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CLEANUP ACTION PLAN

Former Treated Wood Products Area
International Paper Facility
Longview, Washington

Prepared for

INTERNATIONAL PAPER

International Paper
Longview, Washington

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Woodward-Clyde

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LIST OF ACRONYMS

ARARS	applicable or relevant and appropriate requirements
bgs	below ground surface
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
COC	chemical of concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
CPT	cone penetrometer test
DNAPL	dense nonaqueous phase liquid
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	Environmental Protection Agency
FFS	Focused Feasibility Study
GWPS	Groundwater Protection Standard
HDPE	high density polyethylene
LNAPL	light nonaqueous phase liquid
MCL	maximum contaminant level
MRL	method reporting limit
msl	mean sea level
MTCA	Model Toxics Control Act
NAPL	nonaqueous phase liquid
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PCMP	Performance and Compliance Monitoring Plan
PQL	practical quantitation limits
PVC	polyvinyl chloride
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
TWP	treated wood products
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

This draft Cleanup Action Plan (CAP) has been prepared for the International Paper Longview, Washington facility, per the Agreed Order between the Washington State Department of Ecology (Ecology) and International Paper. The CAP addresses cleanup actions to be completed at the facility to meet the requirements of the Washington State Model Toxics Control Act (MTCA) Chapter 70 105D Revised Code of Washington (RCW), and the Hazardous Waste Management Act of 1976, Chapter 70 105 RCW, as amended in 1980 and 1983. The CAP will be implemented under a Consent Decree between Ecology and International Paper.

Cleanup actions at the Longview facility will be conducted in accordance with Washington Administrative Code (WAC) 173-303-645 through 680 and the Ecology MTCA Method C industrial cleanup standards, as outlined in the MTCA cleanup regulation (WAC 173-340)

The cleanup actions discussed in this CAP focus on the former treated wood products (TWP) area of the International Paper Longview facility, which is where the majority of the work will be completed. However, as discussed below, this document is the framework for all cleanup actions at the facility. Therefore, as discussed in Section 1 2, this CAP references actions to be completed per the Consent Decree for the Perimeter Ditch (SWMU #1) and Site C (SWMU # 6).

1.1 PURPOSE AND SCOPE OF CLEANUP ACTION PLAN

The objective of the cleanup action for the former TWP area and the Longview facility is to ensure long-term protection of human health and the environment in an industrial setting. The purpose of the CAP is to:

- Briefly describe the basis for the cleanup actions
- Outline the general approach to be used for the cleanup
- Describe how the effectiveness of the cleanup actions will be monitored

The CAP is designed to provide Ecology and the public with a general roadmap of how the cleanup action process will occur. As a framework document, the CAP is not meant to provide the details of the cleanup action. The specific details regarding implementation of the cleanup action are provided in the Engineering Design Report (EDR). Details regarding how the effectiveness of the cleanup action will be evaluated are presented in the Performance and Compliance Monitoring Plan (PCMP).

The CAP, EDR, and PMCP have been prepared to meet the requirements of the MTCA cleanup regulation (WAC 173-340). A list of the applicable MTCA regulations and where each requirement is addressed in the CAP, PCMP, and/or EDR is included in Appendix A. The cleanup action process for the former TWP area is summarized in Figure 1-1.

1.2 OVERVIEW OF THE CLEANUP ACTION

The cleanup actions outlined in this document will be implemented in the former TWP area, which is located in the southwestern portion of the International Paper Longview facility. As discussed in Section 2.0, International Paper operated the former TWP area from 1956 to 1983. Process water from the TWP operation was routed to the two on-site recovery ponds (Recovery Ponds 1 and 2). In 1983, use of the recovery ponds was discontinued, and International Paper

submitted a closure plan to the U S. Environmental Protection Agency (EPA) and Ecology. Soil from Recovery Ponds 1 and 2 was excavated and disposed of off-site in a permitted treatment, storage, and disposal facility in 1985 In 1989, the former recovery ponds and adjacent areas were backfilled with clean soil and capped with an engineered cover (J.L. Grant 1990). Current structural features in the former TWP area include the concrete foundation from the treatment building, which has been filled with soil, and the fence that surrounds the area capped with the engineered cover.

The former TWP area includes areas identified by EPA in the 1991 Resource Conservation and Recovery Act (RCRA) Facility Assessment as potential Solid Waste Management Units (SWMUs) that warrant further investigation (Figure 1-2) (EPA 1991). These SWMUs are: boiler blowdown area (#5), retort loadout area (#9), storage tank offload area (#11), former cylinder house sumps and basement (#12), wastewater treatment system (#13 through #18), pipe from the treatment system to Recovery Pond 1(#19), pipe from Recovery Pond 1 to Recovery Pond 2 (#20), Recovery Ponds 1 and 2 (#21 and #22), storage tanks (#27),pentachlorophenol work tank farm (#28), and the prill shed (#31).

The information collected to date regarding physical and environmental conditions at the Longview facility, including the former TWP area, is summarized in various reports prepared for International Paper to meet the requirements of WAC 173-340-350 for a MTCA remedial investigation. The remedial investigation data have been used in the Focused Feasibility Study (FFS) (Woodward-Clyde 1997a) in accordance with WAC 173-340-350 to investigate and evaluate potential cleanup actions to fulfill the corrective action requirements of WAC 173-303-646. The preferred alternative discussed in the FFS and summarized in Section 5.0 of this document was chosen to eliminate, or significantly reduce, pathways of potential migration or exposure associated with the chemical impacts due to the operations in the former TWP area. The cleanup action presented addresses all of the SWMUs in the TWP area where dissolved and/or free phase wood-treating constituents have been detected above the MTCA cleanup levels, which are discussed in Section 4 2

As outlined in the Consent Decree and correspondence from Ecology to International Paper, the Department of Ecology has determined that all remaining SWMUs or Areas of Concern at the facility, with the exception of SWMU #1 (the Perimeter Ditch), either require no further action or will be addressed through compliance with the requirements of the Decree. The remediation of SWMU #1 is being completed under a separate Ecology-approved Cleanup Action Plan for the Perimeter Ditch (PTI 1997a), which is incorporated by reference into this CAP for the former TWP area.

Site C

In addition, on the basis of the report submitted by International Paper regarding investigation of Site C (SWMU #6) in October 1996 (PTI 1997b), Ecology has determined that institutional controls pertaining to the extraction of groundwater according to WAC 173-340-440 (i.e., deed restrictions) are necessary.

This CAP is a framework for the cleanup/corrective actions at the former TWP area. The cleanup action includes:

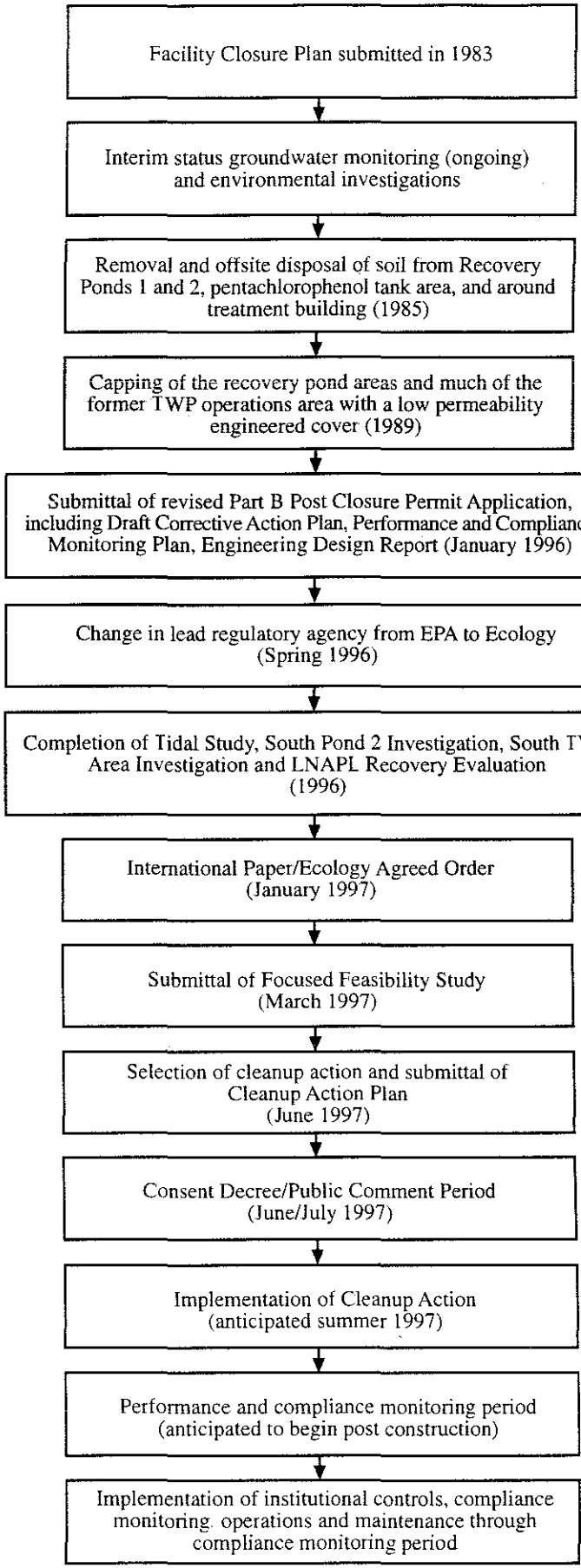
- Physical containment of contaminants (dissolved and free phase product) within facility boundaries

- Removal of light nonaqueous phase liquid (LNAPL), to the extent practicable
- Removal of dense nonaqueous phase liquid (DNAPL) from the top of the Upper Silt, if present, to the extent practicable
- Treatment of contaminants in place, to the extent practicable, to reduce mobility and toxicity
- Institutional controls (i.e., deed restrictions) to limit intrusive activities in areas of impacted soil and groundwater and to protect the containment and treatment systems
- Long-term monitoring to document progress in achieving cleanup goals

In addition, according to the Consent Decree and the CAP for the Perimeter Ditch (PTI 1997a), the impacted sediments in the ditch will be excavated and incorporated within the contained portion of the former TWP area.

The institutional controls for Site C will include filing of deed restrictions to prevent extraction of groundwater. International Paper will record the restriction on groundwater extraction with the register of deeds for Cowlitz County, where the facility is located.

Following Ecology review and approval and the public comment period, this CAP, the PCMP, and the EDR will be finalized and construction of the cleanup action will begin.



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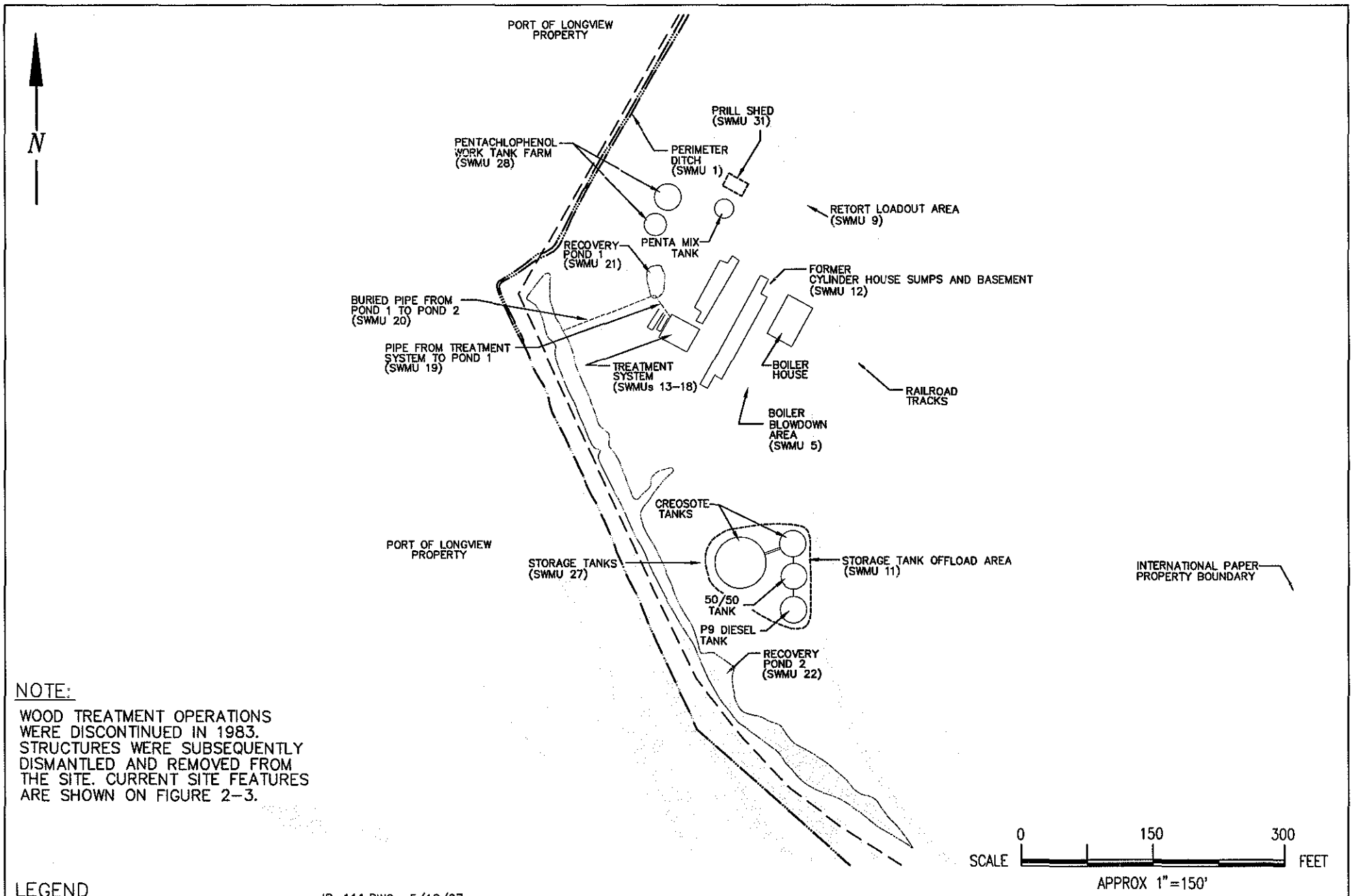
Summary of Cleanup Action Process

Figure 1-1

GR80/IP/01


N
PORT OF LONGVIEW PROPERTY
PRILL SHED (SWMU 31)
PERIMETER DITCH (SWMU 1)
PENTACHLOPHENOL WORK TANK FARM (SWMU 28)
RETORT LOADOUT AREA (SWMU 9)
PENTA MIX TANK
RECOVERY POND 1 (SWMU 21)
FORMER CYLINDER HOUSE SUMPS AND BASEMENT (SWMU 12)
BURIED PIPE FROM POND 1 TO POND 2 (SWMU 20)
PIPE FROM TREATMENT SYSTEM TO POND 1 (SWMU 19)
TREATMENT SYSTEM (SWMUs 13-18)
BOILER HOUSE
RAILROAD TRACKS
BOILER BLOWDOWN AREA (SWMU 5)
CREOSOTE TANKS
PORT OF LONGVIEW PROPERTY
STORAGE TANKS (SWMU 27)
STORAGE TANK OFFLOAD AREA (SWMU 11)
INTERNATIONAL PAPER PROPERTY BOUNDARY
50/50 TANK
P9 DIESEL TANK
RECOVERY POND 2 (SWMU 22)
NOTE:
WOOD TREATMENT OPERATIONS WERE DISCONTINUED IN 1983. STRUCTURES WERE SUBSEQUENTLY DISMANTLED AND REMOVED FROM THE SITE. CURRENT SITE FEATURES ARE SHOWN ON FIGURE 2-3.
0
150
300
SCALE
FEET
APPROX 1"=150'
LEGEND
PROPERTY BOUNDARY
PERIMETER DITCH
IP-111.DWG 5/12/97
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SWMUs in the Former Treated Wood Products Area
Figure 1-2

Investigations regarding the physical and environmental conditions at the Longview facility have been conducted since 1980. These investigations have been conducted to:

- Document site conditions
- Document the nature and history of site operations
- Evaluate potential sources of chemical impact due to site operations
- Evaluate the nature and extent of impacts to site environmental media
- Identify potential impacts to receptors in the site area

The information collected during investigations at the Longview facility is summarized in various reports prepared for International Paper. Summaries of the physical and environmental site conditions are presented in this section.

2.1 SITE LOCATION AND DESCRIPTION

The International Paper Longview facility is located in Sections 8.0 and 9.0, Township 7 North, Range 2 West, in Cowlitz County, near Longview, Washington. The facility is on the north side of the Columbia River, approximately 66 miles upriver from the Pacific Ocean. The facility is located less than two miles downstream (west) of the confluence of the Columbia and Cowlitz Rivers. The facility lies within a 100-year floodplain but is protected by control levees. The facility area is relatively level and ranges in elevation from 10 to 15 feet above mean sea level (msl) (USGS 1953).

The original International Paper facility at Longview was approximately 900 acres. After recent sales of portions of the facility to the Port of Longview, Pacific Fibre, and Longview Fibre, the International Paper property currently consists of approximately 236 acres. The facility is bounded by light industrial and commercial property to the north; Port of Longview property to the south and west; Longview Fibre Company to the east; and the Columbia River to the south.

The former TWP area consists of approximately 4 acres and is located in the southwestern portion of the facility. Due to recent property transactions, it is bordered on all sides by Port of Longview property (Figure 2-1). Port of Longview operations border the former TWP area to the northwest, a paved log deck is located to the north, and vacant Port of Longview property (formerly International Paper property) is located to the northeast. The Columbia River is located approximately 300 feet southwest of the southwest corner of the former TWP area.

In general, the facility and former TWP area are relatively flat. The engineered cover constructed over the former TWP area in 1989 rises only 2 to 4 feet above the surrounding ground surface, with a slope of 5 to 10 percent. The ground surface slopes up to the flood control dike, which runs along the Columbia River west of the western boundary of the former TWP area.

2.2 SITE HISTORY

The International Paper Longview facility and the surrounding area were undeveloped in 1919 (USGS 1919). In the early 1920s, control levees were constructed along the Columbia River, allowing the development of the floodplain. Long Bell operated a sawmill in the former TWP area beginning in the 1920s. Sawmill operations occupied most of the facility from 1923 to

1964 International Paper purchased Long Bell in 1956. The TWP operation was active from 1947 to 1983.

2.2.1 Treated Wood Products Area History and Operations

The TWP operation included a treatment building, wastewater plant, boiler house, pentachlorophenol mix tank, two pentachlorophenol work tanks, four creosote and carrier oil tanks, and two unlined surface impoundments (Recovery Ponds 1 and 2) (Figure 2-2).

Two 8-foot diameter retorts were housed inside the treatment building, which included a basement that extended to approximately 10 feet below ground surface (bgs). One retort was 142 feet long and the other retort was 82 feet long. Pentachlorophenol in carrier oil, creosote, and a 50/50 creosote solution (50 percent creosote and 50 percent low-grade petroleum) were used in both retorts.

The operation had two tank storage areas: one for creosote and 50/50 creosote coal-tar solution, and one for pentachlorophenol and carrier oil. The tanks ranged in size from 20,000 gallons to 800,000 gallons. The creosote tank farm was near Pond 2 and was located in the southernmost part of the wood treatment plant. Product was piped to these tanks from the Port of Longview area along the Columbia River adjacent to the former TWP area.

Recovery Pond 1, formerly located west of the treatment building, was approximately 10 feet by 25 feet in area, 5 feet deep, and unlined. Recovery Pond 2, which was located south of the wastewater plant, was previously part of the perimeter ditch. A portion of the perimeter ditch was closed off at both ends to prevent discharge of the wastewater. Recovery Pond 2 was approximately 5 to 20 feet wide, 800 feet in length, 2 feet deep, and also unlined. The TWP structures have been removed or capped as part of closure activities. Only the foundation of the treatment building currently exists at the facility (Figure 2-3).

International Paper submitted a Notification of Hazardous Waste Activity in August 1980 and a RCRA Part A permit application to EPA in November 1980. The permit application was revised and resubmitted to EPA in September 1981. At EPA's request, International Paper submitted a Part B application in November 1983. In 1983, use of Recovery Ponds 1 and 2 was discontinued, and International Paper submitted a closure plan to EPA and Ecology. The Part B application was updated in 1985, 1987, 1994, and 1996 to reflect additional information collected regarding site conditions.

As part of closure activities, soil was removed from several areas of the former TWP area in 1985—specifically Recovery Ponds 1 and 2, the pentachlorophenol storage tank area, and the vicinity of the treatment building—and was disposed of in a permitted treatment, storage, and disposal facility (J.L. Grant 1990). The former recovery pond areas were capped in 1989 with an engineered cover consisting in part of a 40-mil high density polyethylene (HDPE) liner and a 0.5-foot thick sand drainage layer. The majority of the TWP operation structures have been removed, including buildings, tanks, and related hardware.

The former TWP area is currently surrounded by a 6-foot high metal chain-link fence, as shown on Figure 1-3. Access is controlled by a locking gate. The area is currently inactive and no industrial operations are performed within this area. International Paper and subcontractor personnel occasionally enter the area for routine servicing of remediation equipment. The area is

characterized by gentle relief, with the engineered cover rising gradually 2 to 4 feet above the surrounding area. The ground surface within the former TWP area, including the engineered cover, is largely vegetated with grass.

2.3 PAST ACTIVITIES OF ENVIRONMENTAL CONCERN

The sources of the detected chemical releases at the Longview facility relate to operations at the former TWP area. Based on historical operations and soil and groundwater data collected to date, the potential sources of the releases include:

- Recovery Ponds 1 and 2
- Treatment building (retort shed)
- Wastewater treatment system
- Creosote storage tanks
- Pentachlorophenol storage and mix tanks

The locations of these potential source areas are shown on Figure 2-2, and the specific operations associated with each area are discussed in Section 2.2

2.4 LAND USE AND OWNERSHIP

The facility and surrounding properties have a history of industrial use. Available information indicates that the Longview facility and surrounding property, which is owned primarily by the Port of Longview, will continue to be used for industrial development consistent with the Cowlitz County Master Plan for future development. A parcel northeast and east of the former TWP area has already been acquired by the Port of Longview from International Paper for industrial development

As discussed in greater detail in Section 5.0, the future use of the former TWP area must consider the institutional controls to be implemented as part of the final action program. Conversely, a primary objective for the low permeability engineered cover component of the final action is that the design is consistent with the potential future use of the property

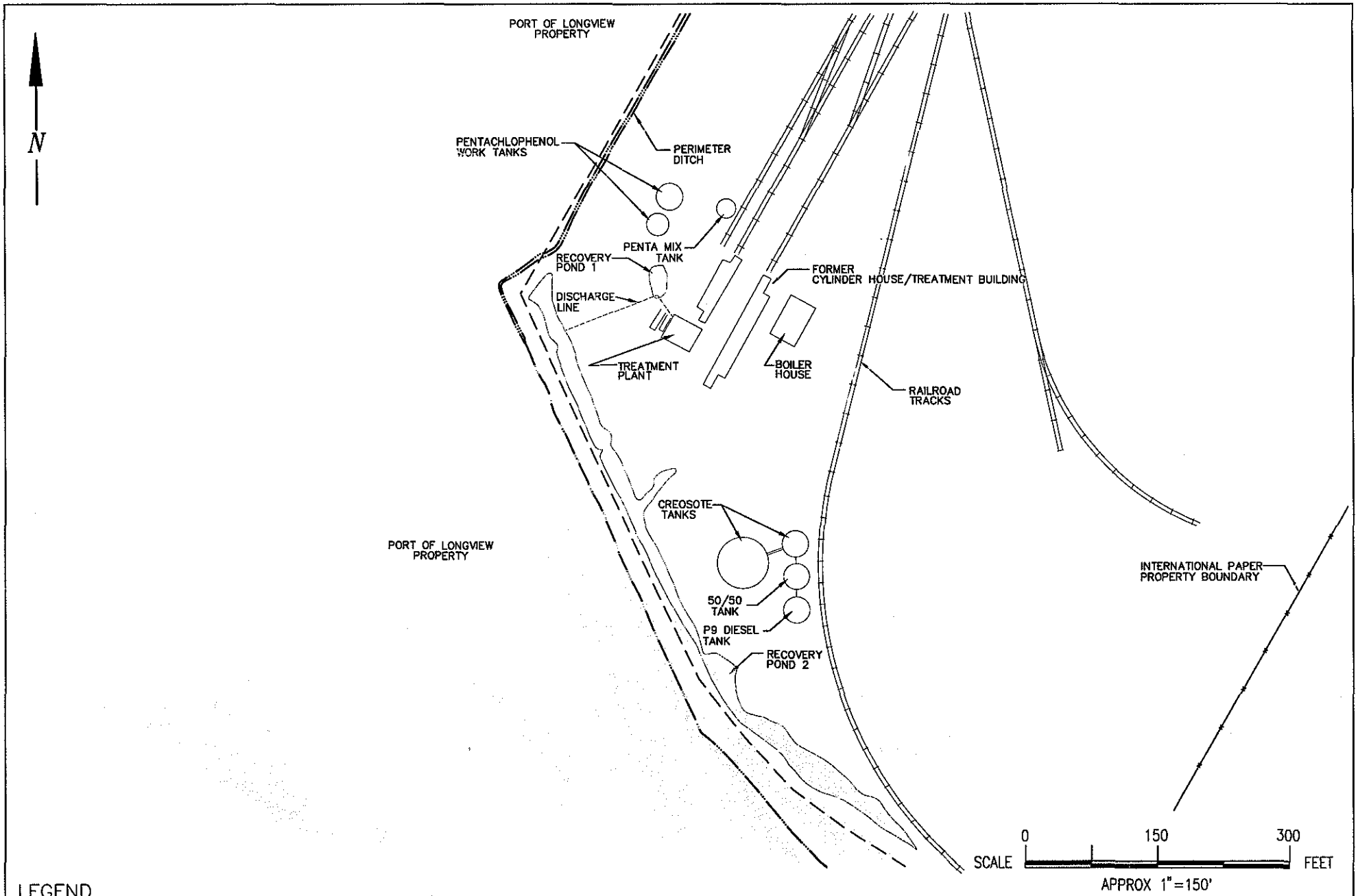

FIG1-2A.DWG 5/12/97

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Previous Features
Former Treated Wood Products Area

Figure 2-2

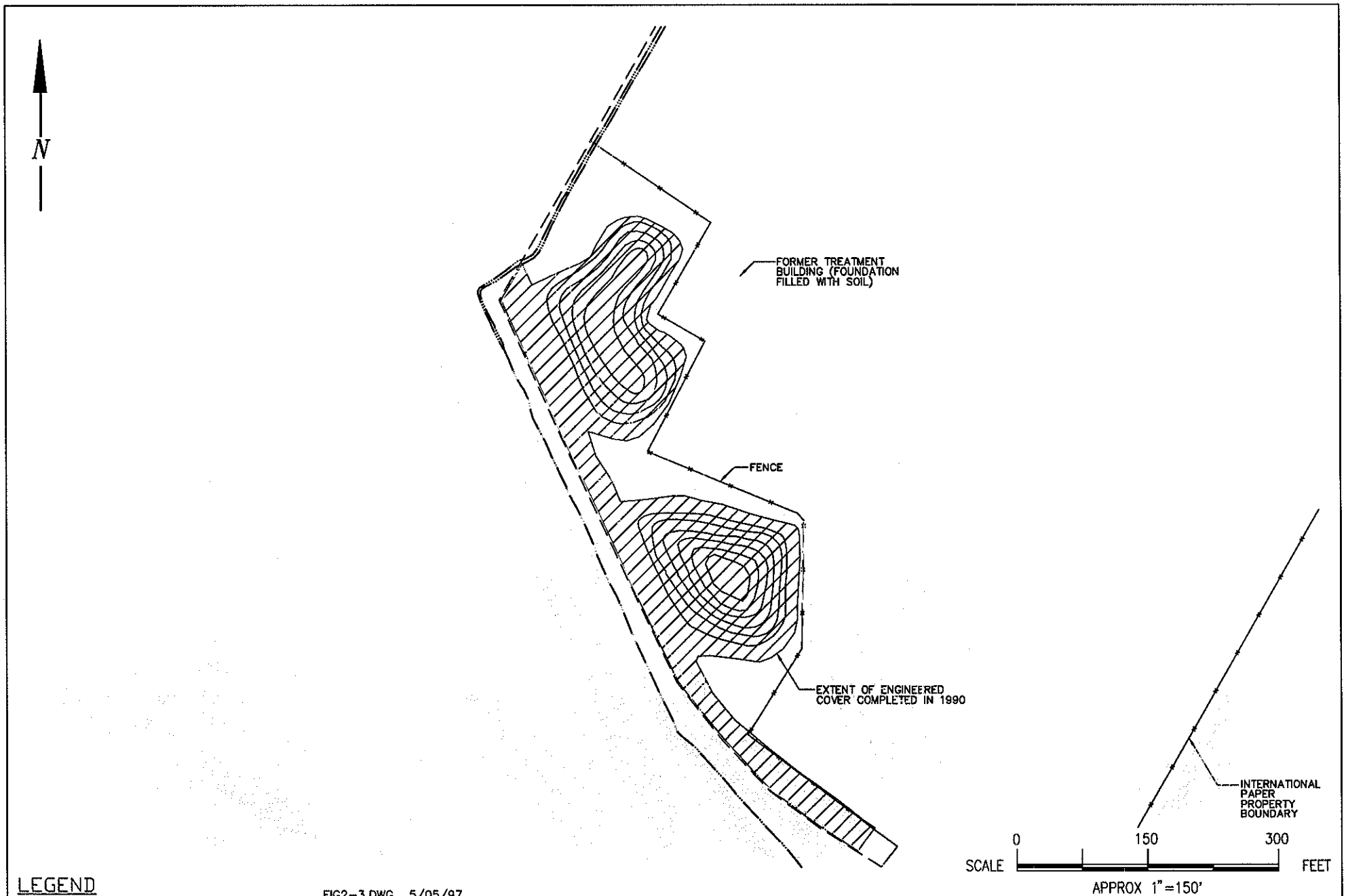

FIG2-3.DWG 5/05/97

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Current Features
Former Treated Wood Products Area

Figure 2-3

This section summarizes the environmental conditions at the former TWP area, including geology, hydrogeology, and the nature and extent of chemical impacts to site media. This information is presented in more detail in the Site Characterization Report (Woodward-Clyde 1994), the 1995 update to the Site Characterization Report (Woodward-Clyde 1995a) and the Focused Feasibility Study (Woodward-Clyde 1997a).

3.1 SUMMARY OF SITE INVESTIGATIONS

As noted in Section 2.2.1, investigations to evaluate the nature and extent of impacts to soil and groundwater at the former TWP area have been conducted since 1980. Monitoring well and soil investigation locations are shown on Figure 3-1. Investigations at the former TWP area to date have included:

- Drilling more than 200 soil borings
- Conducting 15 cone penetrometer tests (CPTs)
- Monitoring groundwater quarterly from 1982 to present
- Installing a monitoring well network with a current total of 17 wells
- Completing tidal studies in fall 1995 and spring 1996, in addition to two previous tidal investigations

These investigations, including the sampling and analysis of site soils and groundwater, were conducted to characterize physical site conditions and the nature and extent of chemical impacts.

3.2 HYDROGEOLOGY, SURFACE WATER, AND GROUNDWATER

Groundwater flow at the former TWP area is influenced by the location of the Longview facility (near the Columbia River) and the alluvial sediments underlying the area. This section summarizes the physical site conditions that influence groundwater flow at the facility.

3.2.1 Hydrogeology

Based on soils investigations conducted to date, four general stratigraphic units are located in the shallow (up to 125 feet bgs) alluvial deposits beneath the former TWP area: the Upper Sand, the Upper Silt, the Lower Sand, and the Lower Silt.

- **Upper Sand.** The Upper Sand is interpreted to be primarily a fill unit and is present virtually everywhere in the former TWP area. The thickness of the Upper Sand ranges from 3 to 7 feet in the former TWP area.
- **Upper Silt.** The Upper Silt is the shallowest zone of fine-grained relatively low permeability material and may influence shallow groundwater movement. The Upper Silt is generally continuous in the former TWP area. However, it is absent in a linear zone across the central portion of the former Pond 2, which is likely due to construction and remediation activities. The thickness of the Upper Silt varies from 2 to 6 feet in the former TWP area.
- **Lower Sand.** The Lower Sand is the locally-extensive water-bearing unit in the former TWP area and directly underlies the Upper Silt. Groundwater movement in the Lower Sand is

influenced by the Columbia River. The Lower Sand is a gray medium dense to dense, medium to coarse grained sand, with red, white, and gray grains of volcanic material

The Lower Sand is divided into two aquifers; the upper aquifer (Aquifer A) is approximately 25 to 35 feet thick and the lower aquifer (Aquifer B) is approximately 35 to 65 feet thick. Aquifers A and B are separated by a distinct silt or silty sand referred to as the Intermediate Silt. Within the northern and central former TWP area, the Intermediate Silt was encountered at elevations of 20 to 30 feet below msl, and ranges from 2 to more than 5 feet in thickness (Figures 3-3 and 3-4). In the southern portion of the former TWP area, the Intermediate Silt is less distinct and may only be distinguishable from the overlying sand by a subtle increase in silt content.

- **Lower Silt.** The Lower Silt is the deepest unit encountered in borings completed at the former TWP area. The Lower Silt is at least 32.5 feet thick in one on-site boring, and serves as a locally extensive aquitard. The depth to this unit ranges from 77 to 103 feet bgs.

Detailed descriptions of these units and soil boring logs are presented in the Site Characterization Report (Woodward-Clyde 1994), 1995 Update to the Site Characterization Report (Woodward-Clyde 1995a), South Pond 2 Investigation Data Summary Report (Woodward-Clyde 1996a), and South TWP Area Investigation Data Summary Report, which is Appendix A of the FFS (Woodward-Clyde 1997a). The conceptual model for the former TWP area, including the stratigraphic and hydrogeologic units, is shown in Figure 3-2

3.2.2 Surface Water

The principal surface water feature near the International Paper Longview facility is the Columbia River. The Columbia River water level varies seasonally due to precipitation and runoff, as well as from tidal influences and releases from dams upstream. The Columbia River is separated from the Longview facility by a flood control dike, is located approximately 300 feet southwest of the former TWP area, and influences groundwater levels beneath the facility. Tidal studies have been conducted to evaluate how the stage of the Columbia River affects groundwater levels and flow directions at the facility.

3.2.3 Groundwater

The analyses of representative tidal data collected in fall 1995 and spring 1996 were used to estimate groundwater movement in Aquifers A and B, located in the Lower Sand unit (Figures 3-5 to 3-8). A detailed discussion of the tidal studies is presented in the Tidal Study Summary Report (Woodward-Clyde 1996b). The groundwater flow directions and velocities in Aquifers A and B were estimated for the mean data using the Serfes method for each of the two representative tidal periods. Typical groundwater conditions are represented by the flow directions based on the 71-hour mean groundwater elevations. Flow directions during high and low tides are also plotted, primarily to evaluate the range of variations during extreme conditions at the former TWP area

The Columbia River stage elevation varied between 1.0 foot and 13.1 feet above msl during the fall 1995 and spring 1996 tidal studies, which is representative of the historical range of

Columbia River stage elevations. The variability of the groundwater flow directions and velocities estimated with the tidal study data are likely representative of historic values.

The tidal influence on the Columbia River stage elevation is dampened at high river stage. Therefore, the influence of the tidal cycle on Columbia River stage elevation was greatest during the fall 1995 tidal study, when the river stage was lower. The tidal study data also indicate that the amplitude of variation in groundwater elevations during a tidal cycle decreased with increased distance from the river. The lag time between high tide in the Columbia River and the resulting peak groundwater elevation increases with increased distance inland. Specific significant findings of the tidal study are:

- Mean direction of groundwater flow was north-northeast from the Columbia River and across the former TWP area (away from the river) during both fall and spring tidal studies; however, the flow gradients are extremely flat and flow direction may vary
- Horizontal groundwater velocities vary across the site but are very low due to the flat gradients
- The groundwater flow direction in Aquifers A and B is consistent, but the groundwater velocities vary
- The vertical groundwater flow direction between Aquifers A and B oscillated up and down within a given tidal cycle
- The vertical hydraulic gradient between Aquifers A and B increases with distance from the river
- The tidal study data indicate that the Intermediate Silt acts as a confining layer, at least in the former TWP area

The groundwater flow data indicate that distribution of chemicals of concern (COCs) would be in the form of a broad plume with very little lateral movement. Any net migration of COCs with groundwater would be to the north-northeast and away from the Columbia River, but due to the low groundwater velocities any migration would be expected to be minimal.

3.3 NATURE AND EXTENT OF CONTAMINATION

This section summarizes the nature and extent of chemical impacts to soil and groundwater at the former TWP area. This information is presented in more detail in the Site Characterization Report (Woodward-Clyde 1994), the 1995 Update to the Site Characterization Report (Woodward-Clyde 1995a), and the Focused Feasibility Study (Woodward-Clyde 1997a).

To evaluate the nature and extent of impacts to soil and groundwater in anticipation of cleanup actions, the concentrations detected have been compared to published MTCA cleanup levels (Ecology 1996). These comparisons have been used as a baseline in the process of evaluating appropriate remedial actions. The cleanup goals are discussed in Section 4.2. Soil concentrations were compared to MTCA Method C industrial cleanup levels based on direct contact. For petroleum hydrocarbon compounds, Ecology (1996b) does not provide MTCA Method C formula values for industrial soil. However, Ecology has recently released an interim total petroleum hydrocarbon policy statement (Ecology 1997) that provides guidance for

calculating cleanup levels for petroleum hydrocarbon compounds in soil at residential, commercial, or industrial sites These guidance values are applicable for the former TWP area Groundwater concentrations have been compared to both MTCA Method C industrial cleanup levels and MTCA Method B cleanup levels, based on the sampling location

3.3.1 Subsurface Soil

Since 1980, extensive soil investigations have been completed to document site stratigraphy and the distribution of the wood-treating COCs pentachlorophenol, polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH) within the former TWP area. Pre-closure activities included soil borings, sampling, and analysis, performed by various consultants for International Paper between 1980 and 1990 (Woodward-Clyde 1994). Post-closure investigations performed by Woodward-Clyde since 1990 were completed to further document soils impacts and collect data to implement the cleanup actions for the former TWP area. The post-closure investigations included soil borings (Figure 3-1):

1992 soil borings to address the depth of the Lower Silt Unit

1993 soil borings to assess soil chemistry and the extent of nonaqueous phase liquid (NAPL) in the central and northern former TWP area

1995 soil borings and CPTs to collect geotechnical information along the perimeter of the former TWP area

1996 soil borings and CPTs in the spring of 1996 to evaluate site soils in and adjacent to the southern portion of former Pond 2, and soil borings in the fall of 1996 to further evaluate the southern portion of the former TWP area, including the former creosote tank farm area

The data indicate that concentrations of COCs greater than the MTCA industrial soil cleanup levels based on direct contact, including the Method C level for carcinogenic PAHs (cPAHs) and the industrial cleanup level for TPH calculated using Ecology guidance (Ecology 1997), have been detected only at a few locations in the former TWP area. Pentachlorophenol has not been detected in site soils at concentrations greater than the MTCA Method C industrial soil cleanup level

The major findings of the soils investigations are:

- The northern part of the former TWP area has three areas where concentrations of COCs in soil are greater than the MTCA industrial soil cleanup levels, based on direct contact, since the surface soil removal in 1985 and completion of backfilling and placement of the engineered cap in 1989:
  - The vicinity of the former wastewater plant, at the south end of the treatment building in the area of former pumping well PW-4
  - The vicinity of the former pentachlorophenol work tanks, just north of former Recovery Pond 1 near the location of former pumping well PW-1
  - Within former Recovery Pond 2, near the location of former pumping well PW-3

- The southern portion of the former TWP area has only one localized area with concentrations of COCs above industrial cleanup standards:
  - One localized area (boring 96SB9) in the southern portion of the former TWP area (the former creosote tank farm) has indicated concentrations of COCs greater than the cleanup levels to a depth of approximately 8 5 feet bgs
- Where the Upper Silt is present, chemical impacts are greatest at or above the Upper Silt, which appears to act as a barrier to downward migration of COCs
- Areas in which concentrations of PAHs have been detected at depths below the Upper Silt are primarily limited to areas where the silt has been disturbed by previous construction activities, including near the treatment building and the area of former Pond 2
- No soil impacts have been detected at depths below the Intermediate Silt, and the Intermediate Silt appears to be continuous below most of the northern portion of the former TWP area, which is the primary area where COCs have been detected at concentrations greater than the MTCA industrial soil cleanup levels based on direct contact

3.3.2 Groundwater Chemistry

Groundwater at the former TWP area has been sampled on a quarterly basis since 1982, according to the requirements of Subpart F, Code of Federal Regulations (CFR) 265 for Interim Status RCRA facilities. The 1995 analytical data are summarized in the Groundwater Quality Assessment Program 1995 Annual Report (Woodward-Clyde 1996c). The 1996 data have been presented in individual quarterly monitoring reports and are summarized in the 1996 annual report (Woodward-Clyde 1997b). A summary of the analytes detected in the monitoring program is presented in Table 3-1, and a summary of the 1996 data is presented in Table 3-2.

The following discussion of groundwater quality is based on the analytical results for sampling completed through the fourth quarter of 1996. Twenty-three wells were included in the 1996 quarterly sampling program. Groundwater samples are analyzed for a list of ten groundwater protection standard (GWPS) constituents: toluene, naphthalene, benzene, pentachlorophenol, total cresols, phenol, fluoranthene, chrysene, benz(a)anthracene, and 2-4-dimethylphenol.

None of the constituents associated with the former TWP area were detected outside of the former TWP operations area. The groundwater monitoring data to date indicate:

- The extent of groundwater impacted by GWPS constituents above MTCA cleanup levels is limited to Aquifer A within the immediate former TWP area.
- None of the GWPS constituents have been detected at concentrations above the cleanup levels in Aquifer B in 1996
- Toluene has been detected in a number of wells, but except for a single detection at well LL-2 17 in May of 1992, has not been detected at concentrations above the MTCA Method B groundwater cleanup level of 1 6 mg/L. Most of the toluene detections are at, or slightly above, the laboratory's method detection limit of 0 001 mg/L. The highest toluene concentration was 0 119 mg/L, observed at LL-20 104 during the third quarter of 1995. This is a deep well located on Port of Longview property and is upgradient of the former TWP

area. The source of the toluene is unknown, but there are no known sources of toulene in the TWP area. Nearly all samples with toluene concentrations greater than 0.01 mg/L are from off-site wells completed near the base of Aquifer B, supporting the likelihood of an off-site source.

- Naphthalene detections are confined to wells in areas of known soil impact. Naphthalene was not detected at any off-site wells sampled in 1994 or 1995. One detection of naphthalene was reported during the second quarter of 1996 at well LL-04.18, located along the site boundary. The detected concentration was 0.004 mg/L, which is well below the MTCA Method B groundwater cleanup level of 0.32 mg/L.
- The only consistent detections of pentachlorophenol are from wells in the northern portion of the former TWP area, where impacted soils are present.
- Benzene was not detected in wells during 1996. Only one of the benzene detections in 1994 or 1995 (0.0022 mg/L) was above the MTCA Method B groundwater cleanup level of 0.0015 mg/L (LL-20.104, first quarter 1995). The concentration was still below the EPA maximum contaminant level (MCL) of 0.005 mg/L. As with the toluene detections discussed above, the one benzene detection above the MTCA cleanup level is from a deep well located upgradient of the former TWP area on Port of Longview property and is likely due to an off-site source.
- Total creosols were detected in three wells within the former TWP area in 1994 at, or near, the method reporting limit (MRL) of 0.01 mg/L. Total creosols were detected in four wells within the former TWP area in 1995. The only detections in 1996 were from well LL-02.17, which is located in the center of the former TWP area. Concentrations detected ranged from 0.01 to 0.5 mg/L.
- None of the seven detections of 2,4-dimethylphenol in 1994 or the one detection in 1996 were above the MTCA Method B groundwater cleanup level of 0.32 mg/L. The highest concentration detected in 1994 or 1996 was 0.06 mg/L in LL-02.17, 93-5.41, and PW-3 during the first quarter 1994. The one detection in 1996 was 0.03 mg/L in well LL-02.17, which is located in the center of the former TWP area. There were no detections of 2,4-dimethylphenol in 1995.
- Five groundwater grab samples were collected from the upper portion of Aquifer A during drilling of soil borings in the southern TWP area in November 1996 to provide screening level data on the concentrations of COCs present in groundwater (Figure 3-1). The samples collected were highly turbid due to suspended sediment in the water. The analytical results indicated concentrations of cPAHs and pentachlorophenol above MTCA Method B groundwater cleanup levels, and TPH concentrations above the Method A groundwater cleanup levels. Due to the turbid nature of the samples and the high soil sorption coefficients of the COCs, the measured concentrations in the screening level groundwater samples likely do not represent actual groundwater conditions.
- On April 29, 1997, groundwater samples were collected from wells LL-01.15 and LL-18.22, which are Aquifer A wells located along the eastern and southeastern margins of the southern TWP area. The samples were submitted for laboratory analysis for semivolatile organics including PAHs, cPAHs, and pentachlorophenol using Method 8270 Selective Ion Method, a gas chromatograph/mass spectrometer method with selected ion monitoring to achieve low

detection limits. No cPAHs or pentachlorophenol were detected at or above the method reporting limits or the respective MTCA Method B cleanup levels. The results of these analyses demonstrate the impacts to soil in the southern TWP area have not resulted in COC migration to the locations of wells LL-18 22 or LL-01.15 during the 15- to 50-year time period that constituents may have been in the soil. Wells LL-18.22 and LL-01.15 are along the boundary of the area proposed for deed restriction, as discussed in Section 4.1, and are wells that will be included for monitoring in the Performance and Compliance Monitoring program presented in Section 6.

3.3.3 Nonaqueous Phase Liquid Occurrence

The available information from soil borings and monitoring wells indicates that NAPL impacts are limited to two localized areas which are both in the northern portion of the former TWP area: 1) the vicinity of PW-1 and the former pentachlorophenol mix tanks; and 2) the vicinity of PW-4 adjacent to the former treatment building and former wastewater plant (Figure 3-9). Specifically, the data collected to date regarding NAPL indicate:

- LNAPL has been detected in only one area (at PW-4 and 93-6.17), and although the extent is limited, a recovery program has been implemented to evaluate the feasibility of long-term recovery
- DNAPL occurrence has been limited in well PW-4, with one trace detection in adjacent well 93-5.41 in 1993. Since 1993, LNAPL has been detected consistently in the PW-4 area. Well PW-4 is located in an area where the Upper Silt appears to be discontinuous due to construction activities.
- Available information indicates that the quantity and extent of DNAPL at the former TWP area is limited and that abandonment of the PW wells will eliminate the likely source of DNAPL impacts to groundwater from the shallower soils. The occurrence of DNAPL in PW-1 is likely related to an ineffective annular seal in the well that has allowed migration of COCs from the Upper Sand downward into the sand pack of the well.
- Soil borings around former pumping well PW-3 (93SB-13 and 93SB-14, Figure 3-1), and near the center of former recovery Pond 2 also have encountered soils with strong odor, heavy sheen, and possible nonaqueous phase liquid in the upper portion of Aquifer A. The Upper Silt is locally discontinuous in this area due to excavation of the former Recovery Pond in 1985
- No impacts to soil above the MTCA industrial soil cleanup levels have been detected in six deep borings and three deep wells completed to depths below the Intermediate Silt at the base of the Lower Sand aquifer The analytical data for soil and groundwater samples from these borings and wells do not indicate the potential presence of DNAPL or COCs below the depth of the Intermediate Silt. No COCs were detected in any of the soil samples collected below the Intermediate Silt, and the isolated low concentrations detected in groundwater are well below the level suggested by EPA for use as an indicator of the presence of DNAPL.

3.4 FATE AND TRANSPORT CONCEPTUAL SITE MODEL

A pre-cleanup action conceptual fate and transport model for the former TWP area, showing sources of COCs, transport mechanisms, impacted media, exposure pathways, and potential receptors was developed in the FFS and is shown in Figure 3-10. Chemicals of concern at the former TWP area were identified and their general chemical transport properties described. Site-specific transport mechanisms were then described. Based on these discussions, potential exposure pathways at the site were analyzed and potential receptors were identified.

Exposure pathways involve four necessary elements. They are: (1) a source and mechanisms of chemical release to the environment; (2) an environmental transport medium; (3) a point of potential receptor contact with the medium containing the site-related chemical; and (4) a receptor intake route at the contact point. Whenever one or more of the exposure pathway elements are missing, the exposure pathway is incomplete and there is no exposure and, therefore, no health risk.

The fate and transport conceptual site model indicates that the only potential complete exposure pathways are a result of direct contact to soil and groundwater in the impacted part of the former TWP area. Chemical transport via leaching and volatilization to other media (groundwater, surface water, and air) is an incomplete pathway. Potential receptors of site-related COCs are:

- Future construction and remediation workers, from potential short-term exposure to dust emissions and affected subsurface soils during construction or remediation
- Future construction and remediation workers, from potential short-term exposure to affected groundwater in Aquifer A during construction or remediation
- Future construction and remediation workers from potential short-term exposure to NAPL during construction or remediation
- Future industrial workers, from potential short-term exposure to groundwater in Aquifer A in the event that affected groundwater is used in the future for water supply

The risks to the potential receptors identified in the conceptual site model will be addressed by the selected cleanup action. The specific rationale and objectives for the cleanup action are presented in Section 4.0.

Table 3-1

GROUNDWATER PROTECTION STANDARD CONSTITUENT STATISTICAL SUMMARY

ANALYTE	NUMBER OF SAMPLES				NUMBER OF DETECTIONS				FREQUENCY OF DETECTIONS (%)			
	pre-1994	1994	1995	1996	pre-1994	1994	1995	1996	pre-1994	1994	1995	1996
Toluene[1]	274	96	98	85	16	26	30	6	5.8	27	30.6	7
Naphthalene	432	96	98	85	120	21	19	11	28	22	19.4	13
Benzene[2]	274	96	98	85	4	9	14	0	1.5	9.4	14.3	0
Pentachlorophenol	436	96	98	85	76	16	13	7	17	17	13.3	8
Cresols	377	96	98	85	19	4	8	3	5.0	4.2	8.2	3.5
Phenol	436	96	98	85	15	0	1	0	3.4	0	1.0	0
Fluoranthene	432	96	98	85	41	1	1	0	9.5	1.0	1.0	0
Chrysene	426	96	98	85	23	1	0	0	5.4	1.0	0	0
Benz(a)anthracene	321	96	98	85	19	0	0	0	5.9	0	0	0
2,4-Dimethylphenol	329	96	98	85	23	7	0	1	7.0	7.3	0	1.2

ANALYTE	MINIMUM DETECTION						MAXIMUM DETECTION			
	MTCA Method B (ppb)	MTCA Method C (ppb)	PRE-94	1994	1995	1996	PRE-94	1994	1995	1996
Toluene[1]	1,600	3,500	2	1	1	1	5,000	37	119	8
Naphthalene	320	700	10	10	20	80	830,000	5,500	4,900	10,000
Benzene[2]	1.51	15.1	0.6	0.8	0.5	-	1,400	1.2	22	-
Pentachlorophenol	0.729	7.29	10	44	1	4	138,000	480	640	890
Cresols	80	175	10	10	20	100	23,300	60	220	500
Phenol	9,600	21,000	10	-	10	-	4,350	-	10	-
Fluoranthene	640	1,400	2	10	10	-	740,000	10	10	-
Chrysene	0.012	0.12	10	10	-	-	360,000	10	-	-
Benz(a)anthracene	0.012	0.12	10	-	-	-	360,000	-	-	-
2,4-Dimethylphenol	320	700	10	10	-	30	3,600	60	-	30

Notes:

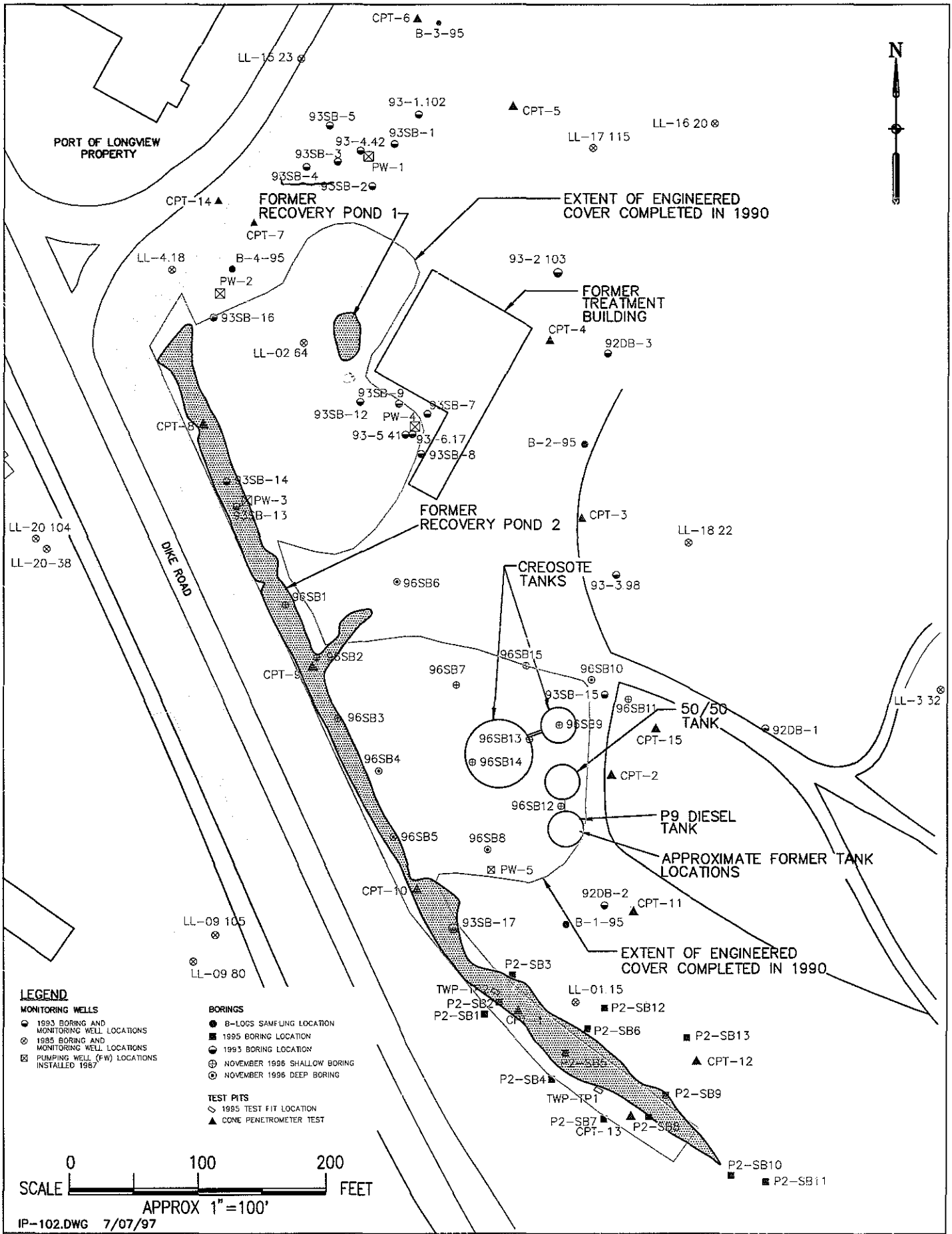
1: Only 7 of the 28 toluene detections in 1994 were above the former method reporting limit of 10 µg/L.
2: None of the benzene detections in 1994 were above the former method reporting limit of 10 µg/L.
Field quality control samples (rinsates, trip blanks, and field duplicates) were not included in the above summary.
All minimum and maximum detections are in µg/L.
Pentachlorophenol summary results for 1995 are based on Method 8150A analysis.

Table 3-2

GROUNDWATER PROTECTION STANDARD CONSTITUENT DETECTIONS IN GROUNDWATER
1996 ANNUAL REPORT
(µg/L)

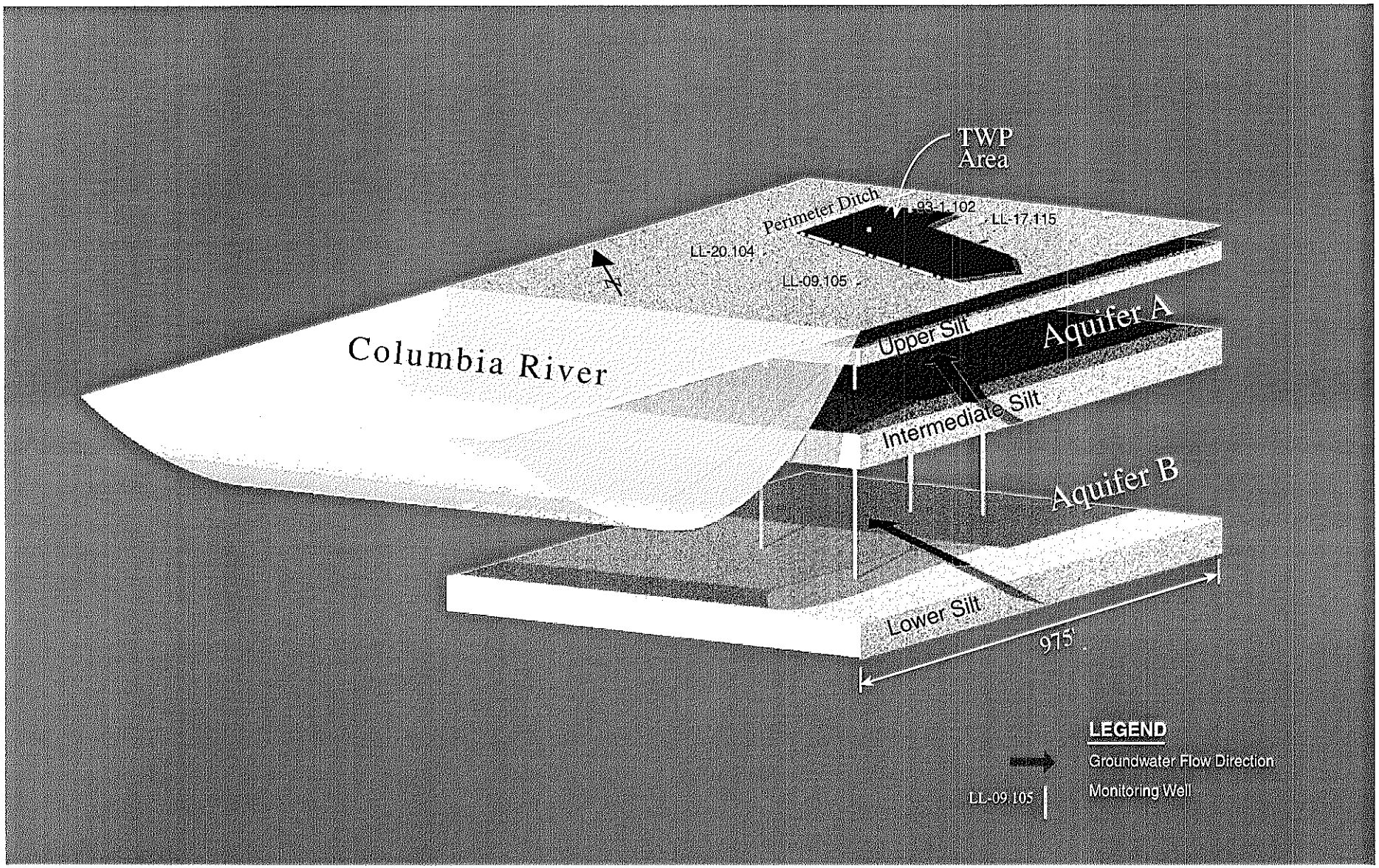
CONSTITUENT:	TOLUENE				NAPHTHALENE				PENTACHLOROPHENOL				2,4-DIMETHYLPHENOL				CRESOLS			
MTCA METHOD B CLEANUP LEVEL:	1,600				320				0.729				320				80			
MTCA METHOD C CLEANUP LEVEL:	3,500				700				7.29				700				175			
QUARTER:	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
LL-02.17	5	7	8	7[7]	10,000J	7,700	3,700	7,900 [7,200]	760	890	890	770 [770]		30			500J	310	100	
LL-02.32R							650	1,000	6	8										
LL-04.18						90														
93-4.42						80		300												
93-5.41							300	700	4											
LL-20.104				1																

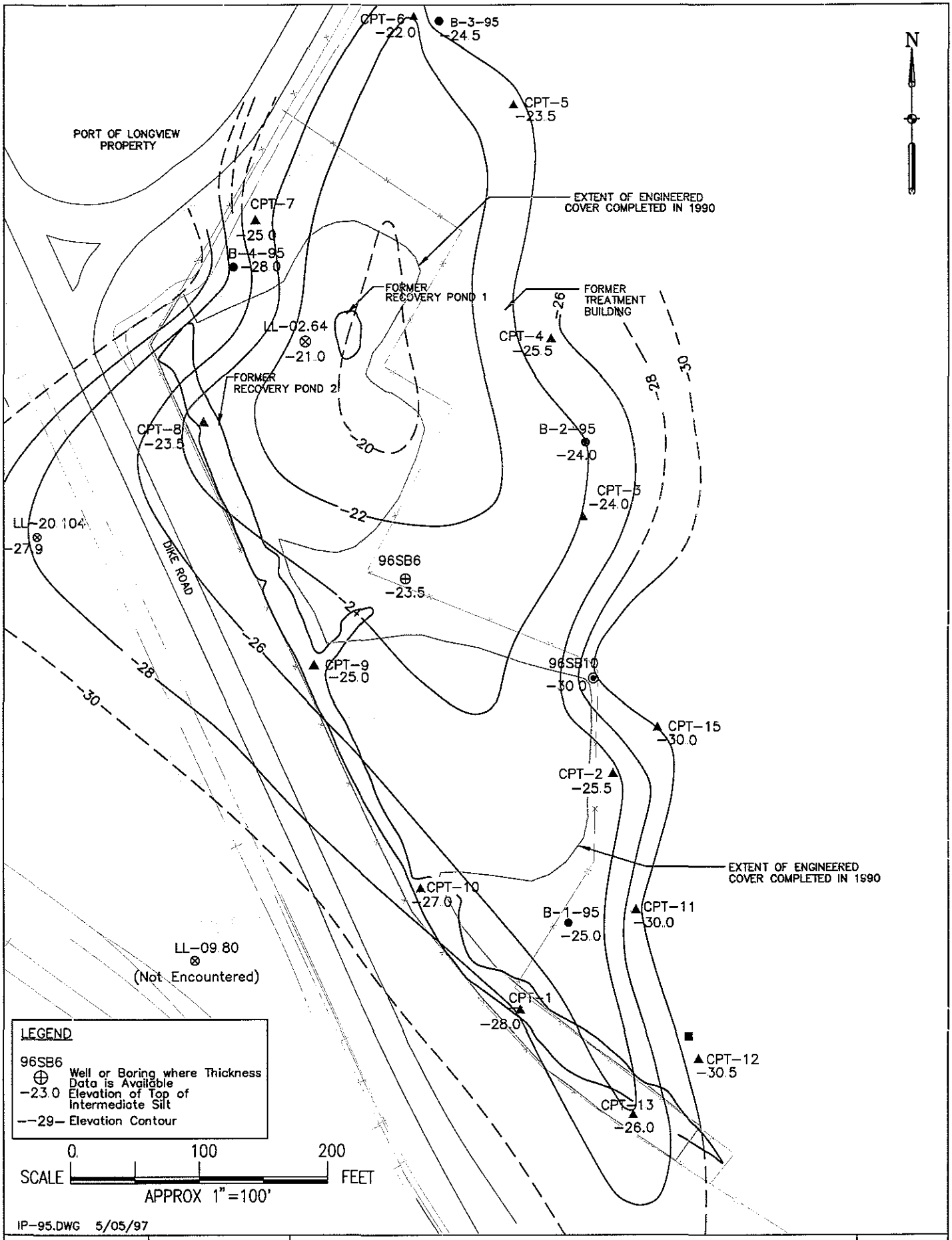
Notes:
A blank cell indicates a non-detect.
J: Estimated value.
[ ]: Duplicate sample result



INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	Monitoring Well and Soil Investigation Locations – Former TWP Area	Figure 3-1
Woodward-Clyde			

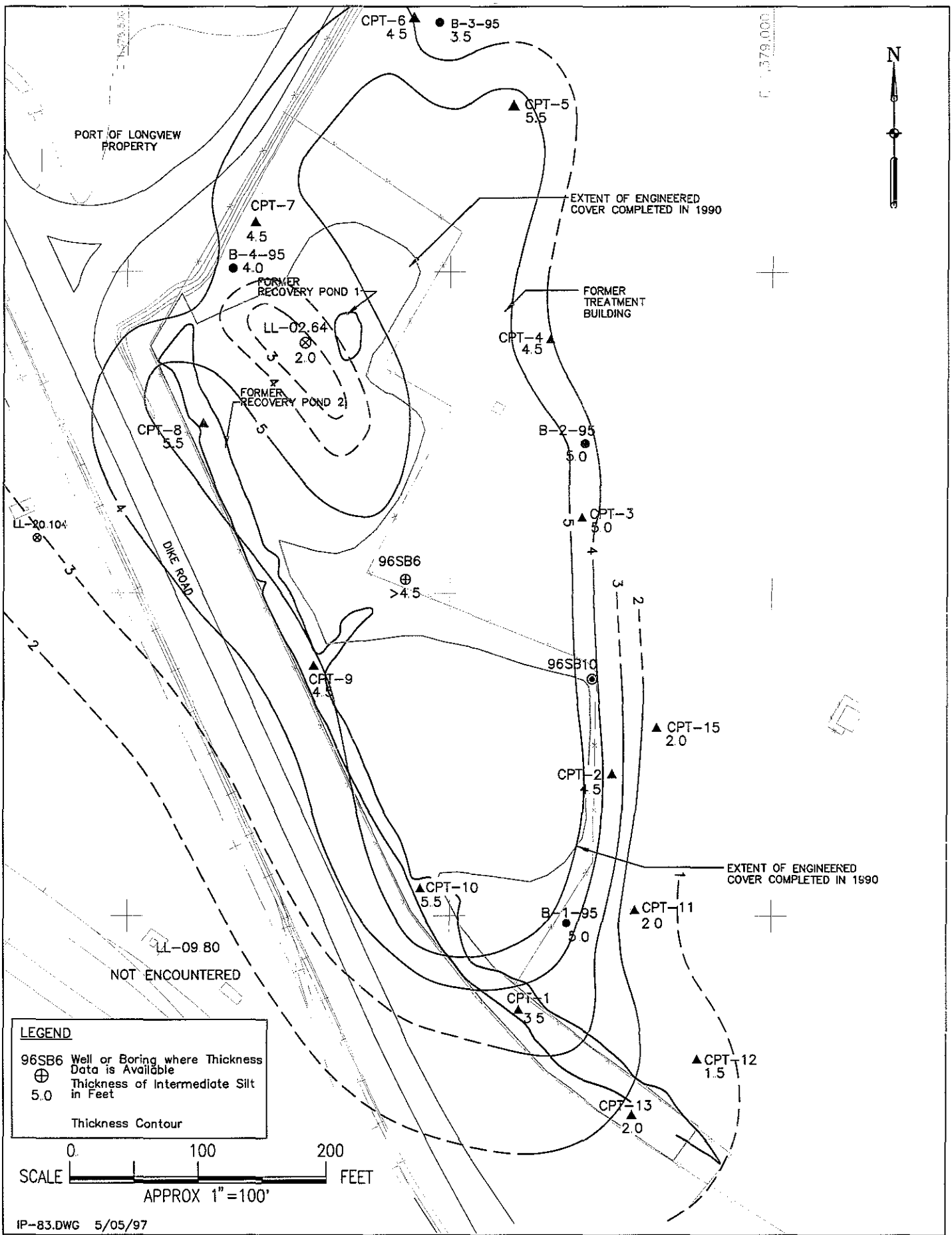
Figure 3-2. Former Treated Wood Products Area
International Paper, Longview Facility
Illustrative Site Cross-Section





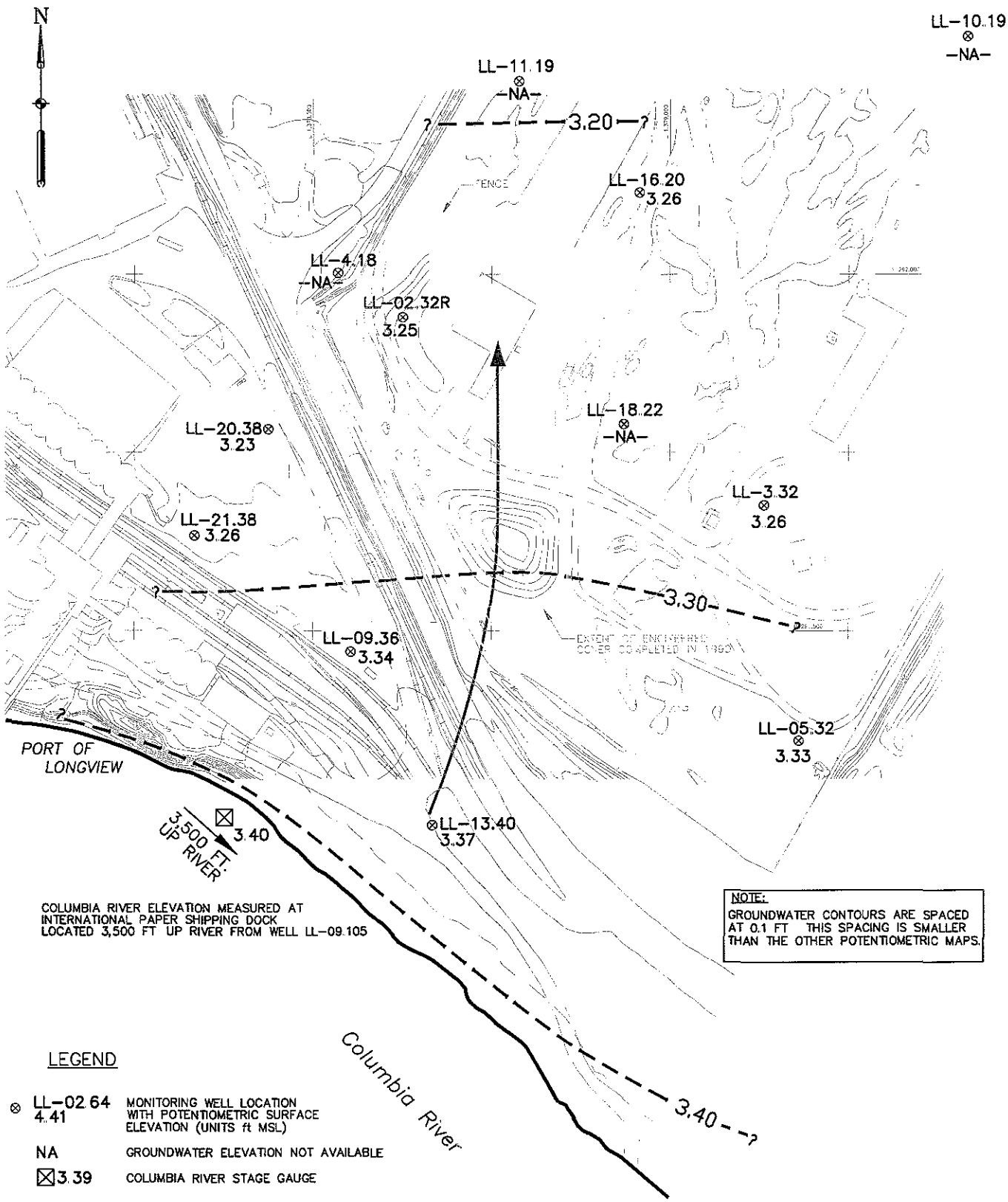
IP-95.DWG 5/05/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	Elevation of the Top of the Intermediate Silt	Figure 3-3
Woodward-Clyde			



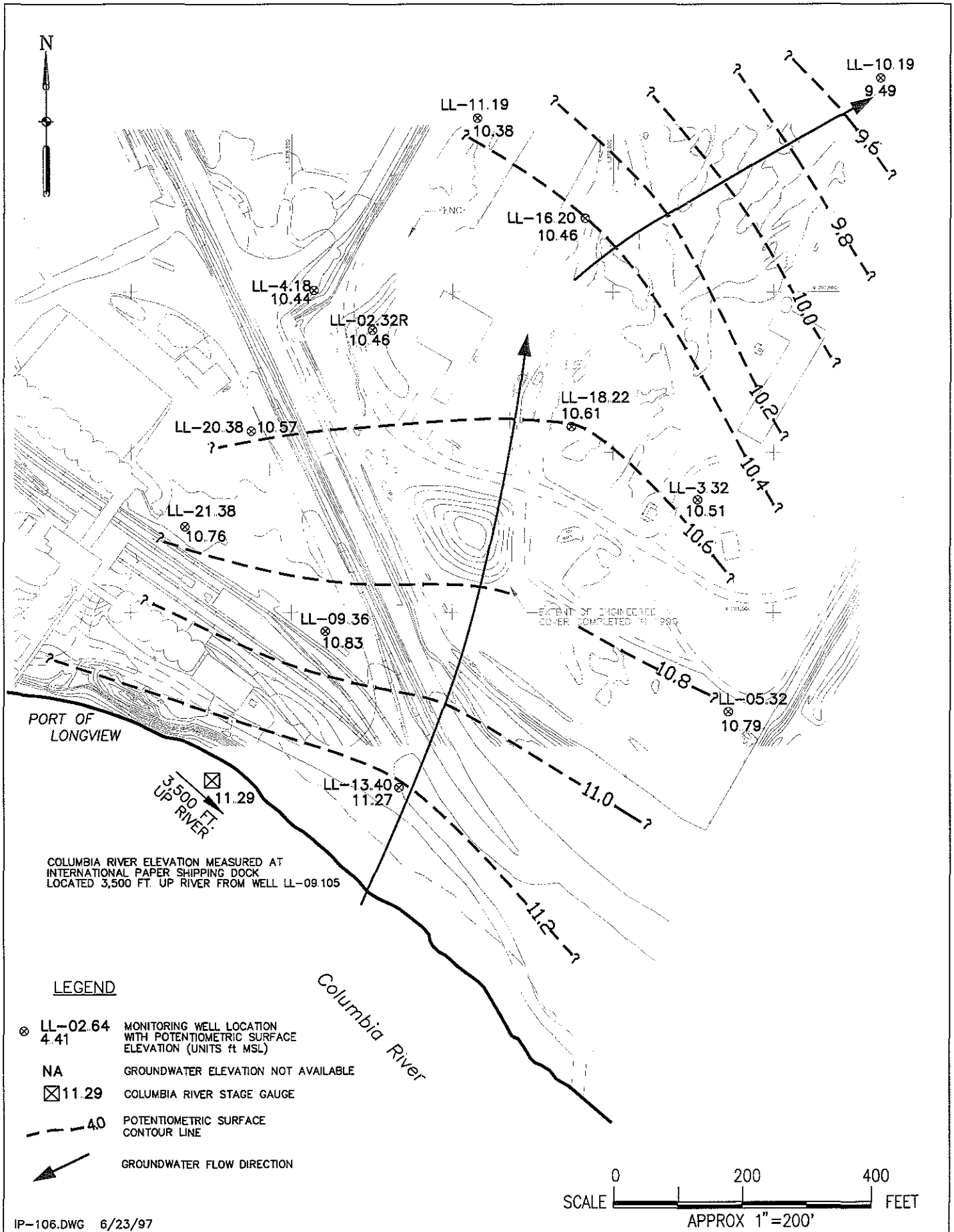
IP-83.DWG 5/05/97

International Paper Longview, WA	Project No. 91C0796B	Thickness of the Intermediate Silt	Figure 3-4
Woodward-Clyde			



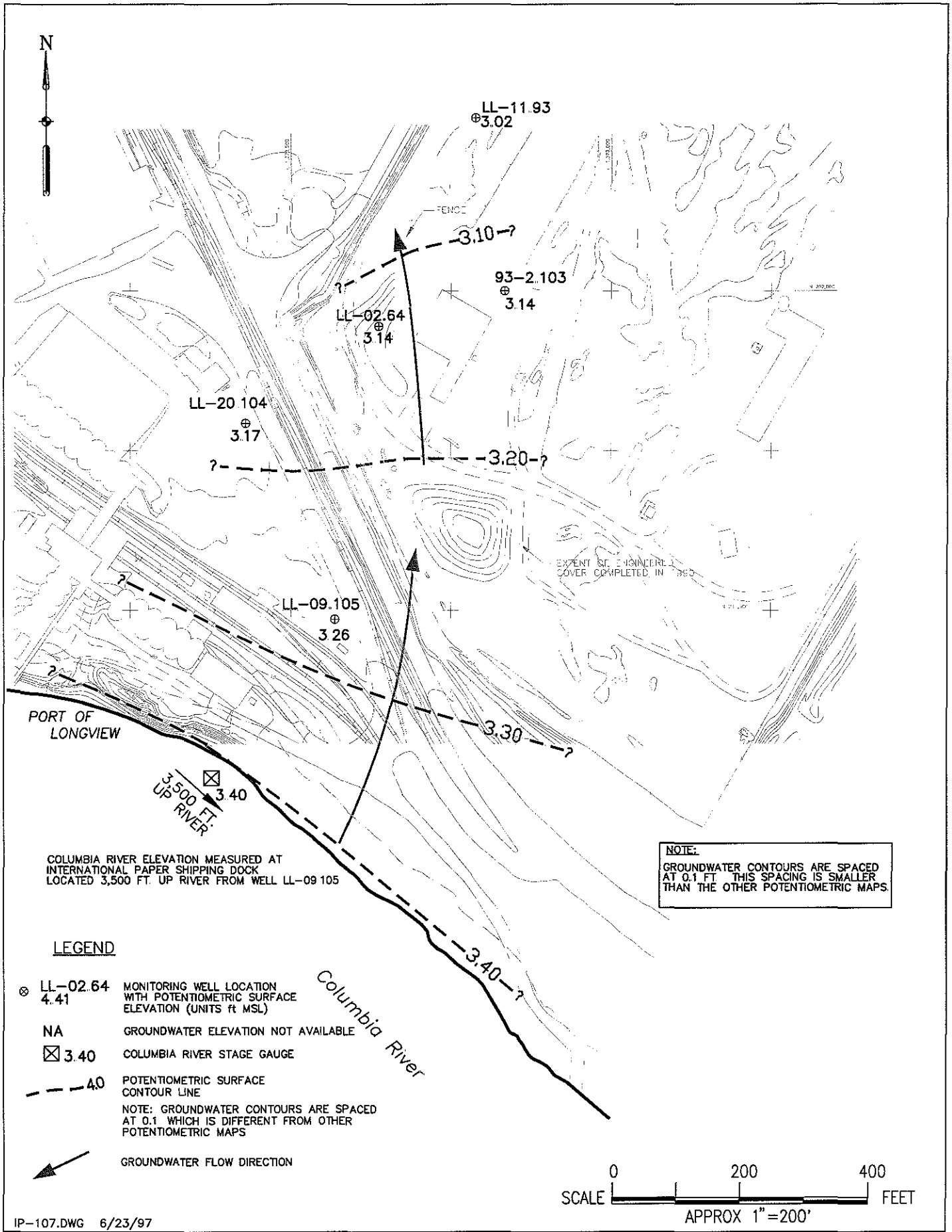
IP-105.DWG 6/23/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No 91C0796B	Fall 1995 Groundwater Potentiometric Map Aquifer A, 71 Hour Mean 10/2/95 – 10/4/95	Figure 3-5
Woodward-Clyde			



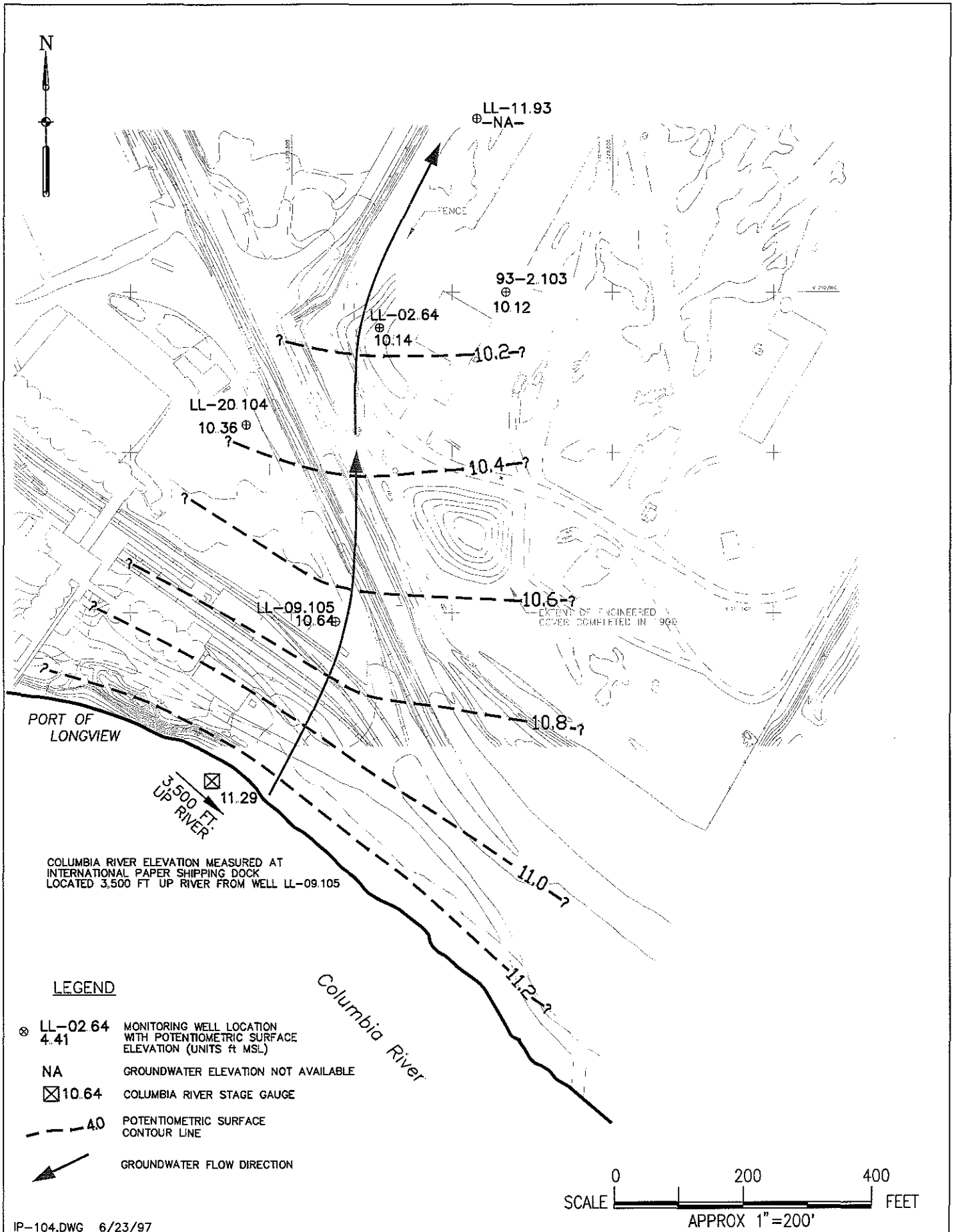
IP-106.DWG 6/23/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	Spring 1996 Groundwater Potentiometric Map Aquifer A, 71 Hour Mean 2/24/96 – 2/27/96	Figure 3-6
Woodward-Clyde			



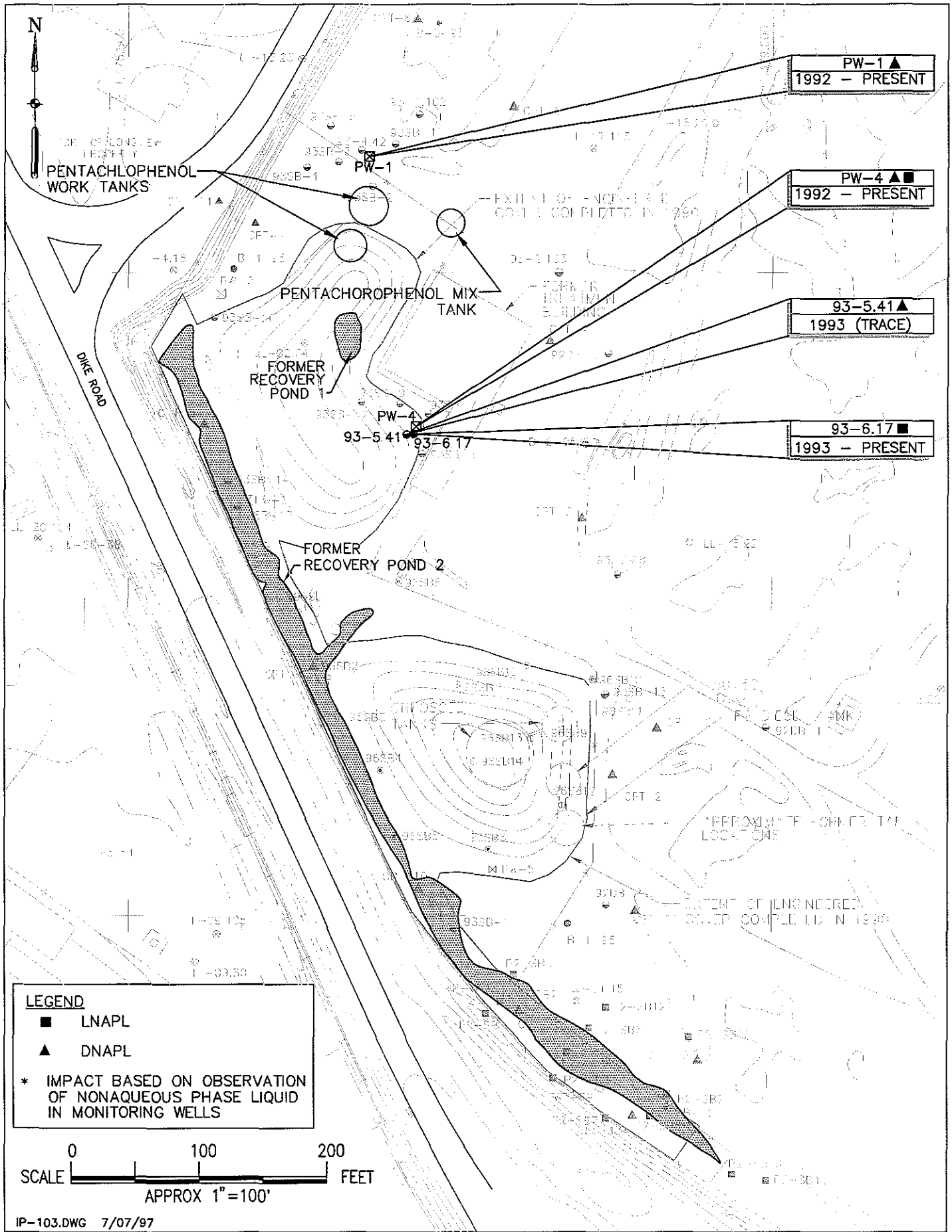
IP-107.DWG 6/23/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No 91C0796B	Fall 1995 Groundwater Potentiometric Map Aquifer B, 71 Hour Mean 10/2/95 – 10/4/95	Figure 3-7
Woodward-Clyde			



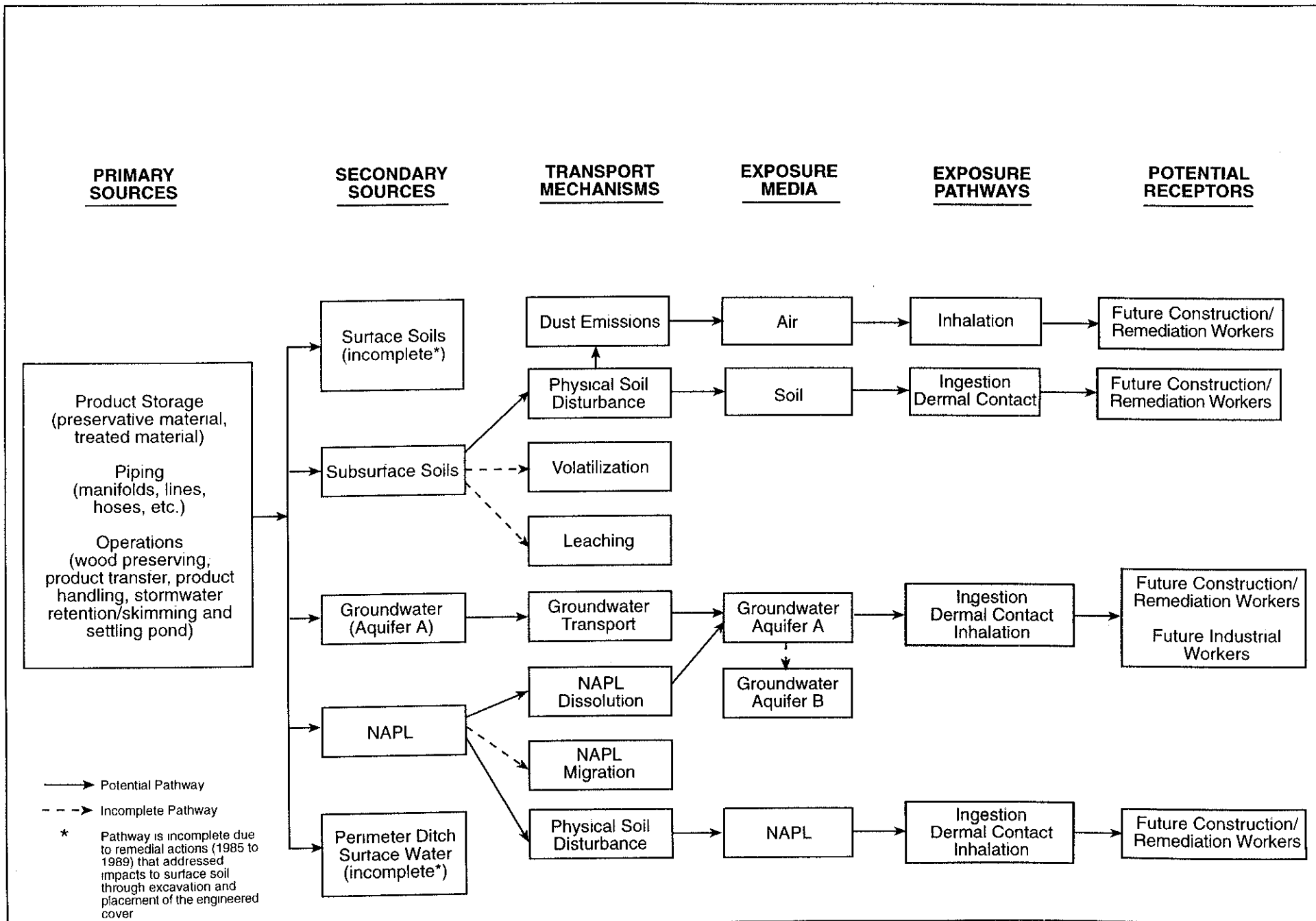
IP-104.DWG 6/23/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	Spring 1996 Groundwater Potentiometric Map Aquifer B, 71 Hour Mean 2/24/96 – 2/27/96	Figure 3-8
Woodward-Clyde			



IP-103.DWG 7/07/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	NAPL Impacts in the Former TWP Area	Figure 3-9
Woodward-Clyde			



International Paper Longview, WA	91CO796B/ 9605	Pre-Cleanup Action Fate and Transport Conceptual Site Model	Figure 3-10
Woodward-Clyde			

GR71/IP/01

The overall objective of the cleanup action for the former TWP area is to ensure long-term protection of human health and the environment in an industrial setting. Specific remedial action objectives (RAOs) for the cleanup action at the former TWP area were developed in the FFS based on the requirements for establishment of cleanup standards (WAC 173-340-700), the nature and extent of chemical impacts at the site, and the conceptual site model. The preferred cleanup action alternative was selected in the FFS to meet the project-specific RAOs.

The preferred cleanup action will include 1) physical containment of COCs, including both dissolved and free-phase constituents, within facility boundaries; 2) removal of LNAPL and DNAPL to the extent practicable; 3) *in situ* bioremediation using bioventing and air sparging, 4) institutional controls (i.e., deed restrictions) to limit intrusive activities in areas of impacted soil and groundwater and to protect the containment and treatment systems, and 5) long-term monitoring to document progress in achieving the cleanup goals. The overall approach and strategy for achievement of the cleanup action goals is presented in detail in Section 5.0.

4.1 RATIONALE FOR CLEANUP ACTION

The cleanup action is being implemented to address wood-treating chemicals in soils and groundwater resulting from operations in the former TWP area. Environmental investigations have established that the site hydrogeology, as outlined in Section 3.0, is characterized by a varied alluvial stratigraphy and is impacted by fluctuations in the stage of the nearby Columbia River.

The characterization work performed at the site to date, the conceptual site model, and the FFS shows that COCs are present in the northern portion of the property and are locally impacting groundwater. Although groundwater directly beneath the former TWP area is impacted, off-site migration has not been detected in recent years. Under present conditions, potential risks to human health and the environment are low, because all existing potential pathways appear to be incomplete. Potential long term-risks are also low because site use is expected to remain industrial, and no offsite migration of COCs at concentrations of concern is occurring.

Due to the low current and future risk posed by the site, the FFS identified physical containment, including a subsurface barrier wall and low permeability engineered cover, as the primary component of the preferred alternative. The containment will isolate the impacted soil and groundwater in the northern portion of the former TWP area and minimize the long-term potential for migration of impacted groundwater. In addition, NAPL removal, to the extent practicable, and bioremediation (aeration of the vadose and saturated zones) are included in the preferred alternative to remove free-phase COCs and attempt to reduce the mobility and toxicity of COCs remaining in soil and groundwater.

Performance of the containment system will be monitored over the long term to meet the post-closure groundwater monitoring requirements in WAC 173-303-610(7)(a,b). The monitoring program will also include compliance monitoring. Performance and compliance monitoring are described in detail in the PCMP and summarized in Section 6.0 of this document.

Based on the available data regarding the southern portion of the former TWP area, including: 1) the concentrations of COCs present, 2) the localized extent of COC impacts, 3) the absence of NAPL, 4) the conceptual site model, 5) industrial use of the area, and 6) the existing engineered

cover over much of the area, the impacts in the southern TWP area do not pose a current or long-term risk to human health or the environment Therefore, engineered containment is not justified for the southern portion of the TWP area. However, to maximize long-term protection, the southern portion of the site will be subject to deed restrictions and be included in the long-term monitoring program outlined in the PCMP.

As outlined in the PCMP, the point of compliance, where progress in achieving the cleanup goals discussed in Section 4.2 will be evaluated, will be the boundary of the deed-restricted portion of the International Paper property, which contains the former TWP area. As noted above, deed restrictions will be implemented as part of the cleanup action described in Section 5 0. The point of compliance will coincide with the outside boundary of the containment area along the western and northwestern sides of the former TWP area, but will be at distances of approximately 100 to 600 feet beyond the containment area boundary in other directions (Figure 4-1). In addition, the point of compliance will be outside the area of impacted groundwater.

4.2 SELECTION OF CLEANUP GOALS

Cleanup goals were established for the project based on discussions with Ecology and on the feasibility study process. These goals are outlined in the following subsections. The rationale for the cleanup goals includes:

- COCs exist at concentrations greater than MTCA cleanup levels in subsurface soils of the northern portion of the former TWP area, including below the water table, making removal actions or treatment impracticable or ineffective in meeting established cleanup criteria
- There is currently no risk to off-site receptors nor to on-site workers, because potential existing exposure pathways are incomplete
- The area will remain industrial in the long term
- Containment of COCs in the northern portion of the former TWP area is the only practical option to ensure long-term environmental protection
- For industrial property, containment of impacted media is an accepted alternative; in fact, under the national brownfields initiatives, containment is considered a presumptive remedy

Part of the cleanup rationale is the practical realization that soil and groundwater concentrations within the containment area will likely never achieve published MTCA cleanup criteria. Therefore, the cleanup goals are to:

1. Isolate the impacted soil and groundwater in the northern portion of the former TWP area and minimize the long-term potential for migration of impacted groundwater
2. Remove free-phase COCs, to the extent practicable, from within the containment area
3. Attempt to reduce the mobility and toxicity of COCs remaining within the containment area
4. Maximize long-term protection from isolated impacts by COCs in the southern portion of the former TWP area through deed restrictions and long-term monitoring

The effectiveness of the cleanup action will be assessed based on applicable state regulations, as outlined in Section 1.1. Monitoring will establish the physical performance of the cleanup action, as well as short and long-term progress toward meeting the cleanup goals.

4.2.1 Groundwater Cleanup Goals

Based on the existing and expected long-term industrial use of the site and the surrounding properties, Ecology has determined that the MTCA Method C industrial soil and Method C groundwater cleanup levels are appropriate for the deed-restricted portion of the International Paper property. Therefore, the MTCA Method C groundwater cleanup levels will be the long-term cleanup goals for groundwater within the deed-restricted area.

Due to concerns regarding potential future use of groundwater in the site area, Ecology has determined that the MTCA Method B groundwater cleanup levels will be applicable beyond the boundary of the deed-restricted area (which is the point of compliance). Therefore, except for TPH, which is discussed below, the MTCA Method B groundwater cleanup levels will be the long-term cleanup goals for groundwater beyond the point of compliance.

Because no MTCA Method B or C cleanup values exist for TPH, the Method A cleanup level will be used as the long-term cleanup goal for TPH. The TPH cleanup policy is currently undergoing revision by Ecology. Guidance for revised TPH soil cleanup levels has already been issued and complementary guidance regarding TPH groundwater cleanup levels is anticipated. Therefore, the long-term TPH groundwater cleanup goal for the site will be re-evaluated when applicable interim or final guidance becomes available from Ecology or when revisions to the MTCA cleanup regulations occur.

Because the point of compliance coincides with the boundary of the containment area along the north and northwestern sides of the former TWP area, the MTCA Method B groundwater cleanup levels will be considered the long-term goals for both performance and compliance monitoring.

The long-term cleanup goals may not be achieved at the point of compliance until the hydrogeologic system stabilizes following the cleanup action, which includes construction of the containment system and installation of the performance and compliance monitoring system. The stabilization of hydrogeologic conditions will be particularly important along the western and northwestern sides of the former TWP area, where the point of compliance will coincide with the boundary of the containment area.

Therefore, "trigger levels" and indicator parameters will be used to evaluate the chemical quality of the groundwater at the point of compliance. For the first five years (short-term), the goal for both performance and compliance groundwater monitoring is to demonstrate that groundwater concentrations are not consistently greater than the trigger levels. Achieving the short-term goal, based on the trigger levels, will demonstrate progress toward attainment of the long-term groundwater cleanup goals at the point of compliance.

As outlined in the PCMP, samples will be analyzed quarterly for at least the first two years for five indicator parameters (TPH, naphthalene, pentachlorophenol, benzo(a)anthracene, and chrysene) to evaluate groundwater quality.

These indicator parameters were selected in accordance with procedures outlined in WAC 173-340-708, and are based on toxicity, mobility, distribution, and source constituents. Selection of the indicator parameters is discussed in detail in the FFS (Woodward-Clyde 1997a). Chrysene will be included with the indicator parameters in addition to benzo(a)anthracene, because of its similar mobility in groundwater. One additional compound, acenaphthylene, that was used as an indicator parameter for the FFS fate and transport modeling, is not included in the list of indicator parameters because no cleanup levels have been established by Ecology or EPA for this compound.

The trigger levels and long-term cleanup goals for TPH, naphthalene, benzo(a)anthracene, chrysene, and pentachlorophenol are provided in Table 4-1. For benzo(a)anthracene and chrysene, the practical quantitation limit (PQL) listed in SW-846 (EPA n.d.) for Method 8310 will be used as the cleanup goals based on WAC 173-340-700(6) and WAC 173-340-707(2).

During the first five years (short-term) of monitoring, the trigger levels for the indicator parameters will be the MTCA Method C groundwater cleanup levels for PAHs and pentachlorophenol, and ten times the Method A cleanup levels for TPH. The factor of ten times greater than the long-term cleanup goal for TPH is warranted based on the FFS, including:

- The lack of complete exposure pathways for COCs for the site
- The variability in the existing groundwater chemical data
- The existing and expected long-term industrial uses of the site and the surrounding region

The use of these trigger levels as the monitoring goals for the first five years meets the objective of the cleanup action which is protection of human health and the environment in an industrial setting. The short-term trigger levels are also suitable for evaluation of the effectiveness of the cleanup action per MTCA requirements and of the objectives for performance and compliance monitoring outlined in the PCMP.

After the first five years of monitoring, the long-term cleanup goals (i.e., the MTCA Method B groundwater levels) will become the trigger levels. These cleanup goals will be re-evaluated over the performance and compliance monitoring period and adjusted, as appropriate, to address revisions in the MTCA cleanup regulations.

The short-term and long-term goals will also be protective of potential future groundwater users. As outlined in the PCMP, the trigger levels will be effective for evaluating the effectiveness of the cleanup action in the near term, and provisions are included in the PCMP for continued evaluation of the monitoring system and cleanup action to meet the long-term cleanup goals per the monitoring schedule. If any additional potential exposure pathways are identified in the future, the trigger levels and cleanup goals will be re-evaluated at that time.

The COCs for the site have been determined based on the assessment of groundwater and source chemical data that was presented in the FFS. The COCs, as stated in the FFS, are pentachlorophenol, PAHs, and TPH. Table 4-2 lists the COCs and their associated cleanup goals. In addition, the EPA list of priority pollutant compounds (see Appendix A of the PCMP) will be analyzed for on an annual basis to determine whether additional constituents need to be added to the list of COCs. Groundwater samples from one well, to be selected as discussed in the PCMP, will be analyzed for the priority pollutant compounds once per year.

If the exceedances of the trigger levels for groundwater are statistically significant according to the evaluation process outlined in the PCMP, which is based on MTCA and EPA statistical guidance, then an Additional Action Feasibility Study, as outlined in the PCMP, may be needed to evaluate further cleanup measures.

The cleanup goals within the containment area are the MTCA Method C groundwater cleanup levels. However, these levels might not be met in the near term or possibly even in the long term. No current technology will allow the practical reduction of the COCs to a point that will meet the cleanup criteria; therefore, containment technology was chosen. However, the implementation of aeration within the containment area should reduce the toxicity and the mobility of remaining contaminants.

4.2.2 Soil Cleanup Goals

The cleanup goals for soils both inside and outside the point of compliance will be the published MTCA Method C industrial soil cleanup levels (Ecology 1996). According to WAC 173-340-745(4)(a)(ii), the cleanup actions presented in Section 5.0 must also address protection of groundwater. The barrier wall will physically isolate the impacted soils in the northern portion of the former TWP area and prevent long-term impact to groundwater surrounding the containment area. The performance of the containment system will be documented through the monitoring program outlined in the PCMP.

Protection of groundwater from the isolated impacts by COCs in the southern portion of the former TWP area outside of the containment area will be addressed through the long-term monitoring program detailed in the PCMP and as discussed below. As discussed in the FFS, the COCs at the site have:

- Low solubility (i.e., a low potential to dissolve in water)
- High sorptivity (i.e., a high tendency to bind to soil and organic matter)

Therefore, leaching of COCs to groundwater is unlikely and soil cleanup levels based on protection of human health are sufficiently protective for this site. Specifically, protection of groundwater outside the containment area will be evaluated through:

- Chemical monitoring of groundwater in the southern portion of the former TWP area, as discussed in Section 6.0 and the PCMP
- Modeling of COC transport in groundwater and the Additional Action Feasibility Study process, if groundwater concentrations in the southern TWP area are greater than the cleanup goals

AAFS

The groundwater sampling and modeling data, as appropriate, will be used to demonstrate that the isolated concentrations of COCs in the southern TWP area do not pose a potential threat to area groundwater.

If soils that are visibly impacted by contaminants are encountered during construction of the barrier wall, the course of action will depend on the location of the impacted soils:

- If the visibly impacted soil is along the boundary with Port of Longview property, the area of impacted soil will be noted and construction of the wall will continue. The impacted area would then be evaluated using the Additional Action Feasibility Study process.
- If the visibly impacted soils are within the deed-restricted area, construction of the barrier wall will be stopped and evaluation of the nature and extent of the visual impact will be conducted. The evaluation will include trenching to delineate the area and volume of impacted soil, and whether re-alignment of the barrier wall to include the area of visually impacted soil is appropriate.

Any visibly impacted soil excavated during construction of the barrier wall will be placed within the containment area and will not be included in the soil bentonite mix used for wall construction.

Table 4-1
GROUNDWATER CLEANUP GOALS AND TRIGGER LEVELS
FOR INDICATOR PARAMETERS

INDICATOR CONSTITUENTS	CLEANUP GOALS		TRIGGER LEVEL[a] (ppb)
	MTCA METHOD B (ppb)	MTCA METHOD C (ppb)	
naphthalene	320	700	700
benzo(a)anthracene	0.012 0.13 (PQL)	0.12 0.13 (PQL)	0.13 (PQL)
chrysene	0.012 0.13 (PQL)	0.12 0.13 (PQL)	0.13 (PQL)
pentachlorophenol	0.729	7.29	7.29
TPH	1000[b]	1000[b]	10,000

Notes:

a. Trigger levels for the first five years of monitoring. After five years the cleanup goals will become the trigger levels

b. Cleanup levels are based on the MTCA Method A cleanup standards. TPH cleanup levels/goals will be re-evaluated when applicable interim or final guidance becomes available from Ecology

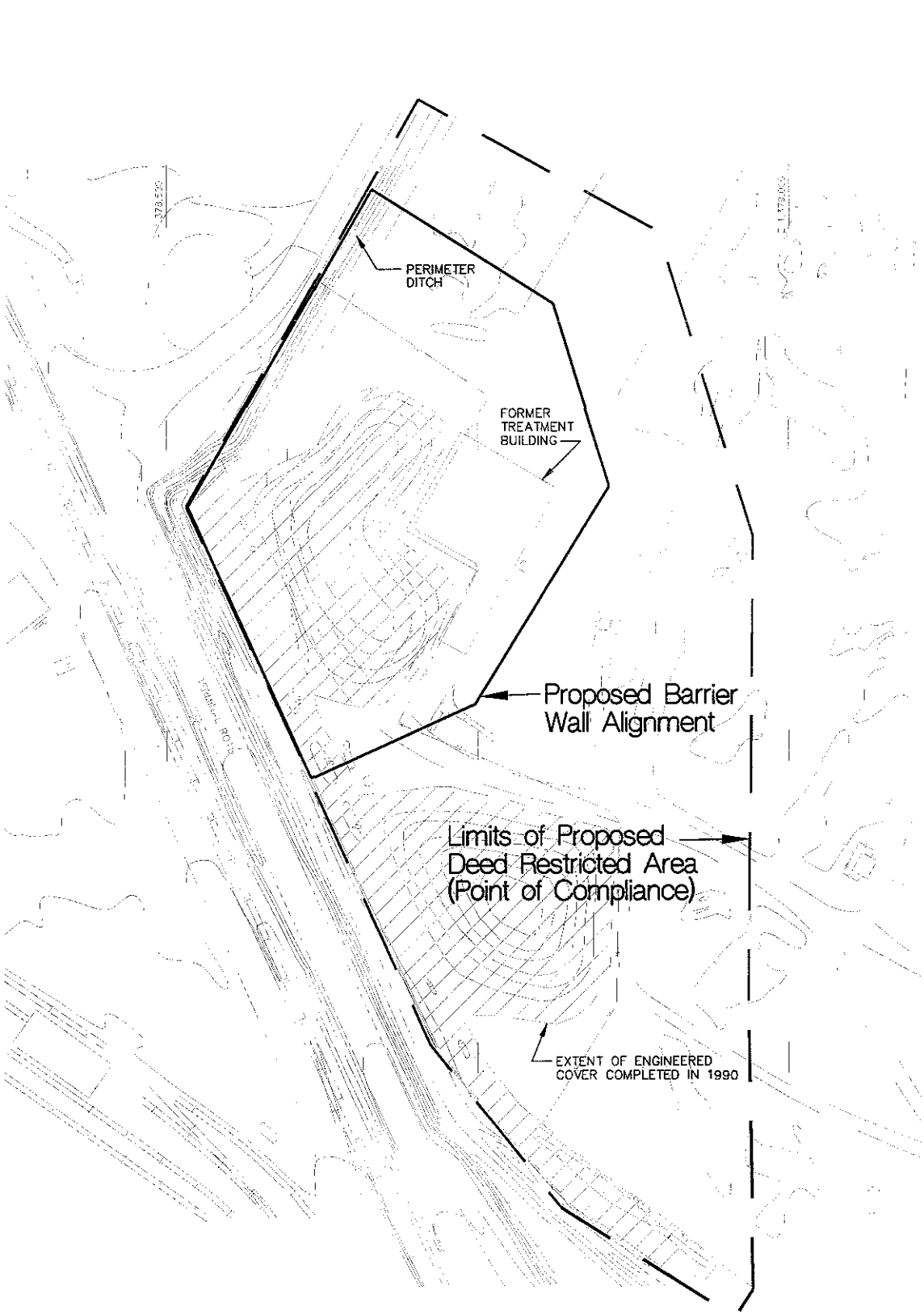
PQL: Practical Quantitation Limit, Method 8310 (SW-846) will be used as the cleanup goals and trigger level based on WAC 173-340-700(6) and 173-340-707(2)

Table 4-2
GROUNDWATER CLEANUP GOALS FOR CHEMICALS OF CONCERN

CONSTITUENTS OF POTENTIAL CONCERN	CLEANUP GOALS (ppb)		TRIGGER LEVEL[a](ppb)
	COMPLIANCE GOAL MTCA B	PERFORMANCE GOAL MTCA C	
Polynuclear aromatic hydrocarbons (PAHs)			
acenaphthene	960	2100	2,100
anthracene	4800	10500	10,500
benzo(a)anthracene	0.012 0.13 (PQL)[b]	0.012 0.13 (PQL)[b]	0.13 (PQL)[b]
benzo(a)pyrene	0.012 0.13 (PQL)[b]	0.012 0.13 (PQL)[b]	0.13 (PQL)[b]
benzo(b)fluoranthene	0.012 0.13 (PQL)[b]	0 012 0.13 (PQL)[b]	0.13 (PQL)[b]
benzo(k)fluoranthene	0.012 0.13 (PQL)[b]	0.012 0.13 (PQL)[b]	0.13 (PQL)[b]
chrysene	0.012 0.13 (PQL)[b]	0 012 0.13 (PQL)[b]	0.13 (PQL)[b]
dibenzo(a,h)anthracene	0 012 0.13 (PQL)[b]	0.012 0.13 (PQL)[b]	0.13 (PQL)[b]
indeno(1,2,3-cd)pyrene	0.012 0.13 (PQL)[b]	0.012 0.13 (PQL)[b]	0.13 (PQL)[b]
benzo(g,h,i)perylene	480[c]	1050[c]	1,050
carbazole	4.37	43.8	43.8
dibenzofuran	64[d]	140[d]	140
fluoranthene	640	1400	1,400
fluorene	640	1400	1,400
2-methylnaphthalene	320[e]	700[e]	700
naphthalene	320	700	700
phenanthrene	480[c]	1050[c]	1,050
pyrene	480	1050	1,050
pentachlorophenol	0.729	7.29	7.29
TPH	1000[f]	1000[f]	10,000

Notes:

a. Trigger levels for the first five years of monitoring. After five years the cleanup goals will become the trigger levels
b Practical Quantitation Limit, Method 8310 (SW-846) will be used as the cleanup goals and trigger level based on WAC 173-340-700(6) and WAC 173-340-707(2)
c Cleanup goal based on value for pyrene
d Cleanup goal calculated based on a provisional oral RfD of 0 004 mg/kg-day available from the EPA National Center for Environmental Assessment Superfund Health Risk Technical Support Center (cited in EPA Region III RBC table) and MTCA B and C formulas. Source: Ecology 1996
e Cleanup goal based on value for naphthalene
f. Cleanup levels are based on the MTCA Method A cleanup standards



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SCALE FEET

IP-112.DWG 6/24/97

INTERNATIONAL PAPER LONGVIEW, WA	Project No 91C0796B	Proposed Barrier Wall Alignment and Point of Compliance Former TWP Area	Figure 4-1
Woodward-Clyde			

5.1 OVERALL CLEANUP ACTION STRATEGY

The goal of the cleanup action is to provide environmental protection and to mitigate releases of wood-treating chemicals to soils and groundwater that have resulted from operations in the former TWP area. Long-term monitoring will be used to evaluate the effectiveness of the remedy.

The FFS evaluated three potential remedial alternatives for the former TWP area. All three options included NAPL recovery, a low-permeability engineered cover, institutional controls, and long-term monitoring. Option one included a subsurface barrier wall as a physical containment technology, and vadose zone and saturated zone aeration as an *in situ* bioremediation technology. Option two included the subsurface barrier wall as physical containment with no bioremediation, while Option three included vadose zone and saturated zone bioremediation with no physical containment. After evaluation of each option per WAC 173-340-360, Option one was chosen as the most appropriate remedial alternative for the site. The components of this selected cleanup action are described below and are discussed in detail in the EDR.

The cleanup action will consist of physical containment of dissolved and free-phase COCs, NAPL removal to the extent practicable, and *in situ* bioremediation within the containment area; deed restrictions; and performance and compliance monitoring (Woodward-Clyde 1995b). The monitoring program is discussed in Section 6.0 and detailed in the PCMP. The containment/treatment system for the northern portion of the former TWP area will include:

- A subsurface low permeability barrier wall to physically limit migration of COCs
- Replacement of the existing engineered cover within the containment area with a new cover that will tie into the barrier wall and minimize infiltration of precipitation into the contained area
- *In situ* bioremediation to enhance natural attenuation of COCs in soil and groundwater
- NAPL recovery to remove free phase COCs, to the extent practicable, if NAPL is encountered during construction. The ongoing LNAPL recovery program will be evaluated and may be replaced by a mechanical system, if appropriate.
- Deed restrictions stating the site will remain industrial and to limit disruption of the containment/treatment and monitoring system

As discussed in Section 4.0, the localized impacts by COCs in the southern portion of the former TWP area do not pose a current or long-term risk to human health or the environment. Therefore, further engineered containment and treatment is not justified for the southern portion of the TWP area. However, to maximize long-term protection, the southern portion of the site will be subject to deed restrictions and be included in the long-term monitoring program.

As outlined in the PCMP, groundwater in the southern portion of the former TWP area will be monitored for COCs as part of the compliance monitoring program. The monitoring data from the southern portion of the former TWP area will be compared to the appropriate cleanup goals, discussed in Section 4.2.1, to evaluate the natural attenuation of COCs and progress toward meeting the long-term cleanup goals.

5.2 CLEANUP ACTION

This section includes a brief discussion of the design criteria and description of each major component of the cleanup action. A detailed discussion of the design is presented in the EDR.

The design criteria for the cleanup action include containment of dissolved and free phase COCs in the northern portion of the former TWP area, NAPL removal to the extent practicable, and enhancement of natural biodegradation to attempt to reduce the toxicity of COCs remaining within the containment area.

5.2.1 Soil-Bentonite Barrier Wall

As detailed in the EDR, a soil-bentonite barrier wall of low permeability will be used to physically enclose the northern portion of the former TWP area (Figure 4-1). The purpose of the barrier wall is to isolate soils and groundwater impacted with COCs from the former TWP operations, thereby minimizing potential migration of the associated chemicals beyond the point of compliance.

The soil-bentonite barrier wall will be constructed by excavating a trench along the wall alignment and will extend in depth to the Intermediate Silt layer. The alignment of the barrier wall was determined based on the results of soil and groundwater investigations conducted to date. The material excavated from the trench will be mixed with bentonite and water to form a low permeability soil-bentonite mix. The soil-bentonite mix will be designed to provide an average in-place permeability of 10^{-6} cm/sec and a maximum in-place permeability of 10^{-5} cm/sec through the wall. The wall will have a minimum thickness of 3 feet. Based on the design properties for the barrier wall and the average linear horizontal velocity of 0.01 feet per year for migration of naphthalene presented in the FFS, naphthalene would require 300 years to migrate through the barrier wall.

Soils excavated during construction of the barrier wall be visually assessed for evidence of contamination as discussed in Section 5.1 of the EDR. Any visually impacted soil encountered during excavation will be segregated for incorporation under the engineered cover and will not be included in the soil bentonite mix for the barrier wall. The approach that will be used to address the visually impacted soil is also presented in Section 4.2.2.

5.2.2 Low-Permeability Engineered Cover

Much of the area to be contained is presently covered by a low-permeability engineered cover installed as part of closure activities in 1989–1990 (Figure 2-3). As outlined above, placement of a new cover over the entire area within the barrier wall alignment is a component of the cleanup action. The existing cover will be cut in the vicinity of the barrier wall. Within the containment area, the existing cover will be left in place to the extent practicable. After construction and grading, a new engineered cover will be placed over the containment area and tied into the barrier wall. The objectives of the engineered cover are to minimize surface water infiltration into the area confined by the barrier wall, to minimize potential contact with impacted soil, and to allow future industrial use of the site. The existing cover will be left in place in the southern portion of the TWP area beyond the containment area.

The engineered cover will consist of a geomembrane, a sand drainage layer, a geotextile separation fabric, and topsoil. A 30-mil polyvinyl chloride (PVC) geomembrane was selected for the engineered cover because it provides a satisfactory reduction in infiltration and is significantly less expensive and easier to work with during construction than HDPE. A sand drainage layer 1 foot thick will overlie the geomembrane to provide drainage of water off of the geomembrane, and to protect the geomembrane during construction and final grading. The sand will consist of less than five percent material finer than the U.S. Standard #200 Sieve.

Preliminary grading of the area within the alignment of the barrier wall will be performed during construction. The purpose of preliminary grading is to prepare a foundation for the engineered cover so that the 30-mil PVC geomembrane will be sloped upon placement to provide adequate drainage of precipitation. The slopes will be constructed at a minimum of two percent to provide for drainage, and a maximum of six percent to ensure stability along the geomembrane-soil interfaces and to minimize final grading required to accommodate potential future uses of the site. The excess soil from the barrier wall excavation and backfill mixing operations will be spread and compacted within the barrier wall boundaries

Final grading will be performed to minimize ponding of surface water. The slopes will be graded to promote surface runoff away from the containment area. Water from surface runoff and the sand drainage layer will drain onto the native soils surrounding the containment area. The former TWP area will be hydroseeded with grasses following construction to mitigate erosion.

5.2.3 *In Situ* Biosparging/Bioventing

As discussed in the EDR, the containment system is designed to minimize COC migration from the site area and minimize the recharge of groundwater through the vadose zone in the northern portion of the former TWP area. *In situ* enhanced biodegredation using bioventing/biosparging also will be used to mitigate the most mobile COCs. The COCs at the facility have varying physical properties and mobility. The objective of the biosparging/bioventing system will be to enhance degradation of those COCs which are most mobile. These include the single- and double-ring PAHs and the single-ring aromatic hydrocarbons. Low rates of biodegredation of single- and double-ring PAHs have been observed during *in situ* bioventing at wood-preserving sites (Gentry and Simpkin 1995). Biosparging has been shown to be effective in laboratory tests of total PAHs from wood-preserving sites (Mueller et al. 1995). Biosparging and bioventing have been shown to be very effective at remediating single-ring aromatic compounds without nutrient addition (USAF 1992). However, carcinogenic PAH (cPAH) remediation has been shown to be limited under the proposed remediation approach (Gentry and Simpkin 1995).

No data are available on the presence or absence of biological activity on the site. Therefore, the observational/streamlined approach has been incorporated into the basis of design (EPA 1989a). The observational/streamlined approach provides a means of building the required degree of flexibility into the planning and implementation of an environmental restoration project to overcome potential deviations in expected site conditions. The performance specifications will offer flexibility in the design and implementation of the cleanup action. For example, specifications for the air sparging unit will accommodate a range of soil permeabilities. In addition, the biosparging system can accommodate the addition of gas phase nutrients, if appropriate. The passive bioventing system can accommodate the addition of active bioventing

by adding a blower because the piping system for active bioventing will already be in place. Active bioventing in the Upper Sand may be initiated only if either: 1) additional LNAPL is observed in Aquifer A and the most likely source is the Upper Sand or 2) concentrations of the most mobile COCs in Aquifer A are not decreasing over time as the result of untreated source areas in the Upper Sand, and if annual testing of bioventing wells indicates that oxygen-limited conditions in the Upper Sand are the cause of either condition 1 or 2. A bioventing evaluation will be performed after one year of operation in accordance with procedures to be developed in the operation and maintenance plan. Data collection and evaluation during system startup are discussed in the PCMP. No additional bioventing/biosparging wells will be installed within the containment area after system startup.

The biosparging/bioventing system will include a series of approximately 10passive bioventing wells screened in the Upper Sand and approximately 7biosparging/venting wells screened in the upper portion of Aquifer A. The wells will be located in the primary source areas identified in Section 3.3.1, where COCs in soil are greater than the appropriate MTCA cleanup levels. The biosparging/bioventing system layout is shown in Figure 5-1 Two additional vents will also be installed for the engineered cover In addition, if significant visual contamination is encountered during construction of the barrier wall, placement of additional biosparging wells will be considered.

Bioventing wells will not be screened across the Upper Silt layer In addition, bioventing wells will not be located in areas where the Upper Sand is less than 5 feet thick The venting wells for the biosparging system, which will be located in the upper portion of Aquifer A, may be in the saturated zone most of the year However, they will still provide an escape pathway for air injected into the aquifer with the sparging wells.

It is anticipated there will not be a significant hydraulic gradient across the site, due to the barrier wall. As such, the electron acceptor for bioremediation (oxygen) will be supplied in Aquifer A utilizing air sparging wells. Atmospheric air will be sparged approximately 15 feet below the Upper Silt layer. Oxygen will dissolve into the aqueous phase within the radius of influence of the sparging well The Aquifer A venting system will discharge carbon dioxide generated during aerobic biological activity, as well as low levels of COCs, which may volatize into the sparged air. Both systems will be operated to limit release of COCs to the atmosphere by adjusting air flows to the sparging wells. Therefore, no off-gas treatment is proposed.

No nutrient addition is proposed, based on data from other wood-preserving sites (Mueller et al. 1995). However, baseline and operation nutrient analysis will be performed during system start-up, as noted in the PCMP. Gas phase nutrients will only be added to the biosparging system if the annual system evaluation indicates concentrations in groundwater of the most mobile COCs are not decreasing as the result of nutrient limiting conditions.

A Notice of Construction for the biosparging/bioventing system will be submitted to the Southwest Washington Air Pollution Control Authority

5.2.4 NAPL Recovery System

Nonaqueous phase liquids have been detected at two locations within the northern portion of the former TWP area including the area of wells 93-6.17 and PW-4, and at the former location of

pumping well PW-1. LNAPL has been detected only at wells 93-6.17 and PW-4. An Interim Action, including bailing to the extent practicable and use of absorbent tubes, is in progress to recover the LNAPL in wells 93-6.17 and PW-4.

The Interim Action has removed approximately 70 gallons of LNAPL, with some water, since December 1996, and the thicknesses of LNAPL in wells 93-6.17 and PW-4 are less than detectable levels (Woodward-Clyde 1997c). The Interim Action, including the use of absorbent tubes for LNAPL recovery, will continue through construction of the containment system for the northern portion of the former TWP area.

DNAPL has been detected in PW-1 during monitoring events since 1993, but has been detected only sporadically in PW-4. As discussed in the various documents describing the nature and extent of chemical impacts at the site, the site data indicates that the source of the DNAPL in these wells is leakage from the Upper Silt aquitard through the annular seals and into the former pumping wells (Woodward-Clyde 1994, 1997a, and 1997c) To mitigate further migration of the DNAPL at PW-1, the well has been abandoned. Well PW-4 has been retained for the LNAPL recovery Interim Action and has not indicated the presence of DNAPL since 1994. The DNAPL evaluation/recovery measures during the cleanup action will focus on the upper surface of the Upper Silt aquitard at the base of the Upper Sand.

If NAPL is encountered during construction, evaluation and recovery will be initiated, to the extent practicable. The biosparging/bioventing wells will be located in the areas where NAPL has been detected, including the area of 93-6.17 and PW-4 and at PW-1, and where the presence of NAPL has been suspected due to available soil and groundwater data (at PW-3 and the LL-02 well cluster). The wells will be the primary methodology for NAPL evaluation/recovery. The bioventing wells will be positioned in the Upper Sand to evaluate the potential for DNAPL on the upper surface of the Upper Silt aquitard. The biosparging wells will be screened across the water table near the top of the Lower Sand Aquifer to evaluate the potential presence of LNAPL.

The bioremediation wells will be monitored during and following installation for the presence of NAPL, as outlined in the PCMP. If recoverable NAPL is encountered, recovery techniques will be utilized to the extent practicable, including:

- Initial NAPL recovery manually, as being performed for the ongoing LNAPL Interim Action at wells 93-6.17 and PW-4 (Woodward-Clyde 1996c)
- Follow-up product recovery, if necessary, will be made using absorbent tubes capable of absorbing LNAPL or DNAPL. A mechanical recovery system will be evaluated and implemented, based on discussions with Ecology, if appropriate.
- Spent absorbent tubes will be transferred into a drum with secondary containment and removable rain cover for appropriate off-site disposal
- Routine monitoring during site visits

The containerized NAPL will be transferred periodically by a hazardous waste transporter to a licensed treatment, storage and disposal facility.

If NAPL is encountered during excavation or grading for the containment system, evaluation and recovery will also be initiated, to the extent practicable. Options for evaluation or recovery could include installation of additional shallow wells or infiltration trenches. If NAPL is encountered

in recoverable quantities along the outer margin of the barrier wall alignment, the wall will be re-aligned to include the impacted area, if possible. The appropriateness of any actions would be evaluated based on the site conditions, property ownership and access, the type and extent of the impact, and overall impact on the objectives of the cleanup actions.

5.2.5 Deed Restrictions

Deed restrictions will be imposed for both the containment area and the southern portion of the former TWP area to limit the possible disruption of :

- The containment, biotreatment, and monitoring systems
- Isolated areas of soil impacts in the southern portion of the former TWP area
- Residual impacts to groundwater on International Paper property

The restrictions will include legal and/or administrative measures limiting use of the property to industrial purposes and restricting activities that may disturb the containment area or impacted groundwater. Activities that will be prohibited will include:

- Subsurface intrusion such as drilling, excavation, and grading activities
- Construction of structures that require subsurface foundations, such as below-grade footings or pilings

Following completion of the cleanup action, the site will be suitable for surface development and usage with appropriate authorization.

5.2.6 Performance/Compliance Monitoring

The objectives of performance/compliance monitoring are to 1) demonstrate that the containment system is performing as designed to prevent migration of COCs, 2) monitor the quality of groundwater migrating beyond the deed-restricted area, and 3) document constituent migration and attenuation, if any. The monitoring plan is summarized in Section 6.0 of this CAP, and is described in detail in the PCMP

5.3 PERIODIC REVIEW

Although the site will be under continuous performance and compliance monitoring during the remediation, Ecology will review the cleanup action every five years after the initiation of the remediation according to WAC 173-340-420. Ecology's review will evaluate whether human health and the environment are being protected during the cleanup action.

5.4 COMPLIANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL LAWS

Model Toxics Control Act regulations (WAC 173-340-710[1][a]) require that cleanup actions conducted under MTCA comply with applicable state and federal laws. Applicable state and federal laws include legally applicable requirements and those requirements that Ecology has determined are relevant and appropriate.

As part of the FFS and CAP process, applicable or relevant and appropriate requirements (ARARs) were assessed. These included local, state, and federal requirements. Potential ARARs for the selected cleanup action are listed below. Responsibility for determining the final ARARs list lies with Ecology (WAC 173-340-710[1][b])

Potential ARARs:

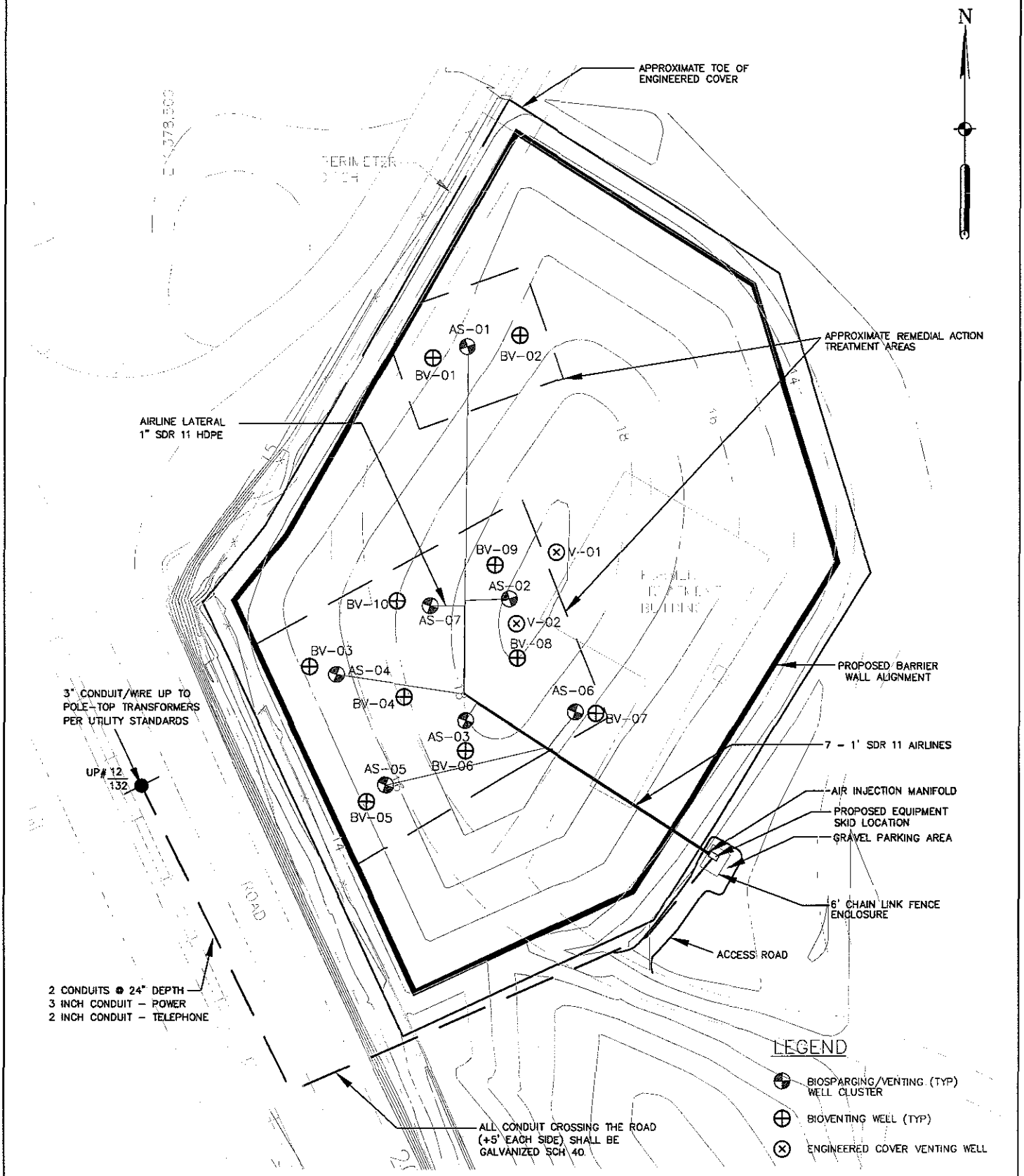
- City and County laws and regulations:
  - Cowlitz County Clearing and Grading Code
  - Cowlitz County Sensitive Areas Ordinance
  - Cowlitz County Building and Construction
- State laws and regulations:
  - Washington State Environmental Policy Act (SEPA) (RCW 43 21; WAC 197-11)
  - Washington State Executive Order 90-094: Protection of Wetlands
  - Washington State Dangerous Waste Regulations (WAC 173-303)
  - Washington State Model Toxics Control Act Cleanup Standards (WAC 173-470)
  - Washington State General Safety and Health Standards (WAC 296-24)
  - Washington State General Occupational Health Standards (WAC 296-62)
  - Washington Industrial Safety and Health Act (WISHA)
  - Washington Clean Air Act (RCW 70 94)
- Federal Laws and Regulations:
  - Occupational Safety and Health Act (OSHA, 29 CFR, subpart 1910.120)

Under MTCA (RCW 70.1050.090), this cleanup will not need to meet the procedural requirements but will have to meet the substantive provisions of specific state laws and any laws requiring or authorizing local government permits or approvals for remedial actions. The Agreed Order for this project specifically addresses this issue (Section IV - Terms and Conditions of Order, Number 12 - Compliance With Other Applicable Laws). The Order requires International Paper to determine whether permits or approvals addressed in RCW 70 105D.090(1) would otherwise be required for the cleanup action. If so, Ecology shall be notified and Ecology will then determine whether International Paper or Ecology will contact the appropriate state and/or local agencies. A final determination on the substantive requirements will be made by Ecology based on written documentation from the agencies in question. Once established by Ecology, the requirements become enforceable under the consent decree.

Permit requirements were evaluated as part of the design for the cleanup action at the former TWP area of the Longview facility. This evaluation showed that the following permits would likely be required:

- Grading Permit (from Cowlitz County Building and Planning)
- Building Permit if a permanent structure is needed for the biosparging/bioventing system (from Cowlitz County Department of Building and Planning)

- NPDES Construction Site Permit, for stormwater runoff (from Ecology)
- Notice of Construction per WAC 173-400 for submittal to Southwest Washington Air Pollution Control Authority
- Wetlands delineation/notification for submittal to the U.S. Army Corps of Engineers, Seattle District



NOTE: LAYOUT MAY BE MODIFIED TO EXTEND TO AREAS OF VISIBLE CONTAMINATION ENCOUNTERED DURING EXCAVATION OF BARRIER WALL.

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International Paper Longview, WA	Project No 91C0796B	Bioventing/Biosparging System
Woodward-Clyde		Figure 5-1

A PCMP has been developed as a separate document to meet the applicable requirements of WAC 173-340-400(4)(c)(x) - Cleanup Action Monitoring, WAC 173-340-410 - Compliance Monitoring, WAC 173-303-645(8) - General Groundwater Monitoring Requirements, and WAC 173-303-645 (11)(d) - Corrective Action Monitoring, for the cleanup action for the former TWP area. This section briefly summarizes the PCMP.

6.1 MONITORING APPROACH AND OBJECTIVES

The PCMP establishes the objectives for and outlines components of the performance and compliance monitoring program for the cleanup action at the former TWP area. The PCMP outlines the process by which the monitoring data will be evaluated to assess the effectiveness of the cleanup action, and to assess compliance. The overall PCMP, as well as the monitoring system, will be evaluated throughout implementation of the cleanup action and will be modified as appropriate.

6.1.1 Purpose and Objectives

The purpose of the PCMP is to describe how monitoring will demonstrate the effectiveness of the cleanup action at the former TWP area, and show progress toward attainment of the cleanup goals. The specific objectives of performance and compliance monitoring for the cleanup action containment system are:

- To demonstrate that the containment system is performing as designed to prevent migration of COCs (performance monitoring)
- To monitor the quality of groundwater migrating off-site (as defined by the deed-restricted area) and to document constituent migration and attenuation, if any (compliance monitoring)
- To show that the bio-treatment system is performing as designed to facilitate COC mobility reduction in the saturated and vadose zones within the containment area
- To demonstrate progress toward meeting the long-term MTCA Method B groundwater cleanup standards at the deed-restricted area boundary

The data quality objectives for the chemical monitoring are specified in the Quality Assurance Project Plan, which is Appendix A of the PCMP.

6.2 PERFORMANCE AND COMPLIANCE MONITORING

Groundwater performance and compliance monitoring will be conducted simultaneously using a system of performance/compliance monitoring wells. The performance and compliance monitoring period will start after installation of the performance/compliance monitoring well network and will continue for a minimum of 30 years. Performance and compliance monitoring will continue for 30 years or until the biotreatment performance monitoring demonstrates that the mobility of COCs within the source area (inside the barrier wall) has declined and no longer represent a threat to groundwater quality in the area. Data analysis and evaluation procedures to confirm compliance are presented in the PCMP. In accordance with WAC 173-340-420,

Ecology will conduct a periodic review of the cleanup action at least once every five years following installation of the performance/compliance monitoring network.

The bioventing/biosparging system will be monitored during startup to optimize performance of the system. The system monitoring will focus on measurement of oxygen and carbon dioxide concentrations in gases vented to the atmosphere and adjustments necessary to air flow and pressure to optimize the oxygen and carbon dioxide balance.

6.3 PERFORMANCE/COMPLIANCE MONITORING SYSTEM

Groundwater chemical monitoring of Aquifer A and B wells will take place quarterly during at least the first two years of performance and compliance monitoring, as described in Section 3.4 of the PCMP. After the two-year review, if the analysis of data from Aquifer A wells demonstrates that no COCs are migrating from the containment area at concentrations exceeding the trigger levels, the frequency of sampling will decrease to annual in those wells. After the first five-year periodic review of the cleanup action, Ecology and International Paper will evaluate the monitoring results and determine whether decreased frequency (e.g., five-year monitoring) of groundwater monitoring is warranted. Figures 3-3 through 3-6 of the PCMP show the process for evaluating the monitoring data. If the analysis of performance monitoring data demonstrates that no COCs are migrating to Aquifer B from the containment area at concentrations exceeding the trigger levels, monitoring of the well(s) completed in Aquifer B may be suspended, unless analyses from the paired well completed in Aquifer A indicate COCs are migrating from the containment area.

Each performance/compliance monitoring well will be inspected and sampled according to the Field Sampling Plan, which is Appendix B to the PCMP. One water sample will be collected from each well per sampling event. The proposed locations of the performance and compliance wells are shown on Figure 6-1.

To evaluate groundwater quality, samples will be analyzed quarterly for at least the first two years for the five indicator parameters listed in Table 4-1. In addition, a groundwater sample from one well will be collected and analyzed annually for the list of priority pollutant compounds (Table A-3 in Appendix A of the PCMP). COCs for the site have been determined based on the assessment of groundwater and source chemical data that was presented in the FFS. The data collected in the former TWP area indicate that, due to former wood-treating activities, site soils and groundwater have been impacted with pentachlorophenol, PAHs, and TPH. The sampling schedule is presented in detail in the PCMP.

Groundwater chemical monitoring will be accomplished using the following wells:

- Six well pairs spaced at intervals outside of the containment area; each pair consisting of one well completed in Aquifer A (above the Intermediate Silt), and another well completed in Aquifer B (below the Intermediate Silt). Existing Aquifer A well LL-18.22 will be monitored as part of one of the well pairs.
- One additional Aquifer A well located on the northwest side of the containment area (97-10.A)
- Four additional single wells completed in Aquifer A and located in the southern portion of the deed-restricted area, including existing well LL-01.15.

The six well pairs and one additional well (97-10A) will function as performance monitoring wells. The performance well system was designed with wells completed in Aquifer A or B to demonstrate that the containment system is functioning laterally across the barrier wall and vertically across the Intermediate Silt layer.

The compliance monitoring wells will consist of:

- The Aquifer A well in the six well pairs
- Four additional compliance wells (97-8A, 9A, and 10A, and existing well LL-01.15)

Because no groundwater impact has been detected to date in Aquifer B, compliance monitoring wells are screened only in Aquifer A. If, during the performance monitoring period, the performance monitoring demonstrates that no COCs are migrating to Aquifer B from the containment area at concentrations exceeding the trigger levels, chemical monitoring at the point of compliance in Aquifer A will be sufficient to meet compliance monitoring requirements.

Since the point of compliance encompasses a localized area of known soil impact south of the barrier wall, one sentry well (97-3A) is included to monitor progress toward long-term cleanup goals inside the point of compliance and constituent attenuation, if any. The sentry well will be monitored using the same schedule and constituents as the compliance wells, but will have different compliance goals.

6.3.1 Data Evaluation and Reporting

The groundwater samples will be collected using current industry standards for monitoring well sampling, which can be found in Appendix B to the PCMP, and according to the Project Health and Safety Plan, which is Appendix C to the PCMP.

Data collected during the initial year of the performance and compliance monitoring program will be evaluated for quality assurance/quality control purposes, as discussed in Appendix A of the PCMP, and compared to the trigger levels. A brief data report will be prepared summarizing the data collected.

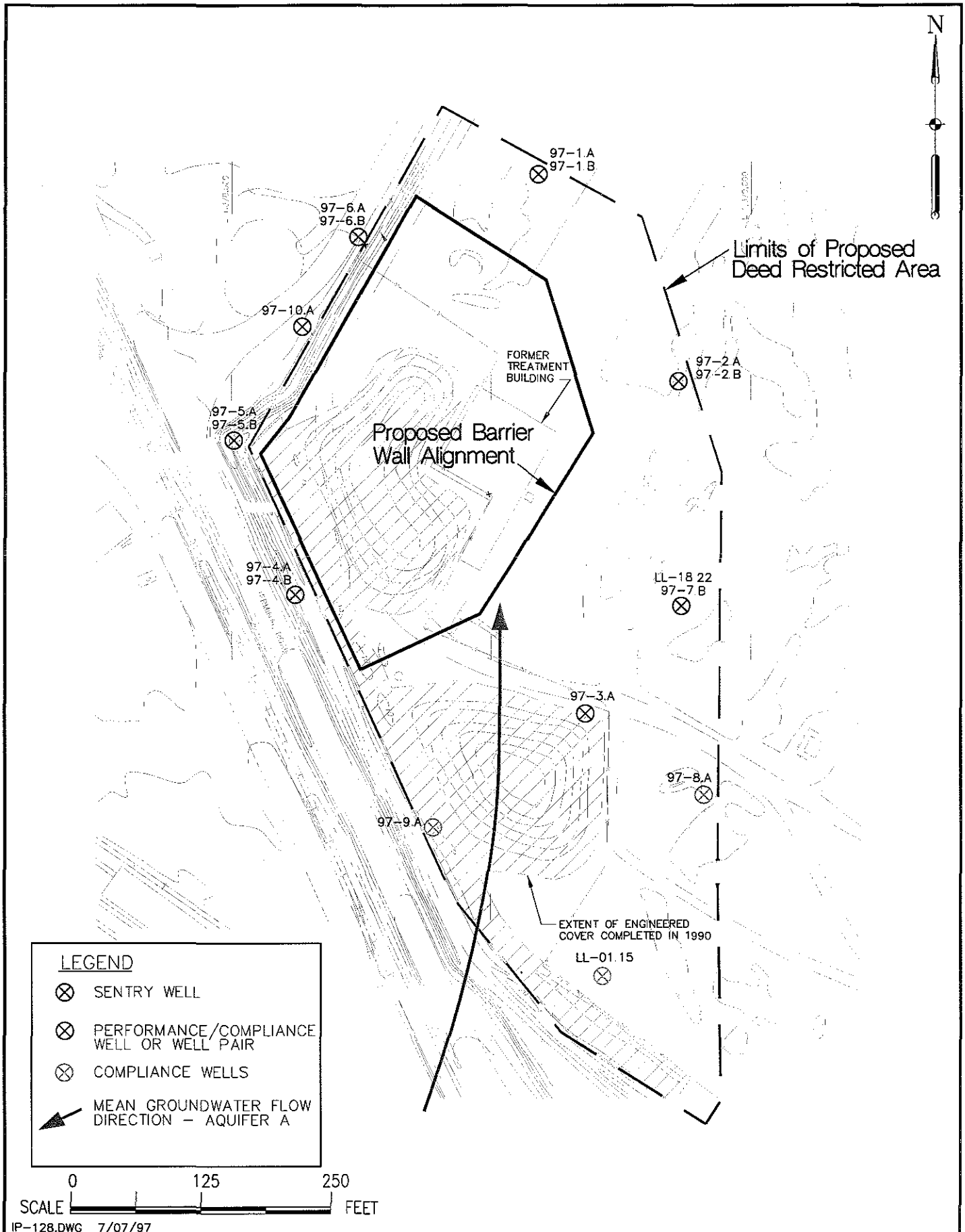
Beginning after Year 2, the data will be evaluated according to applicable guidance from Ecology and EPA, and the procedures described in the PCMP. These procedures were developed based on applicable compliance monitoring regulations WAC 173-340-720(8) and regulatory guidance, including EPA's Guidance for Data Quality Assessment: Practical Methods for Data Analysis (EPA 1996), Data Quality Evaluation Statistical Toolbox (Data QUEST) (EPA n.d.), Guidance on Sampling and Data Analysis Methods (Ecology 1995), Statistical Guidance for Ecology Site Managers (Ecology 1992), and Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA 1989). For each well, the data will be assessed for quality assurance/quality control acceptability, which is defined as meeting the project-defined criteria for precision, accuracy, representativeness, completeness, and comparability prior to any statistical evaluation.

The chemical data collected from the performance and compliance monitoring wells will be assessed identically using the procedures outlined in the PCMP to determine whether there is statistically significant evidence that groundwater concentrations outside the barrier wall or beyond the point of compliance exceed the cleanup goals.

If the cleanup goals are not being attained at any monitoring well at the point of compliance, regulations require Ecology to be notified. Therefore, if statistically significant evidence of increased impact at a well is found, that information will be reported to Ecology, as required by WAC 173-303-645 within 7 days of the determination. Determination of statistical significance of the groundwater monitoring data will be completed within 6 weeks after receipt of the laboratory analytical data reports. Based on the evidence, International Paper and Ecology will determine whether implementation of further actions, as outlined in the PCMP, are necessary.

For the first five years of monitoring, annual performance evaluation reports will be prepared and submitted to Ecology. These reports will include a presentation of the data from the monitoring of the biotreatment system, the performance and compliance data collected during the past 12 months, and a statistical evaluation of that data after the second and fifth years of data collection. If the frequency of sampling decreases to annual or less, five-year data reports that include statistical evaluation will be prepared and submitted to Ecology. Laboratory analytical data will be submitted to Ecology on an annual basis. All reports submitted will meet the general submittal requirements as listed in WAC 173-340-840, unless mutually agreed to by International Paper and Ecology. An outline of the annual report format is included in the PCMP.

After the evaluation of the first 2 years of data, if it is determined that compliance with the cleanup goals is being attained in the compliance wells, International Paper will propose the monitoring frequency be changed to annual sampling. International Paper will also evaluate the list of COCs, and may propose to change the constituents analyzed. These revisions will require review and approval by Ecology.



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INTERNATIONAL PAPER LONGVIEW, WA	Project No. 91C0796B	Proposed Performance and Compliance Monitoring Well Locations for the Former TWP Area	Figure 6-1
Woodward-Clyde			

In accordance with WAC 173-340-810, protection monitoring will confirm that human health is adequately protected during the cleanup action. The Health and Safety Plan included as Appendix C of the PCMP establishes the minimum health and safety requirements to conduct the monitoring, well installation, and sampling field activities for the cleanup action at the former TWP area. A separate Health and Safety Plan will be prepared for construction activities associated with installation of the barrier wall, bioventing system, and cap. The Health and Safety Plan is approved by the Project Manager, the Health and Safety Manager, and a Corporate Health and Safety Officer.

The Health and Safety Plans establishes guidelines and requirements for maintaining healthy and safe working conditions during activities at the site. The plans describe procedures and equipment required to minimize personnel injuries and exposure to hazardous materials. The plans will include provisions for employee training, employee medical surveillance, appropriate required personal protective equipment, and environmental monitoring and sampling techniques and instrumentation to ensure worker protection.

Operation and maintenance (O&M) for the cleanup action program will primarily include routine inspections and activities to ensure that the containment system is functioning properly and that the wells included in the monitoring system are also functioning properly and providing data of necessary quality.

The O&M of the engineered cover and biosparging/bioventing system will be outlined in the project-specific O&M plan, prepared in accordance with WAC 173-340. A summary and outline of the draft O&M plan are included in the EDR. The O&M plan will be divided into two volumes:

- Volume 1 will contain information relative to system startup and O&M of the engineered cover
- Volume 2 will contain information relative to O&M of individual pieces of equipment submitted by the various equipment suppliers

The O&M manual will be organized by the three major elements of the cleanup action: the biosparging/bioventing wellhead and header piping system, the biosparging system, and the engineered cover. The wellhead and piping system includes the bioventing and biosparging wells and header piping system. The biosparging system includes the compressor, piping and instrumentation in the treatment building used to provide pressurized air to the biosparge header. The engineered cover includes the vegetative cover, geosynthetics, fencing, access roads and drainage system.

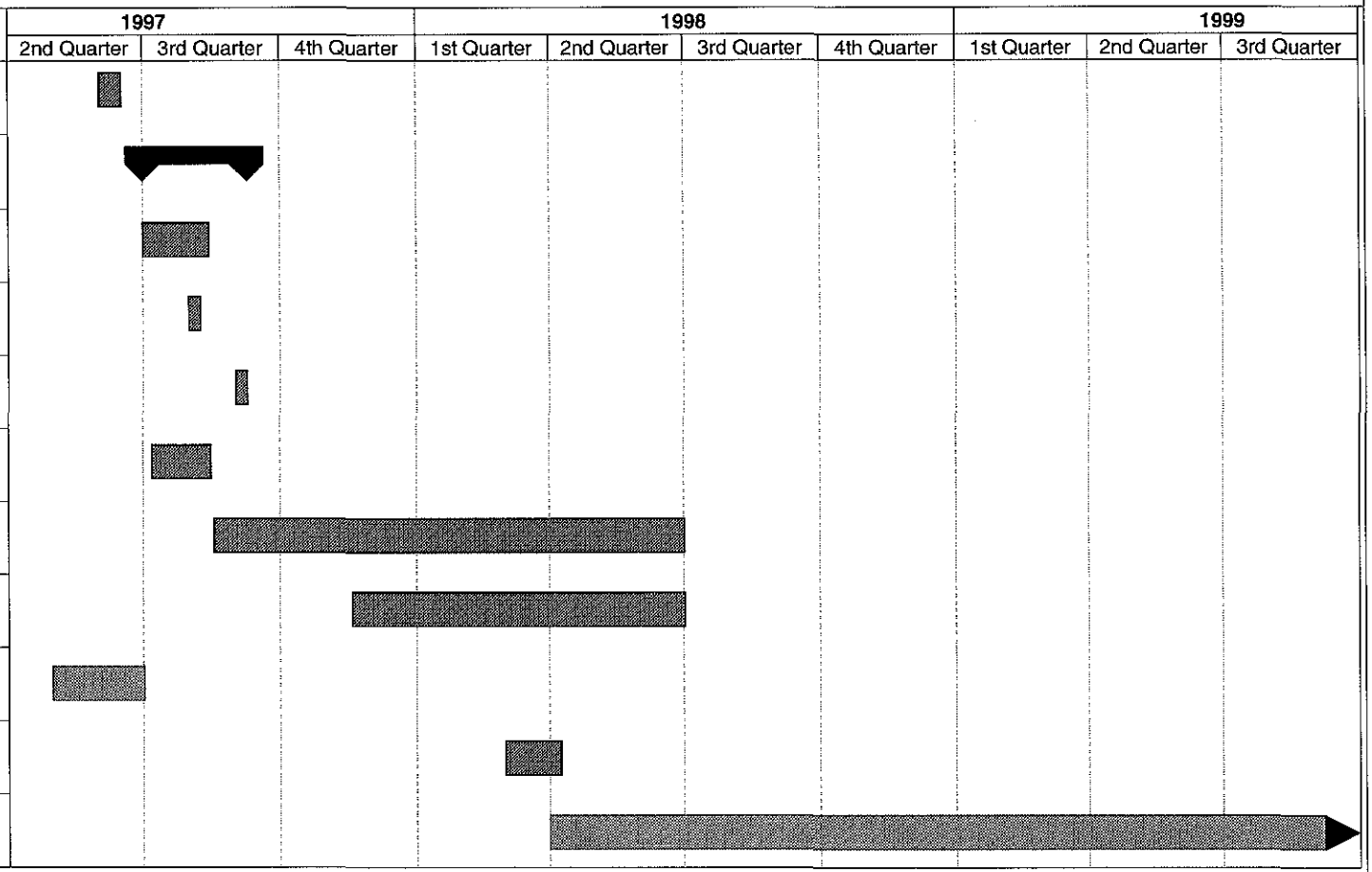
The Draft O&M Plan will be submitted within 120 days of Ecology approval of the EDR. The Final O&M Plan will be submitted within 30 days of system start up.

The proposed schedule for the cleanup action for the former TWP area is presented in Figure 9-1. The schedule includes major projected milestones related to planning and implementation of the cleanup action. Construction activities for the containment system are scheduled to begin in the third quarter 1997. The work will take approximately 12 to 14 weeks to complete, barring unforeseen exceptional circumstances.

The groundwater monitoring system will be installed within 60 days of completing the cap construction, unless the Port of Longview begins construction at one or more of the well locations before or during that time period, or unless International Paper and Ecology are notified by the Port of Longview of final construction plans that would impact the locations of the wells. It is anticipated that the installation and development of the monitoring system wells will take approximately three weeks. The first sampling event from these wells will take place approximately 30 days, and no longer than 60 days, after installation of the wells.

Figure 9-1 Cleanup Action Schedule
Former TWP Area
International Paper, Longview, Washington

ID	Task Name
1	Ecology Approval of Final CAP
2	**Final Consent Decree**
3	Public Review
4	Public Meeting
5	File Consent Decree with Court
6	Mobilization for Construction
7	Construction*
8	Bioventing/Biosparging System Startup
9	Interim Status Groundwater Monitoring
10	Performance/Compliance Well Installation
11	Performance and Compliance Monitoring



International Paper
Longview, Washington
Date: Mon 7/7/97 2:00 PM

*Assumes Consent Decree filed with the court by August 1, 1997

Revised June 23, 1997

Task

Summary

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Ecology - see Washington State Department of Ecology

EPA - see United State Environmental Protection Agency

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APPENDIX A MTCA Regulatory Requirements

REGULATION	REGULATION REQUIREMENTS	WHERE REQUIREMENT IS ADDRESSED
WAC 173-340-360	**General** Selection of cleanup requirements	CAP Section 4 FFS Section 6,7
(2)	Threshold requirements	CAP Section 5 FFS Section 7
(3)	Other requirements	FFS Section 7
(4)	Cleanup technologies	FFS Section 6
(5)	Permanent solutions	FFS Section 7
(6)	Restoration time frame	FFS Section 7
(7)	Ground water restoration	FFS Section 7 PCMP
(8)	Containment actions	FFS Section 6 EDR
(9)	Expectations	FFS Section 7
(10)	Draft cleanup action plan	
(10)(a)(i)	General description of cleanup action	CAP Section 4,5
(10)(a)(ii)	Brief summary of other alternative cleanup actions	CAP Section 5
(10)(a)(iii)	Site cleanup levels and points of compliance	CAP Section 4
(10)(a)(iv)	Schedule for implementation	CAP Section 9
(10)(a)(v)	Required institutional controls and site use restrictions	CAP Section 5
(10)(a)(vi)	Justification for selecting a cleanup action	CAP Section 5
(10)(a)(vii)	Applicable state and federal laws	CAP Section 5.4
(10)(a)(viii)	Preliminary determination that the proposed cleanup will comply with sections (2) and (3)	CAP Section 5
(10)(a)(ix)	Where cleanup involves on-site containment, specification of types and levels	CAP Section 4
WAC 173-340-400	**General** Cleanup Actions	CAP FFS EDR PCMP
(4)	Plans describing the cleanup action	EDR
(4)(a)	Engineering EDR	EDR
(4)(a)(i)	Goals of cleanup	EDR Section 1.4, 3
(4)(a)(ii)	RI/FS summary	EDR Section 2
(4)(a)(iii)	Site owner	EDR Section 1.2
(4)(a)(iv)	Site maps	EDR Section 1
(4)(a)(v)	Character of material to be treated	EDR Section 2
(4)(a)(vi)	Schedule	EDR Section 5.10
(4)(a)(vii)	Description of cleanup actions	EDR Section 1.3, 4
(4)(a)(viii)	Engineering justification	EDR Section 3, 4
(4)(a)(ix)	Spill control	EDR Section 5.9
(4)(a)(x)	Long-term safety	EDR Section 6.2
(4)(a)(xi)	Management of treatment residuals	EDR Section 4,6
(4)(a)(xii)	Site characteristics that affect design	EDR Section 1, 2, 4
(4)(a)(xiii)	Construction testing	EDR Section 5, Appendix A
(4)(a)(xiv)	Compliance Monitoring	EDR Section 6.3
(4)(a)(xv)	Health and safety during construction	EDR Section 5.9
(4)(a)(xvi)	Information needed for SEPA	EDR Section 1
(4)(a)(xvii) and (xviii)	Other information	EDR Section 5
(4)(b)	Construction plans and specifications	EDR

REGULATION	REGULATION REQUIREMENTS	WHERE REQUIREMENT IS ADDRESSED
(4)(b)(i)	General description	EDR 1.2
(4)(b)(ii)	General location map	EDR
(4)(b)(iii)	Copies of permits	EDR 5.7
(4)(b)(iv)	Detailed plans and procedural material specifications	EDR Section 4
(4)(b)(v)	Specific quality control tests to be performed	EDR Section 4, Appendix A
(4)(b)(vi)	Startup procedures and criteria to demonstrate cleanup action is prepared for routine operation	EDR Appendix A
(4)(b)(vii)	Applicable state, federal, and local requirements	CAP Section 5.4
(4)(b)(viii)	Compliance monitoring plan	PCMP Sections 3 & 4
(4)(b)(ix)	Provisions to assure health and safety	EDR Section 5.9
(4)(b)(x)	Other information	--
(4)(c)	Operations and maintenance plan	EDR Section 6.1 & O&M Plan (future)
(4)(c)(i)	Name and phone number of responsible individuals	O&M Plan (future)
(4)(c)(ii)	Process description and operating principles	EDR Section 3 & 4
(4)(c)(iii)	Design criteria and operating parameters and limits	EDR Section 3 & 4
(4)(c)(iv)	General operating procedures	EDR Section 3 & 4
(4)(c)(v)	Discussion of detailed operation of individual treatment units	EDR Section 3 & 4
(4)(c)(vi)	Procedures and sample forms for keeping O&M records	O&M Plan (future)
(4)(c)(vii)	Spare parts inventory	O&M Plan (future)
(4)(c)(viii)	Equipment maintenance schedules	O&M Plan (future)
(4)(c)(ix)	Contingency procedures	O&M Plan (future)
(4)(c)(x)	Compliance monitoring plan	PCMP Section 3.0
(4)(c)(xi)	Description of health and safety procedures	PCMP Appendix C (HSP)
(4)(c)(xii)	Procedures for maintenance of the facility after completion of the cleanup action	O&M Plan (future)
(4)(c)(xiii)	Other information	--
(6)	Permits and approvals	EDR Section 5.7
(7)	Construction	EDR Section 5
(10)	Waste management	EDR FFS Section 5
WAC 173-340-410	**General** Compliance monitoring requirements	PCMP (all sections) CAP Section 4, 6
(1)	General purpose	PCMP Section 3
(3)(a)	Sample and analysis plan meeting the requirements of WAC 173-340-820: statement of how the general purposes are met	PCMP Appendix B
(3)(b)	Data analysis and evaluation procedures	PCMP Section 3.4
(3)(b)(i)	Description of statistical methods	PCMP Section 3.4.3
(3)(c)	Other information	PCMP
WAC 173-340-420	**Periodic Review** General	CAP Section 5.3 PMCP Section 3

REGULATION	REGULATION REQUIREMENTS	WHERE REQUIREMENT IS ADDRESSED
WAC 173-340-440	**Institutional Controls** General	CAP Section 5.2.5 FFS Section 6 EDR
WAC 173-340-700	**Overview of Cleanup Standards** General	CAP Section 4 FFS EDR
WAC 173-340-720	**Ground Water Cleanup Standards** General	PCMP Section 3.2 CAP Section 4.2 FFS
(6)	Point of compliance	PCMP Section 3.1 CAP Section 4.1 FFS Section 5
(8)	Compliance monitoring	PCMP
(8)(c)	Data analysis and evaluation procedures	PCMP Section 3.4
(8)(c)(iv)	Compliance with ground water cleanup shall be determined for each monitoring well	PCMP Section 3.4
(8)(c)(v)	Statistical parameters for data analysis shall be specified	PCMP Section 3.4
(8)(c)(vi)	Determination of when the ground water is no longer influenced by the cleanup action	NA
WAC 173-340-745	**Soil Cleanup Standards for Industrial Sites** General	CAP FFS EDR
(6)	Point of compliance	CAP Section 4.1 FFS Section 5
(7)	Compliance monitoring	CAP
WAC 173-340-810	**Worker Safety and Health** General	CAP Section 7 FFS PCMP Appendix C (HSP) EDR Section 5.4
WAC 173-340-820	**Sampling and Analysis Plans** General	PCMP Appendix B
(2)	Contents	PCMP
(a)	Statement of purpose	PCMP Appendix B
(b)	Organization and responsibilities for sampling and analysis	PCMP Appendix A, A 2
(c)	Requirements for sampling activities	PCMP
(c)(i)	Project schedule	PCMP Section 5
(c)(ii)	Identification and justification of location and frequency of sampling	PCMP Sections 3 & 4
(c)(iii)	Identification and justification of parameters to be sampled	PCMP Sections 3.2 & 4.2
(c)(iv)	Procedures for installation of sampling devices	PCMP EDR
(c)(v)	Procedures for sample collection and handling	PCMP Appendix B
(c)(vi)	Procedures for the management of waste material	PCMP Appendix B, B.17
(c)(vii)	Description and number of QA/Q samples	PCMP Appendix B, B.11
(c)(viii)	Protocols for labeling and chain of custody	PCMP Appendix B, B.13, B.16
(c)(ix)	Provisions for splitting samples when appropriate	

REGULATION	REGULATION REQUIREMENTS	WHERE REQUIREMENT IS ADDRESSED
(d)	Procedures for reporting results	PCMP Appendix A (QAPP)
(d)(i)	Detection limits	PCMP Appendix A (QAPP)
(d)(ii)	Analytical techniques and procedures	PCMP Appendix A (QAPP)
(d)(iii)	QA/QC procedures	PCMP Appendix A (QAPP)
(d)(iv)	Data reporting procedures	PCMP Appendix A (QAPP)
WAC 173-340-840	**General Submittal Requirements** General	PCMP Section 6 FFS
(3)	Certification	EDR Appendix A
WAC 173-303-610	**Closure and Postclosure** General	CAP Section 6 PCMP
WAC 173-303-645	**Releases from Regulated Units**	
(8)	General ground water monitoring requirements	PCMP
(11)	Corrective action program	CAP PCMP FFS EDR
WAC 173-303-806	**Final Facility Permits** General	CAP PCMP EDR

Notes:
CAP: Cleanup Action Plan
EDR: Engineering Design Report
FFS: Focused Feasibility Study
HSP: Health and Safety Plan
PCMP: Performance and Compliance Monitoring Plan
QAPP: Quality Assurance Project Plan