.12**	**0.071**	**0.16**	**0.1**
SSS-V06	0.25	05/12/96	<0.0022	<0.0022	<0.0022	**0.0046**	**0.0041**	**0.0061**	**0.0033**	**0.0035**	**0.0048**	<0.0022	**0.0098**	<0.0022	**0.003**	<0.0022	**0.0045**	**0.007**
Industrial Worker Screening Level			34,190	--	170,900	2.19	0.22	2.19	--	21.9	219	0.22	22,790	22,790	2.19	22,790	--	17,090
Resident Screening Level			3,116	--	15,580	0.64	0.06	0.64	--	6.37	63.7	0.06	2,077	2,077	0.64	2,077	--	1,558

Notes and Key:
Units reported in milligrams per kilogram (mg/kg)
[light shading] Detection at or above the Resident Screening Level.
[dark shading] Detection at or above the Industrial Worker Screening Level.
NA = Not analyzed
-- = No screening level established

Table 4 ***Total Metals Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
BSB-001	0.5	03/30/94	**30**	NA	NA	NA	NA	**292**	NA	NA	NA	NA	NA	NA
BSB-001	3	03/30/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
BSB-001	5	03/30/94	**11**	NA	NA	NA	NA	**16**	NA	NA	NA	NA	NA	NA
BSB-002	0.5	04/05/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
BSB-002	5	04/05/94	**18**	NA	NA	NA	NA	**8**	NA	NA	NA	NA	NA	NA
BSB-002	10	04/05/94	**21**	NA	NA	NA	NA	**9**	NA	NA	NA	NA	NA	NA
BSB-003	0.5	04/05/94	**2**	NA	NA	NA	NA	**9**	NA	NA	NA	NA	NA	NA
BSB-003	5	04/05/94	**6**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
BSB-003	10	04/05/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
BSB-004	0.5	04/05/94	**2**	NA	NA	NA	NA	**7**	NA	NA	NA	NA	NA	NA
BSB-004	5	04/05/94	**2**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
BSB-004	10	04/05/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
BSB-005	0.5	03/30/94	**7**	NA	NA	NA	NA	**62**	NA	NA	NA	NA	NA	NA
BSB-005	4.5	03/30/94	**1**	NA	NA	NA	NA	**44**	NA	NA	NA	NA	NA	NA
BSB-005	6.5	03/30/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-J08	0.5	03/29/94	**10**	NA	NA	NA	NA	**371**	NA	NA	NA	NA	NA	NA
DSB-J08	4.5	03/29/94	NA	NA	NA	NA	**16,900**	NA	NA	NA	**1,060**	NA	NA	NA
DSB-J08	5	03/29/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-J08	6	03/29/94	NA	NA	NA	NA	**17,400**	NA	NA	NA	**2,740**	NA	NA	NA
DSB-J08	9.5	03/29/94	NA	NA	NA	NA	**17,700**	NA	NA	NA	**2,940**	NA	NA	NA
DSB-J08	10	03/29/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-J08	20.5	03/29/94	NA	NA	NA	NA	**33,900**	NA	NA	NA	**2,540**	NA	NA	NA
DSB-L08	4	04/04/94	NA	NA	NA	NA	**15,200**	NA	NA	NA	**2,890**	NA	NA	NA
DSB-L08	11	04/04/94	NA	NA	NA	NA	**16,600**	NA	NA	NA	**3,000**	NA	NA	NA
DSB-M04	0.5	03/29/94	<1	**13**	<1	**6**	NA	<5	<0.2	NA	NA	<1	<2	NA
DSB-M04	2.5	03/29/94	**2**	**93**	<1	**6**	NA	**147**	<0.2	NA	NA	<1	<2	NA
DSB-M04	3.5	03/29/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-M04	5	03/29/94	NA	NA	NA	NA	**15,400**	NA	NA	NA	**3,900**	NA	NA	NA
DSB-M04	9.5	03/29/94	NA	NA	NA	NA	**20,500**	NA	NA	NA	**4,900**	NA	NA	NA

Table 4 ***Total Metals Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
DSB-M04	10	03/29/94	**2**	**207**	<1	**39**	NA	<5	<0.2	NA	NA	<1	<2	NA
DSB-M04	11	03/29/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-M04	17.5	03/29/94	NA	NA	NA	NA	**16,100**	NA	NA	NA	**3,200**	NA	NA	NA
DSB-M04	22	03/29/94	NA	NA	NA	NA	**11,400**	NA	NA	NA	**2,300**	NA	NA	NA
DSB-M04	30.5	03/29/94	NA	NA	NA	NA	**31,900**	NA	NA	NA	**1,900**	NA	NA	NA
DSB-N06	0.5	03/28/94	**1**	**95**	<1	**22**	NA	**28**	<0.2	NA	NA	<1	<2	NA
DSB-N06	2.5	03/28/94	**1**	**96**	<1	**22**	NA	**28**	<0.2	NA	NA	<1	<2	NA
DSB-N06	3.5	03/29/94	NA	NA	NA	NA	**12,600**	NA	NA	NA	**3,680**	NA	NA	NA
DSB-N06	5	03/29/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-N06	10	03/29/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
DSB-N06	10.5	03/28/94	**1**	**63**	<1	**19**	NA	<5	<0.2	NA	NA	<1	<2	NA
DSB-N06	11.5	03/29/94	NA	NA	NA	NA	**13,000**	NA	NA	NA	**3,960**	NA	NA	NA
DSB-N06	30.5	03/29/94	NA	NA	NA	NA	**21,000**	NA	NA	NA	**1,620**	NA	NA	NA
DSB-V04	4.5	05/09/96	**1.4**	**73**	<1	**9.5**	**6,000**	**3**	<0.12	**230**	**1,000**	<1	<1	<0.00001
DSB-V04	8	05/09/96	**3.1**	**56**	<1	**17**	**13,000**	**2.7**	**0.2**	**970**	**2,400**	<1	<1	<0.00001
DSB-V04	14.5	05/09/96	**5.1**	**39**	<1	**12**	**12,000**	**1.6**	<0.09	**870**	**2,100**	<1	<1	<0.00001
DSB-V04	18.5	05/09/96	**28**	**200**	<1	**12**	**11,000**	**15**	<0.12	**350**	**2,200**	<1	<1	<0.00001
DSB-V04	21	05/09/96	**2.6**	**110**	<1	**8.7**	**32,000**	**5.9**	<0.1	**310**	**1,100**	<1	<1	<0.00001
MW-K05	3.5	05/11/96	**3.6**	NA	NA	NA	NA	**10**	NA	NA	NA	NA	NA	NA
MW-K05	7.5	05/11/96	**7.5**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-K05	10	05/11/96	**1.8**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-Q03	2.5	05/12/96	**4.7**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-Q03	6	05/12/96	**3.7**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-Q03	10	05/12/96	**4.9**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-V03	3	05/20/96	**3.8**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
MW-V03	8	05/20/96	**2.8**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
Pond-A-S-001		04/07/94	**1**	**106**	<1	**21**	NA	<20	<0.2	NA	NA	<1	<2	NA
Pond-A-S-002		04/07/94	**1**	**80**	<1	**22**	NA	<20	<0.2	NA	NA	<1	<2	NA

Table 4 *Total Metals Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
Pond-B-S-001		04/07/94	**103**	**222**	**2**	**20**	NA	**65**	<0.2	NA	NA	<1	<2	NA
Pond-B-S-002		04/07/94	**14**	**200**	**2**	**41**	NA	**100**	<0.2	NA	NA	<1	<2	NA
Pond-B-S-003		05/21/96	**3.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pond-B-S-004		05/21/96	**31**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SSB-I07	2	05/29/96	**1**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
SSB-I07	6	05/29/96	**3.1**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-I08	2	05/29/96	**1.1**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-I08	7	05/29/96	**0.49**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-J04.5	2	03/24/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J04.5	5	03/24/94	**14**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J04.5	10	03/24/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J06	0.5	04/05/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J06	5	04/05/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J06	10	04/05/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J07	0.5	03/28/94	**13**	NA	NA	NA	NA	**871**	NA	NA	NA	NA	NA	NA
SSB-J07	5	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J07	10	03/28/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-J09	2	05/29/96	**1.7**	NA	NA	NA	NA	**10**	NA	NA	NA	NA	NA	NA
SSB-J09	7	05/29/96	**5.8**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-K04	2	03/22/94	**92**	NA	NA	NA	NA	**148**	NA	NA	NA	NA	NA	NA
SSB-K04	5	03/22/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K04	10	03/22/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K04.5	1	03/24/94	**16**	NA	NA	NA	NA	**112**	NA	NA	NA	NA	NA	NA
SSB-K04.5	5	03/24/94	**6**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K04.5	10	03/24/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K05	1	03/22/94	**13**	NA	NA	NA	NA	**81**	NA	NA	NA	NA	NA	NA
SSB-K05	5.5	03/22/94	**2**	NA	NA	NA	NA	**97**	NA	NA	NA	NA	NA	NA
SSB-K05	10	03/22/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K05	15	03/22/94	NA	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA

Table 4 *Total Metals Concentrations in Soil*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
SSB-K07.5	0.5	03/28/94	**7**	**134**	<1	**22**	<4	**640**	<0.2	NA	<400	<1	<2	NA
SSB-K07.5	2	03/28/94	**3**	NA	NA	NA	NA	**299**	NA	NA	NA	NA	NA	NA
SSB-K07.5	5	03/28/94	**4**	NA	NA	NA	NA	**288**	NA	NA	NA	NA	NA	NA
SSB-K07.5	5.5	03/28/94	**4**	**114**	<1	**28**	<4	**109**	<0.2	NA	<400	<1	<2	NA
SSB-K07.5	10	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K07.5	10.5	03/28/94	**2**	**106**	<1	**29**	<4	**87.2**	<0.2	NA	<400	<1	<2	NA
SSB-K07.5	15	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-K09	2	05/29/96	**2**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-K09	7	05/29/96	**2.3**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-L04.5	1	03/23/94	**41**	NA	NA	NA	NA	**12**	NA	NA	NA	NA	NA	NA
SSB-L04.5	5	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L04.5	10	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L05	2	03/28/94	**8**	NA	NA	NA	NA	**139**	NA	NA	NA	NA	NA	NA
SSB-L05	4	03/24/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L05	5.5	03/24/94	NA	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L05	6	03/24/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L05	10	03/24/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L06	0.5	03/28/94	**7**	NA	NA	NA	NA	**204**	NA	NA	NA	NA	NA	NA
SSB-L06	5	03/28/94	**3**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
SSB-L06	10	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L07	0.5	03/28/94	**10**	NA	NA	NA	NA	**337**	NA	NA	NA	NA	NA	NA
SSB-L07	5	03/28/94	**12**	NA	NA	NA	NA	**168**	NA	NA	NA	NA	NA	NA
SSB-L07	10	03/28/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-L07	15	03/28/94	**6**	NA	NA	NA	NA	**11**	NA	NA	NA	NA	NA	NA
SSB-L09	2	05/28/96	**2.1**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-L09	6.5	05/28/96	**1.6**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-L10	2	05/29/96	**1.1**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-L10	7	05/29/96	**0.71**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M03	2.5	05/11/96	**1.4**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-M03	7.5	05/11/96	**0.51**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA

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Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
SSB-M04	0.5	03/22/94	**7**	NA	NA	NA	NA	**158**	NA	NA	NA	NA	NA	NA
SSB-M04	1.5	03/22/94	**21**	NA	NA	NA	NA	**248**	NA	NA	NA	NA	NA	NA
SSB-M04	2	03/22/94	**2**	NA	NA	NA	NA	**8**	NA	NA	NA	NA	NA	NA
SSB-M04	5	03/22/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M04	6	03/22/94	**2**	NA	NA	NA	NA	**35**	NA	NA	NA	NA	NA	NA
SSB-M04	10	03/22/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M04.5	1	03/23/94	**5**	NA	NA	NA	NA	**84**	NA	NA	NA	NA	NA	NA
SSB-M04.5	4.5	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M04.5	10	03/23/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M05	1	03/24/94	**2**	NA	NA	NA	NA	**132**	NA	NA	NA	NA	NA	NA
SSB-M05	2	03/24/94	**3**	NA	NA	NA	NA	**17**	NA	NA	NA	NA	NA	NA
SSB-M05	5	03/24/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M05	8	03/17/94	NA	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M05	10	03/17/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M06	0.5	03/28/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M06	5	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M06	10	03/28/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M08	5	03/28/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M08	10	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M08	11.8	03/28/94	**3**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-M09	2	05/29/96	**1.7**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
SSB-M09	7	05/29/96	**0.7**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-N04.5	1	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-N04.5	5	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-N04.5	10	03/23/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-N05	2	03/24/94	**2**	NA	NA	NA	NA	**169**	NA	NA	NA	NA	NA	NA
SSB-N05	5	03/24/94	**4**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-N05	10	03/24/94	**1**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O04.5	0.5	03/22/94	NA	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-O04.5	5	03/28/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA

Table 4 ***Total Metals Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
SSB-O05	0.5	03/24/94	**5**	NA	NA	NA	NA	**236**	NA	NA	NA	NA	NA	NA
SSB-O05	4	03/24/94	**1**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O05	6	03/24/94	**4**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O05	10	03/24/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O06	0.5	03/30/94	**13**	NA	NA	NA	NA	**755**	NA	NA	NA	NA	NA	NA
SSB-O06	5	03/30/94	**2**	NA	NA	NA	NA	**21**	NA	NA	NA	NA	NA	NA
SSB-O06	12	03/30/94	**5**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-O07	0.5	03/25/94	**5**	NA	NA	NA	NA	**780**	NA	NA	NA	NA	NA	NA
SSB-O07	5	03/25/94	**5**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O07	10	03/25/94	**3**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-O07	12	03/25/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-P04	2	03/22/94	<1	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-P04	5	03/22/94	**1**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-P04	10	03/22/94	**4**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-P04	15	03/22/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-P05	0.5	03/25/94	**4**	NA	NA	NA	NA	**813**	NA	NA	NA	NA	NA	NA
SSB-P05	5	03/25/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-P05	9	03/25/94	**1**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-P06	0.5	03/30/94	<1	NA	NA	NA	NA	**33**	NA	NA	NA	NA	NA	NA
SSB-P06	5	03/30/94	**2**	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA
SSB-P06	7.5	03/30/94	**2**	**80**	<1	**20**	NA	<5	<0.2	NA	NA	<1	<2	NA
SSB-P06	10	03/30/94	**3**	**108**	<1	**16**	NA	<5	<0.2	NA	NA	<1	<2	NA
SSB-P06	13.5	03/30/94	**2**	**88**	<1	**30**	NA	<5	<0.2	NA	NA	<1	<2	NA
SSB-P06	14	03/30/94	**5**	NA	NA	NA	NA	<5	NA	NA	NA	**0.19**	NA	NA
SSB-P08.3	2.5	05/11/96	NA	NA	NA	NA	NA	**15**	NA	NA	NA	<0.1	NA	NA
SSB-P08.3	5	05/11/96	**0.86**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-P08.3	25	05/11/96	**2.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SSB-Q06	0.5	03/25/94	**6**	NA	NA	NA	NA	**256**	NA	NA	NA	NA	NA	NA
SSB-Q06	2	03/25/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-Q06	5	03/25/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-Q06	10	03/25/94	**2**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA

Table 4 ***Total Metals Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
SSB-Q07	0.5	03/25/94	**16**	NA	NA	NA	NA	**451**	NA	NA	NA	NA	NA	NA
SSB-Q07	5	03/25/94	**13**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-Q07	10	03/25/94	**3**	NA	NA	NA	NA	<15	NA	NA	NA	NA	NA	NA
SSB-Q08.1	2.5	05/11/96	**2.2**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
SSB-Q08.1	4.5	05/11/96	**1.3**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-Q08.1	9	05/11/96	**0.79**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-R06	2.5	05/10/96	**3.2**	**68**	<0.1	**14**	NA	**5.2**	<0.11	NA	NA	NA	<0.1	NA
SSB-R06	5	05/10/96	**3.9**	**230**	<0.1	**14**	NA	**2.4**	**0.19**	NA	NA	NA	<0.1	NA
SSB-R06	7.5	05/10/96	**3.8**	**66**	<0.11	**16**	NA	**1.6**	**0.26**	NA	NA	<0.11	<0.11	NA
SSB-R06	12	05/10/96	**2.2**	**62**	<0.11	**17**	NA	**2.6**	**0.24**	NA	NA	<0.11	<0.11	NA
SSB-S05	4.5	05/13/96	**1.8**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-S05	8	05/13/96	**0.89**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-S06	2.5	05/10/96	**2.3**	NA	NA	NA	NA	**25**	NA	NA	NA	NA	NA	NA
SSB-S06	5	05/10/96	**0.77**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-S06	9.5	05/10/96	**1.7**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-S06	12.5	05/10/96	**3.5**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-T04.8	2.5	05/10/96	**1.5**	**100**	<0.12	**15**	NA	**4.2**	<0.093	NA	NA	<0.12	<0.12	NA
SSB-T04.8	7.5	05/10/96	**2**	**210**	<0.12	**19**	NA	**3.2**	**0.14**	NA	NA	<0.12	<0.12	NA
SSB-T04.8	12	05/10/96	**1.5**	**40**	<0.11	**13**	NA	**1.1**	**0.17**	NA	NA	<0.11	<0.11	NA
SSB-U05	3.5	05/13/96	**2.1**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-U05	5	05/13/96	**2.5**	NA	NA	NA	NA	**5**	NA	NA	NA	NA	NA	NA
SSB-U05	8	05/13/96	**0.97**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-U05	11	05/13/96	**3**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-U06	5	05/10/96	**1.9**	NA	NA	NA	NA	**40**	NA	NA	NA	NA	NA	NA
SSB-U06	7	05/10/96	**1.5**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSB-V06	2.5	05/10/96	**5.4**	NA	NA	NA	NA	**210**	NA	NA	NA	NA	NA	NA
SSB-V06	5	05/10/96	**4**	NA	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA
SSS-K03.5	0.25	05/13/96	**8.8**	**110**	**1.5**	**22**	NA	**230**	**0.13**	NA	NA	**0.12**	**0.21**	NA
SSS-K04.5	0.25	05/13/96	**8.2**	**48**	**0.55**	**18**	NA	**24**	**0.15**	NA	NA	**0.44**	<0.1	NA
SSS-K08	0.25	05/14/96	**4**	**87**	**0.18**	**13**	NA	**100**	**0.21**	NA	NA	<0.096	**0.16**	NA
SSS-L08	0.25	05/14/96	**3**	**140**	**0.39**	**16**	NA	**240**	**0.24**	NA	NA	<0.12	**0.13**	NA

Table 4 ***Total Metals Concentrations in Soil***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample Location	Sample Depth	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Phosphorus	Potassium	Selenium	Silver	Sulfur
SSS-M04.5	0.25	05/13/96	**9**	**41**	**0.29**	**20**	NA	**39**	**0.098**	NA	NA	**0.44**	**0.1**	NA
SSS-N06	0.25	05/13/96	**1.4**	**93**	**0.34**	**15**	NA	**66**	<0.086	NA	NA	<0.1	**0.12**	NA
SSS-O04.5	0.25	05/13/96	NA	NA	NA	NA	NA		**0.22**	NA	NA	NA	NA	NA
SSS-O07	0.25	05/13/96	**11**	**78**	**0.48**	**14**	NA	**250**	**0.15**	NA	NA	**0.13**	**0.13**	NA
SSS-P04	0.25	05/13/96	**7.6**	**99**	**1.1**	**18**	NA	**180**	**0.25**	NA	NA	<0.091	**0.23**	NA
SSS-P05	0.25	05/13/96	**8.6**	**89**	**0.6**	**15**	NA	**140**	**0.098**	NA	NA	**0.12**	<0.093	NA
SSS-P07	0.25	05/13/96	**8.9**	**89**	**0.41**	**14**	NA	**1,000**	**3.3**	NA	NA	<0.093	<0.093	NA
SSS-P08	0.25	05/13/96	**3.7**	**140**	**0.24**	**18**	NA	**97**	**0.15**	NA	NA	<0.11	<0.11	NA
SSS-Q08	0.25	05/14/96	**9.8**	**100**	**0.25**	**15**	NA	**310**	**0.39**	NA	NA	**0.1**	<0.1	NA
SSS-R06	0.25	05/12/96	**2.3**	**85**	**0.35**	**12**	NA	**130**	<0.082	NA	NA	<0.1	<0.1	NA
SSS-R07	0.25	05/12/96	**13**	**88**	**0.38**	**14**	NA	**120**	**0.088**	NA	NA	<0.099	<0.099	NA
SSS-S05	0.25	05/12/96	**4.7**	**110**	**1**	**16**	NA	**400**	**0.52**	NA	NA	<0.09	**0.16**	NA
SSS-S06	0.25	05/12/96	**4.5**	**110**	**0.64**	**14**	NA	**1,500**	**0.12**	NA	NA	<0.096	**0.23**	NA
SSS-S07.5	0.25	05/12/96	**2.4**	**100**	<0.1	**14**	NA	**6.2**	<0.096	NA	NA	<0.1	<0.1	NA
SSS-T04.8	0.25	05/12/96	**11**	**140**	**2**	**30**	NA	**340**	**0.11**	NA	NA	<0.092	**0.17**	NA
SSS-T05	0.25	05/12/96	**15**	**220**	**2.5**	**26**	NA	**2,300**	**0.66**	NA	NA	<0.095	**0.82**	NA
SSS-T06	0.25	05/12/96	**9.1**	**140**	**0.69**	**15**	NA	**1,600**	**0.16**	NA	NA	<0.1	**0.29**	NA
SSS-U05	0.25	05/12/96	**16**	**170**	**3.7**	**28**	NA	**1,000**	**3**	NA	NA	**0.22**	**0.48**	NA
SSS-U06	0.25	05/12/96	**3.5**	**66**	**0.32**	**12**	NA	**190**	**0.098**	NA	NA	<0.099	<0.099	NA
SSS-V04	0.25	05/12/96	**38**	**160**	**5.5**	**22**	NA	**580**	**0.27**	NA	NA	**0.18**	**1.3**	NA
SSS-V06	0.25	05/12/96	**7.1**	NA	**0.12**	**12**	NA	**52**	<0.09	NA	NA	<0.11	<0.11	NA
Industrial Worker Screening Level			30	15,270	605	86,370	--	2,000	186	--	--	7,599	3,504	--
Resident Screening Level			30	2,161	34.5	15,140	--	200	16.2	--	--	366	284	--

Notes and Key:
Units reported in milligrams per kilogram (mg/kg)
NA = Not analyzed
[light shading] Detection at or above the Resident Screening Level.
[dark shading] Detection at or above the Industrial Worker Screening Level.
-- = No screening level established.

Table 5 *Total Petroleum Hydrocarbon Concentrations in Ground Water*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample ID	Date Collected	Aliquot	Total Petroleum Hydrocarbons (µg/L) Diesel Fuel	Gasoline	Unknown Hydrocarbon Mixture
			Former Car Repair Shed Area		
H-R04	03/17/94	SA	**50U[a]**	NA	NA
	03/17/94	EB	**180**	NA	NA
H-V04	05/07/96	SA	NA	**2,960NJT**	NA
	05/07/96	LD	NA	**2,980NJT**	NA
H-V05	05/09/96	SA	NA	**308NJT**	NA
MW-V03	06/23/97	SA	<50	<50	52
	07/17/97	SA	<50	<50	53
			Locomotive Maintenance and Service Area		
H-J04	03/18/94	SA	**806**	NA	NA
H-J06	03/21/94	SA	**247**	NA	NA
H-J08	03/20/94	SA	**228**	NA	NA
H-L06	03/18/94	SA	**2,190**	NA	NA
H-L07	03/20/94	SA	**762**	NA	NA
H-M06	03/17/94	SA	**650**	NA	NA
H-N04	03/18/94	SA	**317U**	NA	NA
	03/18/94	FD	**232**	NA	NA
	03/18/94	EB	**160**	NA	NA
H-N06	03/17/94	SA	**13,200**	NA	NA
H-N08	03/21/94	SA	**426**	NA	NA
	03/21/94	FD	**426**	NA	NA
H-O05	03/19/94	SA	**157**	NA	NA
H-P04	03/18/94	SA	**90**	NA	NA
H-Q06	03/19/94	SA	**613**	NA	NA
MW-K05	05/23/96	SA	<50	NA	<50
	06/23/97	SA	<50	NA	240
	09/18/97	SA	<50	NA	240
	09/18/97	FD	<50	NA	240
	12/09/97	SA	<50	<50	220
	12/09/97	FD	<50	<50	230
	03/12/98	SA	<50	NA	240
	03/12/98	FD	<50	NA	250
MW-K08	04/15/94	SA	**5,350**	NA	NA
	04/15/94	FD	**3,810**	NA	NA
	02/22/95	SA	<160	NA	**2,600**
	06/28/95	SA	<100	NA	**1,400**
	02/28/96	SA	<150	NA	**1,400**
	02/28/96	FD	<290	NA	**1,600**
	05/24/96	SA	**173J**	NA	**173**
	06/24/97	SA	<200	NA	**2,200**
	09/17/97	SA	<50	NA	**2,300**
	12/09/97	SA	<50	NA	**2,300**
	03/12/98	SA	<250	NA	**2,400**

Table 5 *Total Petroleum Hydrocarbon Concentrations in Ground Water*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

			Total Petroleum Hydrocarbons (µg/L)		
Sample ID	Date Collected	Aliquot	Diesel Fuel	Gasoline	Unknown Hydrocarbon Mixture
			Locomotive Maintenance and Service Area (continued)		
MW-M03	04/14/94	SA	**193**	NA	NA
	02/24/95	SA	<50	NA	**73**
	02/24/95	FD	<50	NA	**73**
	06/28/95	SA	<50	NA	**92**
	12/09/97	SA	<50	NA	**57**
MW-N08	04/15/94	SA	**210**	NA	NA
	02/23/95	SA	<50	NA	**190**
	06/28/95	SA	<50	NA	**510**
	06/28/95	FD	<50	NA	**670**
	02/28/96	SA	<50	NA	**73**
	06/24/97	SA	<50	NA	**73**
	09/18/97	SA	<50	NA	**62**
	12/09/97	SA	<50	NA	**88**
	03/12/98	SA	<50	NA	**63**
MW-P07	04/15/94	SA	**329**	NA	NA
	02/23/95	SA	<50	NA	**54**
	06/28/95	SA	<50	NA	**77**
	02/28/96	SA	<50	NA	**59**
	06/23/97	SA	<50	NA	**67**
	09/17/97	SA	<50	NA	**85**
	12/09/97	SA	<50	NA	**66**
	03/11/98	SA	<50	NA	**58**
			Ponds		
Pond-A-001	04/06/94	EB	**51**	NA	NA
Pond-A-SW-001	04/06/94	SA	**2,020**	NA	NA
	04/06/94	FD	**2,190**	NA	NA
Pond-A-SW-002	04/06/94	SA	**2,370**	NA	NA
Pond-A-SW-003	04/06/94	SA	**1,200**	NA	NA
Pond-B-SW-001	04/06/94	SA	**7,300**	NA	NA
Pond-B-SW-002	04/06/94	SA	**5,500**	NA	NA

Notes and Key:

a = Non-detect value due to equipment blank concentration.

µg/L = Micrograms per liter

SA = Sample

EB = Equipment Blank

LD = Laboratory duplicate

FD = Field duplicate

U = Undetected at the laboratory method reporting limit shown.

J = Analyte was positively identified. Approximate concentration.

NA = Not analyzed.

NJT = 'The product is tentatively identified as weathered gasoline with peaks extending into the diesel range.

Table 6 *Volatile Organic Compound Concentrations in Ground Water*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample ID	Date Collected	Aliquot	Volatile Organic Compounds (µg/L)					
			Benzene	Chloroform	Ethylbenzene	Toluene	Total Xylenes	MTBE
Former Car Repair Shed Area								
H-V04	05/07/96	SA	**224J**	<1.0	**88J**	**31J**	**75J**	NA
H2-V05	05/09/96	SA	**7.0J**	<1.0	**4.0J**	**1.0J**	**6.0J**	NA
MW-V03	06/23/96	SA	<1	NA	<1	<1	<2	**1,100**
	06/23/97	SA	<25	NA	<25	<25	<50	**1,500**
	06/23/97	FD	<25	NA	<25	<25	<50	**1,500**
	09/17/97	SA	<25	NA	<25	<25	<50	**2,100**
	12/09/97	SA	<0.5	NA	<0.5	<0.5	<1	**2,400**
	03/12/98	SA	<25	NA	<25	<25	<50	**1,800**
Locomotive Maintenance and Service Area								
MW-K08	04/15/94	SA	<0.50	**0.5**	<1.0	<1.0	<1.0	NA
	06/28/95	SA	<0.50	NA	<0.50	**1.3**	<1.0	NA
MW-M03	04/14/94	SA	<0.50	<1.0	<1.0	<1.0	<1.0	NA
	04/14/94	EB	<0.50	**2.40**[a]	<1.0	<1.0	<1.0	NA
	02/24/95	SA	<0.50	NA	<0.50	**1.1**	<1.0	NA
	02/24/95	FD	<0.50	NA	<0.50	**1.5**	<1.0	NA
	06/28/95	SA	<0.50	NA	<0.50	**0.94**	<1.0	NA
MW-N08	04/15/94	SA	<0.50	**7.8**	<1.0	<1.0	<1.0	NA
	02/23/95	SA	<0.50	NA	<0.50	**1.9**	<1.0	NA
	06/28/95	SA	<0.50	NA	<0.50	**1.0**	<1.0	NA
	06/28/95	FD	<0.50	NA	<0.50	**0.96**	<1.0	NA
MW-P07	04/15/94	SA	<0.50	**0.9**	<1.0	<1.0	<1.0	NA
	06/28/95	SA	<0.50	NA	<0.50	**0.88**	<1.0	NA
Ponds								
Pond-A-001	04/06/94	EB	<0.50	**2.5**	<1.0	<1.0	<1.0	NA
Pond-A-SW-001	04/06/94	SA	<0.50	**2.5**	<1.0	<1.0	<1.0	NA
USEPA MCLs			5	100	700	1,000	10,000	NR

Notes and Key:

a = Analyte is undetected due to detection in equipment blank.

MTBE = Methyl tert-butyl ether

NA = Not analyzed

NR = Not regulated

µg/L = Micrograms per liter

SA = Sample

EB = Equipment Blank

FD = Field duplicate

J = Analyte was positively identified. Approximate concentration.

USEPA MCLs = United States Environmental Protection Agency Maximum Contaminant Levels for drinking water.

Table 7 *Polynuclear Aromatic Hydrocarbon Concentrations in Ground Water*

Union Pacific Railroad Company

Ashland Rail Yard

Ashland, Oregon

Sample ID	Date Collected	Aliquot	Polynuclear Aromatic Hydrocarbons (µg/L)								
			2-Methylnaphthalene	Acenaphthene	Anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Fluorene	Naphthalene	Phenanthrene	Pyrene
Former Car Repair Shed Area											
H-V04	05/07/96	SA	**60**	<1.0	<1.0	<1.0	<1.0	<1.0	**220**	<1.0	<1.0
MW-V03	05/23/96	SA	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	**0.03J**	<0.09	**0.42**
Locomotive Maintenance and Service Area											
H-J08	03/20/94	SA	NA	<0.10	<0.10	**0.1**	**0.2**	**0.2**	<0.10	**0.3**	**0.2**
MW-K08	11/09/95	SA	NA	<0.47	<0.05	<0.05	<0.09	<0.09	<0.47	<0.05	**0.23**
RW-006	05/21/96	SA	**2,400**	**380**	**280**	<200	<200	**720**	<200	**1,500**	**180.0J**
Ponds											
Pond-A-SW-003	04/06/94	SA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.2**	<0.10
Off-Property Area											
H-I08	05/28/96	SA	<1.0	<0.12	<0.12	<0.12	<0.12	<0.12	**0.18**	<0.12	<0.12
USEPA MCLs			NE	NE	NE	0.2	NE	NE	NE	NE	NE

Notes and Key:

µg/L = Micrograms per liter

NA = Not analyzed

NE = Not established

SA = Sample

J = Analyte was positively identified. Approximate concentration.

USEPA MCLs = United States Environmental Protection Agency Maximum Contaminant Levels for drinking water.

Table 8 *Total Metals Concentrations in Ground Water*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Sample ID	Date Collected	Aliquot	Total Metals (µg/L)				
			Arsenic	Barium	Chromium	Lead	Mercury
Former Car Repair Shed Area							
H-R04	03/17/94	SA	**6.0**	**234**	**43**	<2.0	<0.50
H-T03	05/09/96	SA	NA	**760**	**6.9**	<1.0	**0.84**
	05/09/96	FD	NA	**650**	**4.3**	<1.0	**1.1**
H-T05	05/08/96	SA	**16**	**340**	**59**	**360**	**4.6**
	05/08/96	FD	**20**	**410**	**81**	**53**	**5.7**
H-V04	05/07/96	SA	**59**	**1,140**	**102**	**54**	**1.1**
MW-V03[a]	05/23/96	SA	**19**	**270**	**2.7**	**3.9**	<0.20
	06/23/97	SA	**21**	NA	**9.2**	<5.0	NA
	06/23/97	FD	**21**	NA	**11**	<5.0	NA
	12/09/97	SA	**28**	NA	**15**	<5.0	NA
	03/12/98	SA	**35**	NA	**29**	**7.8**	NA
Locomotive Maintenance and Service Area							
H-J08	03/20/94	SA	**21**	**293**	**58**	**1,270**	<0.50
H-L06	03/18/94	SA	**10**	NA	NA	<2.0	NA
H-L07	03/20/94	SA	**24**	**1,920**	**223**	**94**	**1.6**
H-O06	03/19/94	SA	**28**	**1,130**	**288**	**31**	**4.0**
	03/19/94	FD	**29**	**1,200**	**293**	**34**	**3.5**
H-P06	03/19/94	SA	**28**	NA	NA	**31**	NA
MW-K05	05/23/96	SA	**17**	NA	**1.7**	**3.0**	NA
	05/23/96	FD	**17**	NA	**1.3**	**2.3**	NA
	06/23/97	SA	**14**	NA	**4.7**	<5.0	NA
	12/09/97	SA	**25**	NA	**10**	<5.0	NA
	12/09/97	FD	**27**	NA	**12**	<5.0	NA
	03/12/98	SA	**22**	NA	**14**	**42**	NA
	03/12/98	FD	**22**	NA	**13**	**39**	NA
MW-K08	04/15/94	SA	<5.0	**723**	**66**	<2.0	<0.50
	04/15/94	FD	<5.0	**782**	**83**	<2.0	<0.50
	02/22/95	SA	<5.0	NA	**1.0**	<5.0	NA
	06/28/95	SA	<5.0	NA	**1.0**	<5.0	NA
	11/09/95	SA	<5.0	NA	**1.4**	<5.0	NA
MW-M03[a]	04/14/94	SA	<5.0	**491**	**102**	23	<0.50
	02/24/95	SA	<5.0	NA	**6.8**	<5.0	NA
	02/24/95	FD	<5.0	NA	**9.1**	<5.0	NA
	06/28/95	SA	<5.0	NA	**1.0**	<5.0	NA
	11/09/95	SA	<5.0	NA	**11**	**11**	NA

Table 8 *Total Metals Concentrations in Ground Water*

Union Pacific Railroad Company

Ashland Rail Yard

Ashland, Oregon

Sample ID	Date Collected	Aliquot	Total Metals (µg/L)				
			Arsenic	Barium	Chromium	Lead	Mercury
Locomotive Maintenance and Service Area (continued)							
MW-M03[a]	02/28/96	SA	NA	NA	**5.3**	NA	NA
MW-N08	04/15/94	SA	**6.0**	**662**	**85**	**30**	<0.50
	02/23/95	SA	<5.0	NA	**34**	**11**	NA
	06/28/95	SA	<5.0	NA	**2.1**	<5.0	NA
	06/28/95	FD	<5.0	NA	**1.1**	<5.0	NA
	11/09/95	SA	<5.0	NA	**1.3**	<5.0	NA
MW-P07	04/15/94	SA	**6.0**	**217**	**11**	<2.0	<0.50
	02/23/95	SA	**6.7**	NA	**2.5**	<5.0	NA
	06/28/95	SA	**6.2**	NA	<1.0	<5.0	NA
	11/08/95	SA	**7.2**	NA	**1.8**	<5.0	NA
	11/08/95	FD	**6.0**	NA	<1.0	<5.0	NA
	02/28/96	SA	**5.2**	NA	<1.0	NA	NA
RW-006	05/21/96	SA	**65**	**460**	**2.2**	**120**	<0.80
Ponds							
Pond-A-SW-001	04/06/94	SA	<5.0	**57**	<5.0	<2.0	<0.50
	04/06/94	FD	<5.0	**58**	<5.0	<2.0	<0.50
Pond-A-SW-002	04/06/94	SA	<5.0	**58**	<5.0	<2.0	<0.50
Pond-A-SW-003	04/06/94	SA	<5.0	**58**	<5.0	<2.0	<0.50
Pond-B-SW-001	04/06/94	SA	**7.0**	**69**	<5.0	<2.0	<0.50
Pond-B-SW-002	04/06/94	SA	**14**	**92**	<5.0	**7.0**	<0.50
NAT-Pond-SS-001	05/01/97	SA	**14**	<100	<2.0	<2.0	<0.50
NAT-Pond-SS-002	05/01/97	SA	**18**	<100	<0.20	<2.0	<0.50
Off-Property Area							
H-I08	05/28/96	SA	**3.2**	**270**	**21**	**8.0**	**1.2**
USEPA MCLs			50	2,000	100	15	—

Notes and Key:

a = Well considered background.

µg/L = Micrograms per liter

NA = Not analyzed

SA = Sample

FD = Field duplicate

USEPA MCLs = United States Environmental Protection Agency Maximum Contaminant Levels for drinking water.

Table 9 ***Summary of Soil Remediation Alternatives***
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Technologies and Response Actions Retained for Further Consideration	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
No Action	X				
Common Elements*		X	X	X	X
Engineered Soil Cap over all areas exceeding goals		X			
Excavation, stabilization via asphalt incorporation, and use asphalt on site during redevelopment				X	
Excavation with on-site enclosure of soils beneath asphalt roadways during redevelopment					X
Excavation with off-site treatment and/or disposal			X		X

Common Elements include:
- removal of oil/water separator plus affected soils and concrete tank saddles;
- abandon oil collection culverts and recovery wells, piezometers, free product observation probes, and monitoring wells;
- prepare Ponds A and B for backfilling;
- excavate Bunker C area in former landfill and dispose off site; and
- remove ballast and residual petroleum associated with the former drip pad and dispose off site.

Table 10 Summary of Costs Associated with Each Alternative
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Alternative	Description	Direct and Indirect Capital Costs	Annual O&M	NPV of 30-Year Annual O&M	Total
Alternative 1	No Action	$0	$0	$0	$0
Alternative 2	Soil Cap, Deed Restriction, Common Tasks	$1,099,400	$10,500	$300,000	$1,399,400
Alternative 3	Excavation with Off-site Disposal and Common Tasks	$878,000	$0	$0	$878,000
Alternative 4	Excavation, Asphalt Incorporation, and Common Tasks	$975,000	$0	$0	$975,000
Alternative 5	Excavation, Off-site Disposal, plus On-site Enclosure of Some Soils Beneath Road(s), Deed restriction and Common Tasks	$1,016,000	$3,500	$100,000	$1,116,000

Notes and Key:

NPV = Net present value of annual O&M Costs assuming 5% annual discount rate.

O&M = Operation and Maintenance

Refer to Tables 3 through 6 for detailed cost information on each alternative.

Table 11 *Residual Risk Calculations*
Union Pacific Railroad Company
Ashland Rail Yard
Ashland, Oregon

Constituent	Residential Cleanup Level (mg/kg)		Maximum Residual Soil Concentration (Not Exceeding Residential Clean-Up Level) (mg/kg)	Carcinogenic Risk	Noncarcinogenic Hazard Index
Total Petroleum Hydrocarbons (TPH)					
TPH (speciation results)	1,558	nc	640		4.1E-01
TPH (diesel)	---		---		
Volatile Organic Compounds					
Benzene	0.27	c	0.07	2.6E-07	
Toluene	--		0.17		
Ethylbenzene	392	nc	3.6		9.2E-03
Xylenes	146,500	nc	1.2		8.2E-06
Polynuclear Aromatic Hydrocarbons					
Acenaphthene	3,116	nc	0.36		1.2E-04
Acenaphthylene	--	nc	0.028		
Anthracene	15,580	nc	0.34		2.2E-05
Benzo(a)anthracene	0.64	c	0.24	3.8E-07	
Benzo(a)pyrene	0.06	c	0.056	9.3E-07	
Benzo(b)fluoranthene	0.64	c	0.21	3.3E-07	
Benzo(g,h,i)perylene	--	nc	0.27		
Benzo(k)fluoranthene	6.37	c	0.071	1.1E-08	
Chrysene	63.7	c	0.23	3.6E-09	
Dibenzo(a,h)anthracene	0.06	c	0.05	8.3E-07	
Fluoranthene	2,077	nc	0.16		7.7E-05
Fluorene	2,077	nc	0.33		1.6E-04
Indeno(1,2,3-cd)pyrene	0.64	c	0.24	3.8E-07	
Naphthalene	2,077	nc	0.17		8.2E-05
Phenanthrene	--	nc	0.51		
Pyrene	1,558	nc	0.65		4.2E-04
Metals					
Arsenic	30	b	28		
Barium	2,161	nc	230		1.1E-01
Cadmium	834//34.5	c//nc	3.7	4.4E-09	1.1E-01
Chromium	15,140	nc	39		2.6E-03
Iron	--		33,900		
Lead	200	Pb	190		
Mercury	16.2	nc	3.3		2.0E-01
Phosphorus	--		970		
Potassium	--		4,900		
Selenium	366	nc	0.44		1.2E-03
Silver	284	nc	0.48		1.7E-03
Sulfur	--		ND		
			Total	**3E-06**	**0.8**

Notes:

1. -- No cleanup goal was calculated (ERM, Final Remedial Investigation Report/Ashland Yard, November 1999).
2. c - cleanup level based on carcinogenic effects; nc - cleanup level based on noncarcinogenic effects.
3. b - cleanup level based on background levels; constituent not considered in cumulative risk calculations (see text).
4. Pb - cleanup level based on estimated blood lead (Pb) level; lead was not considered in the cumulative risk calculations (see text).
5. Estimated carcinogenic risk = 0.000001 x maximum residual concentration/residential cleanup level.
6. Estimated noncarcinogenic hazard index = maximum residual concentration/residential cleanup level.
7. Both carcinogenic and noncarcinogenic residential cleanup levels were developed for cadmium, and so both were considered in this analysis.
8. The total estimated carcinogenic risk and noncarcinogenic hazard index are acceptable under ODEQ guidelines (see text).
9. 1E-06 = 0.000001; ND - not detected

APPENDIX A

Administrative Record for the UPRR Ashland Rail Yard

Preliminary Environmental Site Assessment, Ashland Package - Parcel 2; SP Environmental Systems, Southern Pacific Transportation Company, January 16, 1991.

Preliminary Environmental Site Assessment, Ashland Package - Parcel 1; SP Environmental Systems, Southern Pacific Transportation Company, January 22, 1991.

Preliminary Environmental Site Assessment – Ashland Package – Parcel 3; SP Environmental Systems, Southern Pacific Transportation Company, February 6, 1991.

Phase II Environmental Site Assessment - Ashland Package - Parcel 2; Cascade Earth Sciences Ltd., Southern Pacific Transportation Company, March 10, 1992.

Remedial Investigation/Feasibility Study Work Plan, Ashland Rail Yard; Industrial Compliance, Southern Pacific Transportation Company, January 14, 1994.

Draft Phase II Remedial Investigation/Feasibility Study Work Plan Addendum, Ashland Rail Yard; Industrial Compliance, Southern Pacific Transportation Company, September 13, 1994.

February 1995 Ground Water Sampling, Ashland Rail Yard; Industrial Compliance, Southern Pacific Transportation Company, April 13, 1995.

June 1995 Groundwater Sampling, Ashland Rail Yard; Industrial Compliance, Southern Pacific Transportation Company, August 10, 1995.

November 1995 Ground Water Sampling, Ashland Rail Yard; Industrial Compliance, Southern Pacific Transportation Company, January 26, 1996.

February 1996 Ground Water Sampling, Ashland Rail Yard; Terranext, Southern Pacific Transportation Company, April 16, 1996.

Remedial Investigation Report - Outstanding Issues, Union Pacific Railroad Company, Ashland Yard; Environmental Resources Management, May 29, 1998.

Final Remedial Investigation Report (Volumes 1 & 2), Ashland Yard; Environmental Resources Management, November 1999.

Groundwater Monitoring Data Summary (1997 - 1998), Ashland Rail Yard; Environmental Resources Management, October 12, 2000.

Feasibility Study Report, Ashland Rail Yard; Environmental Resources Management, February 15, 2001.

Remedial Action Recommendation for Union Pacific Railroad Ashland Rail Yard Site – Staff Report, Oregon DEQ. May 15, 2001.